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October 6, 2000 (Via: Hand Delivery)

James Bearzi
New Mexico Environmental Department (NMED)
Hazardous and Radioactive Material Bureau
2044 Galisteo
P.O. Box 26110
Santa Fe, New Mexico 87502

Re: Transmittal of Part A and Part B Permit Application for Triassic Park Waste Disposal Facility dated December 1997 (Revised October 2000)

Dear Mr. Bearzi:

I am pleased to present three (2) hard copies and one (1) electronic copy (on two compact disks) of the above referenced document. This document addresses comments provided by the New Mexico Environment Department (NMED) on the previous application submittals and supersedes all previous Part A and Part B permit submittals for the Triassic Park facility.

In accordance with State of New Mexico requirements, the engineering report, design drawings, specification, construction quality assurance plan, and design calculations have been prepared by professional engineers registered in the State of New Mexico (Patrick Corser – No 12236 and John Pellicer – No. 13547) with assistance from other engineering and technical staff.

An additional attachment, entitled "Table of Responses to Comments from the State of New Mexico Environment Department", addresses each of the comments included in NMEDs Notice of Deficiencies dated September 6, 2000 and September 12, 2000. This document is intended to help in the review of revisions made to the application based on comments received from NMED since March 2000. Summary tables are included which referencing each comment by date and comment number along with the response and actions taken. The tables are generally organized chronologically by the original date of the comment, with miscellaneous and verbal comments presented at the end. The comment number consists of the text section referenced in the comment followed by the comment number assigned by NMED in their comment submittals. The comments submitted by NMED are included for each table as referenced by date on tabs, except verbal comments which are included in the comment table itself. In addition, a comparison closure cost estimate table has been included following the comment tables. This table compares the HWB cost estimate with final cost estimates included in the permit application and provides comments on the differences between the line items.

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I anticipate you will find this document satisfies all outstanding issues and look forward to receiving the permit from NMED. If you have any questions during your review, please contact Montgomery Watson (970-879-6260) or the undersigned.

Sincerely,

Gandy-Marley, Inc.

Dale Gandy

Dale Gandy

attachment

cc: Ken Schultz – w/o attachments
Trey Greenwood – w/o attachments
Patrick Corser – w/o attachments

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TRIASSIC PARK FACILITY
PERMIT APPLICATION

TABLE OF RESPONSES TO COMMENTS

from the

STATE OF NEW MEXICO
ENVIRONMENT DEPARTMENT

October 2000

Prepared By:

Montgomery Watson
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Steamboat Springs, Colorado 80477

Prepared For:

GM inc.

Gandy Marley, Inc.
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Prepared for:

TRIASSIC PARK WASTE DISPOSAL FACILITY
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TABLE OF REPONSES TO COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT ON THE TRIASSIC PARK FACILITY PERMIT APPLICATION

October 2000

Prepared by:

MONTGOMERY WATSON
P.O. Box 774018
1475 Pine Grove Road, Suite 109
Steamboat Springs, CO 80477
(970) 879-6260

RESPONSES TO APRIL 2000 WRITTEN COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Number**	**Response**
4/2000	1.0-1	Text revised.
4/2000	1.0-2	Text revised and is consistent with Section 4.1.2.
4/2000	1.0-3	Text revised, reference Appendix F-3.
4/2000	2.0-4	Text revised.
4/2000	2.0-5	Text regarding trucks accumulating waste removed.
4/2000	2.0-6	Section 2.2.2.1 text revised.
4/2000	2.0-7	No special measures required. No revision to text.
4/2000	2.0-8	Text revised.
4/2000	2.0-9	Part A forms request volume in gallons. No revision.
4/2000	2.0-10	Tank certification included in Appendix I and referenced in text.
4/2000	2.0-11	Text added to Section 8.1.3.2.
4/2000	2.0-12	Text revised.
4/2000	2.0-13	1.5 hours per batch of 2,500 cubic yards is reasonable = 22.5 hours to treat 150,000 cubic yards. No revision to text.
4/2000	2.0-14	No revision to text.
4/2000	2.0-15	Assume comment meant to reference comment #10, not #13. Text revised to reference Vol II, Appendix I.
4/2000	2.0-16	Text revised.
4/2000	2.0-17	Text revised.
4/2000	2.0-18	Text revised to reference identification of permitted wastes in Section 4.1.1.
4/2000	2.0-19	List of unacceptable waste deleted – see 7/9/00 comment #2.0-8.
4/2000	2.0-20	553,200 cubic yards is correct. Part A, Section XII corrected. Text revised.
4/2000	2.0-21	Text revised.
4/2000	2.0-22	References to subsections of Section 4.0 have been checked and revised as necessary.
4/2000	2.0-23	Text revised (same as 7/9/00 comment #2.0-9).
4/2000	2.0-24	References provided in Section 12.0
4/2000	2.0-25	Text revised (same as 8/20/00 comment #2.0-4).
4/2000	2.0-26	Text revised.
4/2000	2.0-27	Text revised.
4/2000	2.0-28	Yes. Text revised to reference Figure 1-2 and Figure 2-1 removed.
4/2000	5.0-1	Text revised.
4/2000	5.0-2	Additional checklists provided as agreed – see Appendix I
4/2000	5.0-3	Text revised.
4/2000	5.0-4	Daily security equipment inspections added to Table 5-1. Text revised in Section 5.2.7 to be consistent.
4/2000	5.0-5	Text revised reference Sections 4.5.6 and 4.6 for sampling and analysis of wash water.
4/2000	5.0-6	Text revised.
4/2000	5.0-7	Text revised to state that minimum water storage will meet New Mexico Fire Marshall requirements.
4/2000	5.0-8	Text revised.
4/2000	5.0-9	Text revised.
4/2000	5.0-10	Ditch inspection added to Table 5-1 for containers, tanks and stabilization unit.
4/2000	5.0-11	Text revised.
4/2000	5.0-12	References to subsections of Section 4.0 have been checked and revised as necessary.
4/2000	5.0-13	Text revised.
4/2000	5.0-14	Added evaporation pond run-on/run-off control system to Table 5-1.
4/2000	6.0-15	Inspections of emergency equipment not required.
4/2000	6.0-16	No response required – included as permit condition.
4/2000	6.0-17	Text revised.
4/2000	6.0-18	Text revised.

RESPONSES TO APRIL 2000 WRITTEN COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Number**	**Response**
4/2000	6.0-19	Text revised.
4/2000	7.0-20	Text revised.
4/2000	7.0-21	Text revised.
4/2000	7.0-22	Our experience indicates the items listed can be addressed in an 8-hour session. No revision to text.
4/2000	11.0-29	Subpart BB standards apply to equipment leaks, therefore, they do not apply to storage containers or the landfill (same as 4/2000 comment #11.0-29). No revision to text.
4/2000	11.0-30	Text revised to remove duplicated paragraph.
4/2000	11.0-31	Text revised as requested.
4/2000	11.0-32	Text revised as requested.
4/2000	11.0-33	Text revised.

RESPONSES TO JULY 9, 2000 WRITTEN COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Number**	**Response**
7/9/00	1.0-1	Text revised.
7/9/00	2.0-2	References to subsections of Section 4.0 have been checked and revised as necessary.
7/9/00	2.0-3	Text revised.
7/9/00	2.0-4	Text revised.
7/9/00	2.0-5	Text revised.
7/9/00	2.0-6	Text revised.
7/9/00	2.0-7	Text revised.
7/9/00	2.0-8	Text revised.
7/9/00	2.0-9	Text revised (same as 4/2000 comment #2.0-23).
7/9/00	2.0-10	Text revised.
7/9/00	3.0	Section 12.0 revised to include the missing references listed.
7/9/00	5.0-11	Separate equipment will be stored outdoors for outdoor units, except as noted. Where appropriate, New Mexico State Fire Marshal's Office requirements will be met. No revision to text.
7/9/00	5.0-12	Text revised.
7/9/00	5.0-13	Text revised.
7/9/00	11.0-14	Subpart BB standards apply to equipment leaks, therefore, they do not apply to storage containers or the landfill (same as 4/2000 comment #11.0-29). No revision to text.
7/9/00	11.0-15	Tanks and evaporation pond will only contain waste <500ppmw, drums and roll-off containers may contain waste >500ppmw. No revision to text.
7/9/00	11.0-16	No revision required.

RESPONSES TO AUGUST 10, 2000 WRITTEN COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Number**	**Response**
8/10/00	2.0-1	Text revised to reference Appendix H-3 rather than E-34.
8/10/00	2.0-2	Text revised.
8/10/00	3	Response not required.
8/10/00	2.0-4	Information on the compatibility of the tanks with various waste is discussed in Vol III and supporting information is presented in Vol VI, Appendix H-3.
8/10/00	III-5	Four tanks will be permitted. No revision to text.
8/10/00	III-6	Text revised.
8/10/00	III-7	Text revised to reference Vol IV, Appendix C.
8/10/00	III-8	Text revised to reference Drawings 40 and 45 (same as 8/10/00 comment #III-16).
8/10/00	III-9	There is an Appendix H-3 as of the April 2000 version (Techlaw review copy) of the application. No revision to text.
8/10/00	10	Four tanks will be permitted. No revision to drawing.
8/10/00	III-11	Response not required per S. Kruse.
8/10/00	III-12	Text revised to eliminate reference to table on drawing.
8/10/00	III-13	Text revised. Pad under each tank has collection sump as shown in Drawing 40.
8/10/00	III-14	Text revised to reference Drawing 33.
8/10/00	III-15	Text indicating waste transported by double walled pipe from the liquid waste storage area removed.
8/10/00	III-16	Text revised (same as 8/10/00 comment #III-8).
8/10/00	III-17	Text revised to reference Drawing 40.
8/10/00	III-18	Text revised to indicate how liquid may be removed from the LDRS and reference the correct drawing where LDRS pipes shown.
8/10/00	III-19	Response not required.
8/10/00	2.0-20	See Vol III, Section 8.1.3 for list of excluded waste.
8/10/00	2.0-21	Text revised to reference Drawing 40 and Vol III, Section 8.2.2.
8/10/00	2.0-22	No response required.
8/10/00	III-23	Text revised to clarify capacity of concrete vaults.
8/10/00	24	Primary LD/LCRS between the 2 tank liners and the bottom of the bin sitting directly on the concrete vault are not readily available for visual inspection. No revision.
8/10/00	25	No temperature or pressure gauges are included in the design. No revision.
8/10/00	26	No response required per S. Kruse.

RESPONSES TO AUGUST 13, 2000 WRITTEN COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Number**	**Response**
8/13/00	2.0-1	Drawing 39 is Drum Handling Facility, not Liquid Waste Tanks. No revision.
8/13/00	2.0-2	Text referring to landfill operational staff removed.
8/13/00	III-3	Text revised to reference Drawing 45 instead of 44.
8/13/00	III-4	The entire roll-off area is lined. Text in Vol I and Vol III revised.

RESPONSES TO AUGUST 20, 2000 WRITTEN COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Number**	**Response**
8/20/00	2.0-1	Text revised.
8/20/00	2.0-2	Section 2.6.1 text revised to cite dimensions of 135 x 290. Approximate area indicated remains 78,600.
8/20/00	2.0-3	Text revised.
8/20/00	2.0-4	Text revised (same as 4/2000 comment #2.0-25).
8/20/00	2.0-5	Text revised.
8/20/00	III-6	The bottom of the pond slopes, so depth is variable. Design water elevation is provided on Drawing 30 and text states a minimum of 2 ft of freeboard will be maintained. No revision to text.
8/20/00	III-7	Extent of liner added to Drawing 29.
8/20/00	III-8	Text revised to reference the evaporation pond.
8/20/00	III-9	The discharge pad is used for incoming and outgoing tanker trucks. Drawing 31 identifies the discharge point from tanker trucks in Detail 4, and the leachate removal discharge point to tanker trucks from the LDRS and vadose zone sumps in Detail 5. No revisions.
8/20/00	III-10	Text revised.
8/20/00	III-11	Text revised.
8/20/00	III-12	Drawing title revised.
8/20/00	13	Part A table matrix indicates pond permitted for treatment only.
8/20/00	14	The berms will be a result of excavation into native ground or will be constructed out of onsite soil as specified in the Specifications (Vol IV) for earthworks. The dimensions of the berms (height, width and side slope angle) are shown in the drawings. No revisions.
8/20/00	3.0-15	No response required.
8/20/00	16	The evaporation pond will be clean closed, with the liner removed. Therefore, there will not be any remaining waste to stabilize. No revision to text.
8/20/00	O&M-1	No response required.
8/20/00	O&M-2	Section 2.6.1 text revised to cite dimensions of 135 x 290. Approximate area indicated remains 78,600.
8/20/00	O&M-3	Text regarding pumping out run-off has been removed.
8/20/00	O&M-4	Vol III Section 5.1.2 text revised to state 4 to 8 feet, consistent with O&M Plan.
8/20/00	O&M-5	Text revised to reference Section 4.3.3.
8/20/00	O&M-6	Text revised.
8/20/00	O&M-7	Changed "containers" to "materials" in text. Stabilization bin compatibility will not be assessed.
8/20/00	O&M-8	Reference to required/supplemental sampling removed. Text revised to reference Section 4.5 for sampling methods.
8/20/00	O&M-9	Text revised to reference Section 4.4.
8/20/00	O&M-10	Bullet referencing supplemental analyses removed. Any additional testing is addressed in Section 4.4, as referenced in bullet A.
8/20/00	O&M-11	No revision to text.
8/20/00	O&M-12	Text revised.
8/20/00	O&M-13	Text revised to reference 4.1.2.
8/20/00	O&M-14	Text revised to reference 4.5.6 for types of waste that may be generated on-site.
8/20/00	O&M-15	Text revised.
8/20/00	O&M-16	This section is consistent with Table 4-1. No revision to text.
8/20/00	O&M-17	Text revised.
8/20/00	O&M-18	Text revised.
8/20/00	O&M-19	Text revised to reference Drawing 31.
8/20/00	O&M-20	Text revised.
8/20/00	O&M-21	Text regarding pumping out run-off has been removed.
8/20/00	O&M-22	No response required (no comment).

RESPONSES TO AUGUST 20, 2000 WRITTEN COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Number**	**Response**
8/20/00	O&M-23	Text revised.
8/20/00	O&M-24	Text revised.
8/20/00	O&M-25	Bullet I. has been removed.
8/20/00	O&M-26	Text revised.
8/20/00	O&M-27	Text revised.
8/20/00	O&M-28	Comment unclear as to what needs to be finished. No revision to text.
8/20/00	O&M-29	Text revised.

RESPONSES TO SEPTEMBER 6, 2000 WRITTEN COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Number**	**Response**
9/6/00	Outstanding Issue #1	Text revised as suggested (see 8/14/00 comment on Section 10 from NMED).
9/6/00	Outstanding Issue #2	There are 3 remaining boreholes to be plugged (WW-1, WW-2, PB-14). A letter summarizing the borehole situation commits to plugging these open boreholes prior to construction in accordance with NMED requirements. The letter is presented in Vol II, Appendix C.
9/6/00	2.0-1	Vol III, Section 3.1.4 revised to clarify that this permit application addresses only Phase 1A. Note on Drawing 2 clearly indicates that only Phase 1A is being permitted.
9/6/00	2.0-2	Reference to 'TSCA' in the first sentence and the list of waste not accepted by the Facility (including the last bullet) removed in response to 7/9/00 comment #2.0-8
9/6/00	2.0-3	Text revised to indicate Phase 1A final cover area (35 acres).
9/6/00	2.0-4	Only leachate from the landfill sumps will be stored in the leachate tanks at the crest of the landfill. Leachate from the evaporation pond sumps will not be pumped to the landfill leachate storage tanks. No revision to text.
9/6/00	2.0-5	Text revised to clarify the 3 collection basins associated with landfill run-on and run-off
9/6/00	2.0-6	Text revised in response to 4/2000 comment #2.0-23 and 7/9/00 comment #2.0-9.
9/6/00	III-7	Text revised to reference Drawing 22 instead.
9/6/00	III-8	Reference to Drawing 6 removed.
9/6/00	III-9	Text revised to explain the 16 foot dimension as horizontal thickness
9/6/00	III-10	There is an Appendix H-5 as of the April 2000 version (Techlaw review copy) of the application. No revision to text.
9/6/00	III-11	There is an Appendix H-4 as of the April 2000 version (Techlaw review copy) of the application. No revision to text.
9/6/00	III-12	There is an Appendix H-4 as of the April 2000 version (Techlaw review copy) of the application. No revision to text.
9/6/00	III-13	There is an Appendix H-1 as of the April 2000 version (Techlaw review copy) of the application. No revision to text.
9/6/00	III-14	There is an Appendix H-2 as of the April 2000 version (Techlaw review copy) of the application. No revision to text.
9/6/00	III-15	Text revised to clarify that the application only includes permitting of the Phase 1A area below the access ramps for waste placement. Text revised to include lined acreage. Assumptions listed by NMED are correct.
9/6/00	III-16	Text revised as suggested.
9/6/00	III-17	Discussion of interim cover in text has been removed because stormwater runoff from the interim cover cannot be managed until Phase 2 development. Therefore, only a daily cover will be used and an interim cover will be included in the permit modification for Phase 2 if appropriate. Also removed reference to interim cover in Section 3.1.6.

RESPONSES TO SEPTEMBER 6, 2000 WRITTEN COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Number**	**Response**
9/6/00	III-18	Contaminated Water Basin - The contaminated water basin is now clearly discussed in Vol I, Section 2.5.1.6. Text revised to reference 4 drawings (#10,11,13,24). No revision to drawings. Information on dimensions, capacity and construction timing has been added to Section 3.2.10. Stormwater Collection Basin – Basin is lined. Drawings 13 and 24 indicate basin liner. Berms – Drawing 24 is cross section M shown on Drawing 13, which shows the berm separating the stormwater collection basin from the contaminated water basin. The dimensions for the berms (height, width and slope angle) are shown on the drawings. The berm diverting surface water shown on Drawing 13 will be placed after construction of the cell is complete. At that time, only limited access will be required. The berm will be broad and of limited height so that trucks and construction equipment can easily maintain access to the basins from the south access ramp. All of the berms will be in excavated (native material) or will be constructed out of onsite soil placed and compacted in accordance with the earthworks specifications in Vol IV.
9/6/00	III-19	Text revised to reference sheet 2 of Drawing 25.
9/6/00	III-20	Text revised to indicate the unlined area in Phase 1A is above the access ramps.

RESPONSES TO SEPTEMBER 12, 2000 WRITTEN COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Number**	**Response**
9/12/00	4.0-1	Clarification added to text to include bulk waste meeting WAP criteria
9/12/00	4.0-2	Change incorporated
9/12/00	4.0-3	No change made. Text already states NORM restriction
9/12/00	4.0-4	Change incorporated
9/12/00	4.0-5	Change incorporated
9/12/00	4.0-6	Change incorporated
9/12/00	4.0-7	Reference deleted
9/12/00	4.0-8	Text was revised to read, "other approved method"
9/12/00	4.0-9	Text was added
9/12/00	4.0-10	Change incorporated
9/12/00	4.0-11	Change incorporated
9/12/00	4.0-12	Change incorporated
9/12/00	4.0-13	Change incorporated
9/12/00	4.0-14	Text was revised per additional direction from NMED (S. Kruse)
9/12/00	4.0-15	Change incorporated
9/12/00	4.0-16	Text was revised per additional direction from NMED (S. Kruse)
9/12/00	4.0-17	Change incorporated
9/12/00	4.0-18	Text was revised to include DQOs
9/12/00	4.0-19	Text revisions made in Sections 4.6, 4.7.2.5, 4.7.3
9/12/00	4.0-20	This comment referred to section 4.7.2.5 Change was incorporated.
9/12/00	4.0-21	Change incorporated
9/12/00	4.0-22	Revised tables submitted.
9/12/00	4.0-23	Changes incorporated
9/12/00	4.0-24	Comment noted
9/12/00	CQAP-25	Figure and appendices included.
9/12/00	IC-26	a. The third paragraph has been revised to require a description of any "problems" observed. b. The Inspection Corrective Action Report form has been revised to allow a description of "Remedial Actions/Repairs" to be completed in the comment column.
9/12/00	IC-27	a. The Inspection Corrective Action Report form has been revised to allow a description of "Remedial Actions/Repairs" to be completed in the comment column. GMI believes that the Inspection Reports should concentrate only on identification of problems, while the Inspection Corrective Action Report should concentrate on "remediation/repairs". b. It was envisioned that the ditch numbers would be filled in the order that they were inspected. However, in response to this comment, the ditch numbers will be added to the form. c. The inspection of all loading and unloading areas has been included on the forms for each unit as suggested.
9/12/00	IC-28	a. The typo has been corrected. b. The form has been revised to include the inspection of the concrete floor. c. The form has been revised to include Systems 1 through 7 individually..
9/12/00	IC-29	The form has been revised to include the items stated in the comment.
9/12/00	IC-30	a. The form has been revised to include the inspection of the containment berms. It should be noted that there is no concrete pad associated with this unit.

RESPONSES TO SEPTEMBER 12, 2000 WRITTEN COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Number**	**Response**
		b. The form has been revised to include the inspection of the spacing of the roll-off container columns (at least 4 feet apart) and rows (at least 2.5 feet apart).
9/12/00	IC-31	a. GMI does not believe Tanks 3 and 4 need to be added to the inspection forms until the Tanks become operational. No revision to form b. The form has been revised to include the inspection of the leak detection system. Item d. includes the operating conditions including "overfill". c. GMI does not believe the results of the "annual" sonic tank test belong on the "daily" Liquid Waste Receiving and Storage Unit inspection form. These results would be attached to the inspection form as a separate report on the day the test is performed.
9/12/00	IC-32	a. The inspection form has been revised to include inspection of the surrounding area immediately adjacent to the Stabilization Unit (within the secondary containment system) to detect erosion or signs of hazardous material release. b. The daily inspection would consist of inspecting the outside of the bins, while the monthly inspection would consist of inspecting the inside of the bins, specifically for indications of excessive wear (when empty). The spelling errors have been corrected. c. GMI does not believe the results of the "annual" sonic tank test or cathodic protection system test belong on the "daily" Stabilization Unit inspection form. These results would be attached to the inspection form as separate reports on the day the tests are performed.
9/12/00	IC-33	a. The word "tanks" was an inadvertently included in the descriptions. The reference to "tanks" has been removed from the items f and g. b. The "Average Daily Flow Rate" has been added to the inspection form as requested.
9/12/00	IC-34	a. GMI does not believe that this type of inspection is warranted after every precipitation event only after major events that result in significant runoff. However, the inspection form has been revised to read "Weekly and after Storms". b. There is a berm around the perimeter of the pond and in the interior of the pond. The perimeter berm will lined on the inboard side and the interior berm will be lined on both sides. Inspection of the unlined berms will include observation of slumps in the side slopes, seeps on the face, or bulging at the toe. Inspection of the lined berms will include observation for irregularities in the liner surface that would indicate the presence of slumps on the side slopes or bulging at the toe of the slope c. GMI has revised the inspection form to include documentation of any sudden drop in impoundment contents and the amount of liquid removed from the leak detection system.. d. GMI has included an item on the inspection form to inspect the protective netting.
9/12/00	IC-35	a. GMI has corrected the typo to read "Tank". b. The weekly inspection form has been revised to include documentation of any and all liquids removed from the sump systems. In addition, inspection items have been added to document the depth of water in the contaminated water collection basin and the stormwater collection basin in the landfill
9/12/00	IC-36	A Section 8 – Emergency Equipment inspection form will be developed and

RESPONSES TO SEPTEMBER 12, 2000 WRITTEN COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Number**	**Response**
		submitted as soon as it can be completed. This form will list all emergency equipment within each unit with location so that each can be inspected on a monthly basis.

RESPONSES TO MISCELLANEOUS COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT		
Comment Date	**Comment Description**	**Response**
3/27/00	8.0 – NMED written comments	MW submitted revised text and cost estimate details on 6/26/00, which incorporated these comments.
4/14/00	10.0 – NMED written comments	Text identified as inconsistent with anticipated draft Permit language removed as suggested. Reference to the Corrective Action Permit Module being prepared by NMED added.
6/28/00	3.0 – Glenn VonGonten e-mail	MW addressed comments and submitted revised text and list of figures via e-mail on 7/14/00. Upon Glenn's request, MW submitted complete hard copy of text and figures on 8/4/00. Glenn gave verbal confirmation that his review was complete and all issues resolved on 8/21/00.
8/11/00	8.0 – David Cobrain e-mail	Reference to leachate treatment facility removed from closure cost estimate. Section 8.2.4.2 states leachate will be managed off-site.
8/25/00	8.0 – David Cobrain e-mail	The Stormwater Runoff Basin will be lined. Drawing 25 has been updated to show the liner.
8/31/00	8.0 – NMED request for additional infromation	All outstanding issues regarding the closure cost estimate have been resolved through conversation with David Cobrain, except for the following: 1) We believe the revegetation costs we have included are reasonable based on discussions with local contractors (see attached cost estimate tables), 2) the waste generated during closure will be disposed of in the landfill and therefore, we have not included costs for off-site disposal, 3) the leachate generated during closure will be trucked to an off-site facility for disposal, therefore, we have not included costs for a leachate treatment facility. The cost estimate has been revised along with related references in Section 8.0.

RESPONSES TO VERBAL COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT	
Verbal Comment	**Response**
Vol I,Section 11.3.7.1 – Indicates records to be kept for "design specs for closed vent systems and control devices". For which units and why needed? Containers will remain closed and go directly to landfill.	These records are required for drums and roll-off containers falling under Subpart CC (i.e. contain waste with greater than 500ppmw VOCs). No revision to text.
Does 40 CFR 270.30J regarding keeping continuous records apply? Do we have any continuous strip monitoring?	Continuous strip monitoring may be initiated if an exempt unit receives greater than 500ppmw VOCs. Vol I, Section 11.3.7.2 revised to clarify this situation.
Vol I, Section 2.3.1 – Does the liquid waste unit include a liner or LCRS system?	No, the outer tank provides 100% secondary containment and a concrete pad surrounds each tank and slopes to a collection sump. No revision.
Vol I, Section 2.4.1 – States that an assessment of bin materials and waste along with process influences is provided in the design specs and engineering report. Such assessment could not be found.	Vol III, Section 6.2.5 addresses bin compatibility with waste. Section 2.4.1 text revised to reference only Vol III.
Air emissions – Subpart BB and CC only apply to containers and landfill units?	Only applies to containers, no organic waste accepted in landfill. No revision.
Vol III, Sections 3.1.3,5.1.3,7.1.3 – Why hasn't compatability testing of HDPE with synthetic leachate been conducted yet?	Waiting generate synthetic leachate to better represent waste stream likely to be encountered. No revision.
Vol I, Section 8.4 – May need to add clarification of 'solid waste' – must be hazardous? NMED to provide further info	NMED did not follow up with this comment. Text revised to add "on-site" to description of solid waste.
Vol I, Section 8.1.2.4, 8.1.3.3 – edit end of fist sentence to say ".....facility proposed subset of constituents defined in Section 8.1 and approved by NMED"	Text revised as requested.
Vol I, Section 8 – Change reference to "standard operating procedures" to "standard procedures" to avoid confusion with SOPs.	Text revised as requested.
Vol I, Section 8.1.6 – in regards to sampling frequency of 1/40,000 sf in the stormwater runoff basin, add that if the liner is observed to be damaged, additional sampling may be required.	Text revised as requested.
Vol I, Figure 8-1 – Figure referenced but not included.	Figure 8-1 and references to it have been removed.
Vol I, Section 2.2.2.2 and Vol III, Section 5.1.2 – make roll-off storage area dimensions consistent.	Dimensions in Vol III revised to say 310x180 for each half.
Vol I, Section 8.1.2.3 – Reference either 40 CFR 268.7 or 268.45 and add that the VZMS wells associated with the pond will remain functional to monitor the landfill as specified in Section 3.0.	Text revised as requested.
Vol I, Section 8.1.3.1 – Change 'identified' to 'identical'	Text revised as requested.
Vol I, Section 8.1.6 – after bullets add that the remaining water and sediments will be removed, tested and disposed of appropriately.	Text revised as requested.
Vol I, Section 8.2.4.1 – Add to first sentence after 'when necessary', "to insure leachate depth over liner does not exceed 30 cm (1 foot). 2nd sentence – replace 'initially' with 'at a minimum'	Text revised as requested.

RESPONSES TO VERBAL COMMENTS FROM THE NEW MEXICO ENVIRONMENT DEPARTMENT	
Verbal Comment	**Response**
Vol I, Section 8.2.5.1 and 8.2.5.2 – change 'quarterly' to 'semi-annually' and reference sampling will be performed according to the VZMS WP	Text revised as requested.
Vol I, Section 8.3 – reword last sentence of 1st paragraph and reference clean-closure.	Text revised as requested.
NMED requested survey plat of the property	Survey plat prepared by registered land surveyor in the state of New Mexico provided in Part A

SITE CLOSURE COST ESTIMATE	Cost ($)	HWB Costs ($)	Comments
DRUM HANDLING UNIT			
Stabilization and Disposal of Remaining Drum Waste Inventory	$36,071	$36,064	Cost difference too small to spend time to reconcile
Decontamination of Equipment and Buildings	$7,200	$7,200	
Stabilization and Disposal of Decontamination Water	$14,630	$14,660	Cost difference too small to spend time to reconcile
Chemical Testing of Decontamination Water	$2,040	$6,120	Assume all water goes in 1 tank which will be sampled.
Dismantling and Moving Structure and Equipment	$22,196	$23,775	Buildings to be demolished and landfilled, not salvaged and sold
Dismantling and Disposal of Concrete Floor and Secondary Containment	$123,310	$122,570	Assumes concrete breaker at $45/cy and disposal at $9/cy
Soil Sampling and Chemical Analysis	$138,720	$138,720	
Excavation of Contaminated Soils	$7,307	$7,596	Cost difference too small to spend time to reconcile
Disposal of Contaminated Soil		$15,930	HWB assumes $9/cy for nonhazardous material and 10% hazardous at $30/cy. MW assumed disposal in the landfill prior to closure of the landfill. No costs were included for disposal.in onsite landfill.
Earth Backfill for Excavated Contaminated Soils	$1,827	$4,500	HWB and MW agree on $2/cy for nonhazardous backfill
Revegetation	$22,876	$91,960	HWB assumes regular irrigation for 1 season to establish grass stand, I talked with Jack at Atkins Engineering in Roswell (505) 624 - 7224. He said the biggest cost is acquiring the water rights which he figured at about $2000/acre. He said this is about 2/3 of the cost. He said if we used $3000 to $5000 an acre that would be good. We have been using about $10,000 an acre. I don't know about water rights at the site. I am assuming that Dale has them or can get some. We believe that HWB costs are too high.
Certification of Closure Inspection	$3,000	$3,000	
Certification of Closure Report	$15,000	$20,000	Judgement based on experience.
Subtotal	$394,176	$492,095	
EVAPORATION POND UNIT			
Stabilization and Disposal of Remaining Liquid Waste Inventory	$342,954	$342,952	
Decontamination of Equipment	$240	$240	
Stabilization and Disposal of Decontamination Water	$7,315	$7,315	
Chemical Testing of Decontamination Water	$2,040	$4,080	Assume all water goes in 1 tank which will be sampled.
Removal and Disposal of Liner and Leachate Collection System	$88,144	$99,880	
Soil Sampling and Chemical Analysis	$128,520	$128,520	
Excavation of Contaminated Soils	$13,664	$18,019	
Disposal of Contaminated Soil		$37,790	See above
Earth Backfill for Excavated Contaminated Soils	$3,416	$15,372	HWB and MW agree on $2/cy for nonhazardous backfill
Revegetation	$23,520	$93,620	See above
Certification of Closure Inspection	$3,000	$3,000	
Certification of Closure Report	$15,000	$20,000	See above
Subtotal	$627,813	$770,788	

LIQUID WASTE RECEIVING AND STORAGE UNIT			
Stabilization and Disposal of Remaining Waste Inventory	$105,336	$105,336	HWB used 4 tanks for cost estimate, only 2 tanks will be permitted, ensure text states 2 tanks
Decontamination of Equipment and Buildings	$2,400	$2,400	
Chemical Testing of Decontamination Water	$2,040	$6,120	Assume all water goes in 1 tank which will be sampled.
Stabilization and Disposal of Decontamination Water	$14,630	$14,630	Four tanks used for cost estimate,
Removal and Disposal of Tanks and Concrete Pad	$14,605	$21,139	Four tanks used for cost estimate. Tanks will not be tripled rinsed and sold. Tanks will be crushed by equipment and landfilled.
Soil Sampling and Chemical Analysis	$61,200	$61,200	Four tanks used for cost estimate. Four soil samples added for the incoming and outgoing valves for tanker trucks. See soil sampling spreadsheet
Excavation of Contaminated Soils	$436	$461	
Disposal of Contaminated Soil		$967	See above
Earth Backfill for Excavated Contaminated Soils	$109	$491	HWB and MW agree on $2/cy for nonhazardous backfill
Revegetation	$731	$37,200	See above
Certification of Closure Inspection	$3,000	$3,000	
Certification of Closure Report	$15,000	$15,000	
Subtotal	$219,487	$267,944	
STABILIZATION UNIT			
Stabilization and Disposal of Remaining Waste Inventory	$21,024	$120,336	Stabilization unit waste does not have free liquids which is why a mixing ratio of 1.6 reagent to 1 waste is used. Waste density increased to 100 pcf.
Decontamination of Equipment and Buildings	$4,560	$4,560	
Chemical Testing of Decontamination Water	$2,040	$6,120	Assume all water goes in 1 tank which will be sampled.
Stabilization and Disposal of Decontamination Water	$14,630	$14,668	
Dismantling and Salvaging Tanks, Ancillary Equipment,and Building	$23,222	$24,905	Buildings to be demolished and landfilled, not salvaged and sold
Removal and Disposal of Equipment and Concrete Pad	$34,590	$57,980	Assumes concrete breaker at $45/cy, tanks are crushed and put in landfill not rinsed and resold
Soil Sampling and Chemical Analysis	$32,640	$40,800	16 samples total, 8 extra samples added for bins see soil sampling spreadsheet
Excavation of Contaminated Soils	$2,150	$2,272	
Disposal of Contaminated Soil		$4,766	See above
Earth Backfill for Excavated Contaminated Soils	$538	$2,421	HWB and MW agree on $2/cy for nonhazardous backfill
Revegetation	$6,119	$73,200	See above
Certification of Closure Inspection	$3,000	$3,000	
Certification of Closure Report	$15,000	$15,000	
Subtotal	$159,514	$370,028	

SITE CLOSURE COST ESTIMATE	Cost ($)		
ROLL-OFF STORAGE AREA UNIT			
Stabilization and Disposal of Remaining Waste Inventory	$832,550	$925,056	Waste density increased from 90 pcf to 100 pcf
Decontamination of Equipment	$0	$0	No equipment
Chemical Testing of Decontamination Water	$0	$0	No decontamination will be completed.
Stabilization and Disposal of Decontamination Water	$0	$0	No decontamination will be completed.
Demolition and Disposal of Liner System	$80,960	$192,407	Berms and truck access ramps are not disposed in landfill this material will be used as backfill to regrade the site to its original contours.
Soil Sampling and Chemical Analysis	$144,840	$144,840	
Excavation of Contaminated Soils	$20,240	$21,353	Cost difference too small to spend time to reconcile
Disposal of Contaminated Soil		$44,781	See above
Earth Backfill for Excavated Contaminated Soils	$5,060	$22,770	HWB and MW agree on $2/cy for nonhazardous backfill
Revegetation	$38,507	$136,620	See above
Certification of Closure Inspection	$3,000	$3,000	
Certification of Closure Report	$15,000	$15,000	
Subtotal	$1,140,158	$1,505,827	
TRUCK WASH UNIT			
Stabilization and Disposal of Remaining Waste Inventory	$5,270	$1,200	
Chemical Testing of Decontamination Water	$2,040	$4,080	Assume all water goes in 1 tank which will be sampled.
Decontamination of Equipment	$0	$2,250	Nothing worth deconning. All equipment will be crushed with dozer and landfilled.
Stabilization and Disposal of Decontamination Water	$0	$4,520	No decontamination will be completed.
Demolition and Disposal of Tanks, Concrete and Liner System	$12,321	$16,769	
Soil Sampling and Chemical Analysis	$16,320	$20,400	
Excavation of Contaminated Soils	$713	$285	
Disposal of Contaminated Soil		$598	See above
Earth Backfill for Excavated Contaminated Soils	$178	$414	HWB and MW agree on $2/cy for nonhazardous backfill
Revegetation	$1,592	$4,938	See above
Certification of Closure Inspection	$3,000	$3,000	
Certification of Closure Report	$5,000	$5,000	
Subtotal	$46,435	$63,454	

LANDFILL UNIT			
Landfill Closure			
Landfill Excavation Backfill	$4,120,000	$7,210,000	HWB and MW agree on $2/cy for nonhazardous backfill
Landfill Cover	$2,372,508	$4,831,235	HWB cost too high. No basis for costs provided. See MW detailed worksheet
Demolition and Disposal of Tanks, Concrete and Liner System	$2,426		
Leachate Treatment Facility Construction	$0	*	Note 1
Leachate Treatment Facility Operations	$0	*	Note 1
Leachate pumping and treatment	$79,826		Treatment costs for leachate after closure of stabilization unit. Leachate to be shipped off site
Sump Vadose Zone Sampling and Analysis	$8,000	$8,000	
Well Vadose Zone Monitoring System Sampling and Analysis	$40,000	$48,000	HWB cost too high. No basis for costs provided.
Soil Sampling and Analysis	$104,040	$104,040	
Final Plat Survey	$2,400	$3,600	
Certification of Closure Inspection	$3,000	$3,000	
Certification of Closure Report	$15,000	$15,000	
Subtotal	$6,747,200	*	Note 1
Total Closure Cost (all units)	$9,288,347		
Landfill Post-Closure			
Facility Inspection	$201,600	$201,600	
Routine Landfill Cover Maintenance and Repair	$600,000	$600,000	
Severe Landfill Cover Erosion Damage Repair	$300,000	$300,000	
Perimeter Diversion Ditch Maintenance and Repair	$300,000	$300,000	
Leachate Pumping and Treatment	$239,476	*	Note 1
Leachate Collection System Maintenance	$67,200	*	Note 1
Well and Sump Vadose Zone Maintenance	$67,200	$67,200	Changed to 8 hours per quarter instead of 4 hours per quarter
Sump Vadose Zone Sampling and Analysis	$240,000	$240,000	
Vadose Zone Monitoring Wells Sampling and Analysis	$1,440,000	$1,440,000	Changed from 5 wells to 6 wlls
Notation of Property Deed	$2,500	$2,500	
Certification of Post-Closure Inspection	$3,000	$3,000	
Certification of Post-Closure Report	$150,000	$160,000	Annual reports for 30 years
Subtotal	$3,610,976	*	Note 1
Total Closure Cost + Post-Closure Costs	$12,899,323	*	Note 1

1) We have assumed that leachate generated after closure will be treated off site

Cost Estimate for Site Unit Soil Sampling and Chemical Analysis			
	Number of Samples	Unit Cost of Sample Collection and Analysis ($)	Total Cost ($)
DRUM HANDLING UNIT	1	$2,040	$2,040
EVAPORATION POND UNIT	1	$2,040	$2,040
LIQUID WASTE RECEIVING AND STORAGE UNIT	1	$2,040	$2,040
STABILIZATION UNIT	1	$2,040	$2,040
ROLL-OFF STORAGE UNIT (5)	0	$2,040	$0
TRUCK WASH UNIT	1	$2,040	$2,040
LANDFILL UNIT (6)	0	$2,040	$0

Notes
1) Due to homogeneous nature of decon water only 1 sample will be taken.
2) Decon water will go to 1 tank so only 1 sample will be taken for each facility
3) Chemical analysis cost based on ACZ Hazardous Waste Characteristics test suite.
4) Sampling assumed to be completed at a rate of 2 samples per hour. Cost for sampling assumed to be $80/hour.
5) Roll-off storage unit requires no decontamination.
6) Landfill unit requires no decontamination.

Cost Estimate to Revegetate Site Units

	Area Length (ft)	Area Width (ft)	Building Area (acres)	Unit Cost per Acre ($)	Total Cost ($)
DRUM HANDLING UNIT	418	220	2.11	$10,835.82	$22,876
EVAPORATION POND UNIT	310	305	2.17	$10,835.82	$23,520
LIQUID WASTE RECEIVING AND STORAGE UNIT	84	35	0.07	$10,835.82	$731
STABILIZATION UNIT	123	200	0.56	$10,835.82	$6,119
ROLL-OFF STORAGE UNIT	430	360	3.55	$10,835.82	$38,507
TRUCK WASH UNIT	37	57	0.05	$10,835.82	$525
	33	130	0.10	$10,835.82	$1,067
					$1,592
LANDFILL UNIT (SEE LANDFILL COVER COSTS)					
Notes:					
1)					

Cost Estimate for Closure and Post-Closure Inspection and Report for Site Units

	Quantity	Unit Cost ($)	Total Closure Inspection Cost ($)	Total Closure Report Cost ($)
DRUM HANDLING UNIT				
Closure Inspection	1	$3,000	$3,000	
Closure Report	1	$15,000		$15,000
EVAPORATION POND UNIT				
Closure Inspection	1	$3,000	$3,000	
Closure Report	1	$15,000		$15,000
LIQUID WASTE RECEIVING AND STORAGE UNIT				
Closure Inspection	1	$3,000	$3,000	
Closure Report	1	$15,000		$15,000
STABILIZATION UNIT				
Closure Inspection	1	$3,000	$3,000	
Closure Report	1	$15,000		$15,000
ROLL-OFF STORAGE UNIT				
Closure Inspection	1	$3,000	$3,000	
Closure Report	1	$15,000		$15,000
TRUCK WASH UNIT				
Closure Inspection	1	$3,000	$3,000	
Closure Report	1	$5,000		$5,000
LANDFILL UNIT				
Closure Inspection	1	$3,000	$3,000	
Closure Report	1	$15,000		$15,000
Post-Closure Inspection	1	$3,000	$3,000	
Post-Closure Report	1	$150,000		$150,000

Notes:
1) Closure inspection assumes 30 hours of time at a rate of $100/hour.
2) Closure report assumes 100 hours of time at a rate of $100/hour.
3) Landfill closure report assumes 150 hours of time at a rate of $100/hour.
4) Post Closure reports assumes 300 hours of time at a rate of $100/hour.

Cost Estimate for Earth Excavation and Disposal of Contaminated Soil

	Volume Excavated (cy)	Excavation Cost per cy ($)	Total Cost ($)
DRUM HANDLING UNIT (0.5 ft by 118 ft by 418 ft)	913	$8.00	$7,307
EVAPORATION POND UNIT (0.5 ft by 92,232 ft^2)	1,708	$8.00	$13,664
LIQUID WASTE RECEIVING AND STORAGE UNIT (0.5 ft by 35 ft by 42 ft) * 2	54	$8.00	$436
STABILIZATION UNIT (0.5 ft by 123 ft by 118 ft)	269	$8.00	$2,150
ROLL-OFF STORAGE UNIT (0.5 ft by 414 ft by 330 ft)	2,530	$8.00	$20,240
TRUCK WASH UNIT (0.5 ft by 57 ft by 37 ft) (0.5 ft by 33 ft by 82ft)	89	$8.00	$713
LANDFILL UNIT (No contaminated soil will be excavated from the landfill unit)			

Notes
1) Dimensions based on Design Drawings dated April 2000.
2) Assumes that 0.5 ft thick layer underlying facility is contaminated
3) Assumes excavated material is disposed in landfill.

Cost Estimate for Earth Backfill at Excavated Contaminated Areas			
	Volume Excavated (cy)	Backfill Cost per Cubic Yard ($)	Total Cost ($)
DRUM HANDLING UNIT			
(0.5 ft by 118 ft by 418 ft)	913	$2.00	$1,827
EVAPORATION POND UNIT			
(0.5 ft by 92,232 ft^2)	1,708	$2.00	$3,416
LIQUID WASTE RECEIVING AND STORAGE UNIT			
(0.5 ft by 35 ft by 42 ft) * 2	54	$2.00	$109
STABILIZATION UNIT			
(0.5 ft by 123 ft by 118 ft)	269	$2.00	$538
ROLL-OFF STORAGE UNIT			
(0.5 ft by 414 ft by 330 ft)	2,530	$2.00	$5,060
TRUCK WASH UNIT			
(0.5 ft by 57 ft by 37 ft) (0.5 ft by 33 ft by 82ft)	89	$2.00	$178
LANDFILL UNIT (Volume of air space between			
Phase 1A waste volume and Phase 1A excavation)	2,060,000	$2.00	$4,120,000

Notes
1) Dimensions based on Design Drawings dated April 2000.
2) Backfill unit cost based on experience with other projects in North America.
3) Backfill assumed to be placed in lifts but not compacted.

Cost Estimate for Site Unit Soil Sampling and Chemical Analysis

	Number of Samples	Unit Cost of Sample Collection and Analysis ($)	Total Cost ($)
DRUM HANDLING UNIT	68	$2,040	$138,720
EVAPORATION POND UNIT	63	$2,040	$128,520
LIQUID WASTE RECEIVING AND STORAGE UNIT	30	$2,040	$61,200
STABILIZATION UNIT	16	$2,040	$32,640
ROLL-OFF STORAGE UNIT	71	$2,040	$144,840
TRUCK WASH UNIT	8	$2,040	$16,320
LANDFILL UNIT	51	$2,040	$104,040

Notes
1) See worksheet for calculating number of soil samples required.
2) Chemical analysis cost based on ACZ Hazardous Waste Characteristics test suite.
3) Sampling assumed to be completed at a rate of 2 samples per hour. Cost for sampling assumed to be $80/hour.

Cost Estimate to Decontaminate Buildings and Equipment at Site Units

	Hours	Unit Cost per Hour ($)	Total Cost ($)
DRUM HANDLING UNIT			
Salvage Drum Handling Building	120	$60.00	$7,200
EVAPORATION POND UNIT			
Remove Pump	4	$60.00	$240
LIQUID WASTE RECEIVING AND STORAGE UNIT			
Salvage Valves, Switchs, Electrical Panel	40	$60.00	$2,400
STABILIZATION UNIT			
Salvage Drum Stabilization Building	60	$60.00	$3,600
Salvage Reagent Silos	16	$60.00	$960
			$4,560
ROLL-OFF STORAGE UNIT			
See Note 2	0	$60.00	$0
TRUCK WASH UNIT			
See Note 3	0	$60.00	$0
LANDFILL UNIT			
No decontamination required at the Landfill Unit			

Notes:

1) Unit cost to decontaminate is an estimated average cost of laborers and equipment.
2) No equipment or buildings to decontaminate.
3) No deconning will be completed due to limited salvage value. All material will be disposed in landfill.

Cost Estimate to Dismantle Buildings at Site Units

	Building Length (ft)	Building Width (ft)	Building Height (ft)	Building Volume (ft^3)	Unit Cost per Cubic Foot ($)	Total Cost ($)
DRUM HANDLING UNIT						
Salvage Drum Handling Building	418	118	15	739,860	$0.03	$22,196
EVAPORATION POND UNIT						
No building dismantling at the Evaporation Pond Unit						
LIQUID WASTE RECEIVING AND STORAGE UNIT						
No building dismantling at the Liquid Waste Receiving and Storage Unit						
STABILIZATION UNIT						
Salvage Drum Stabilization Building	123	118	20	290,280	$0.08	$23,222
ROLL-OFF STORAGE UNIT						
No building dismantling at the Roll-Off Storage Unit						
LANDFILL UNIT						
No building dismantling at the Landfill Unit						

Notes:
1) Demolition cost based on Means Site Work & Landscape Cost Data, pg 28.

Cost Estimate to Demolish and Dispose of Site Units Flooring, Liner Systems, etc.

	Demolition Volume (cy)	Disposal Cost per cy ($)	Total Cost ($)
DRUM HANDLING UNIT (3)(4)			
Concrete Floor Pad and Subfloor (1.5 ft by 118 ft by 418 ft)	2,740	$45.00	$123,310
EVAPORATION POND UNIT (3)(4)			
Concrete Floor Pad (1 ft by 60 ft by 36 ft)	80	$45.00	$3,600
Pad Sand and Clay Liner (4 ft by 60 ft by 36 ft)	320	$8.00	$2,560
Liner System (3 ft by 92,232 sq ft)	10,248	$8.00	$81,984
			$88,144
LIQUID WASTE RECEIVING AND STORAGE UNIT (1)(2)(3)			
4 Tanks 15,500 gal	31	$200.00	$6,140
4 Tanks 9,000 gal	18	$200.00	$3,565
Concrete Pad (35 ft by 42 ft by 1 ft) * 2	109	$45.00	$4,900
			$14,605
STABILIZATION UNIT (3)(4)			
Various Equipment	1,300	$8.00	$10,400
Concrete Pad (1 ft by 123 ft by 118 ft)	538	$45.00	$24,190
			$34,590
ROLL-OFF STORAGE UNIT (3)(4)			
Soil Liner System (2 ft by 414 ft by 330 ft)	10,120	$8.00	$80,960
TRUCK WASH UNIT (1)(2)(3)(4)			
3 Tanks 9,000 gal	13	$200.00	$2,674
Liner System (1 ft Foundation Sand)	203	$8.00	$1,622
Concrete Pad (1 ft by 57 ft by 37ft and 1 ft by 33 ft by 82 ft)	178	$45.00	$8,025
			$12,321
LANDFILL UNIT (1)(2)(3)			
1 Tank 15,500 gal	8	$200.00	$1,535
1 Tank 9,000 gal	4	$200.00	$891
			$2,426

Notes
1) Liquid waste tanks will be crushed to 10% of their storage volume
2) Liquid waste tanks disposal cost is higher due to specialized equipment and labor costs.
3) Unit cost includes material loading, hauling, and placement in the landfill unit.
4) Disposal costs based on telephone survey of hazardous waste disposal sites. All companies and sites provided information on condition of anonymity.

Cost Estimate to Stabilize and Dispose of Remaining Waste Inventory at Site Units at Closure Time	Waste Inventory (tons)	Reagent (tons)	Total Waste (tons)	Reagent Unit Cost per Ton ($)	Waste Disposal Unit Cost per Ton ($)	Total Cost ($)
DRUM HANDLING UNIT						
Stabilize and Dispose of Waste Inventory	309	494	803	$60	$8	$36,071
EVAPORATION POND UNIT						
Stabilize and Dispose of Waste Inventory	2,936	4,698	7634	$60	$8	$342,954
LIQUID WASTE RECEIVING AND STORAGE UNIT						
Stabilize and Dispose of Waste Inventory	162	1,530	1692	$60	$8	$105,336
STABILIZATION UNIT						
Stabilize and Dispose of Waste Inventory	180	288	468	$60	$8	$21,024
ROLL-OFF STORAGE UNIT						
Stabilize and Dispose of Waste Inventory	7,128	11,405	18533	$60	$8	$832,550
TRUCK WASH UNIT						
Stabilize and Dispose of Waste Inventory	45	72	117	$60	$8	$5,270
LANDFILL (Stabilization and disposal of remaining waste inventory not applicable to landfill unit)						

Notes
1) Reagent cost includes material and mixing costs.
2) Waste disposal costs include loading material, hauling, and placement in the landfill
3) Reagent costs, mixing rates, and disposal rates based on telephone survey of hazardous waste disposal sites. All companies and sites provided information on condition of anonymity.

Cost Estimate to Stabilize and Dispose of Decontamination Water used for Site Unit Equipment and Buildings at Closure Time

	Decon Water Volume (gal)	Waste Inventory (tons)	Reagent (tons)	Total Waste (tons)	Reagent Unit Cost per Ton ($)	Waste Disposal Unit Cost per Ton ($)	Total Cost ($)
DRUM HANDLING UNIT							
Decontamination Water	5,000	23	213	235	$60	$8	$14,630
EVAPORATION POND UNIT							
Decontamination Water	2,500	11	106	118	$60	$8	$7,315
LIQUID WASTE RECEIVING AND STORAGE UNIT							
Decontamination Water	5,000	23	213	235	$60	$8	$14,630
STABILIZATION UNIT							
Decontamination Water	5,000	23	213	235	$60	$8	$14,630
ROLL-OFF STORAGE UNIT							
Decontamination Water	0	0	0	0	$60	$8	$0
TRUCK WASH UNIT							
Decontamination Water	0	0	0	0	$60	$8	$0
LANDFILL (No decontamination associated with Landfill Unit)							

Notes
1) 85 lbs of reagent used to treat each gallon of decontamination water, decon water 9 lbs/gal
2) Reagent costs and mixing rates based on telephone survey of hazardous disposal sites. All companies and sites provided information on condition of anonymity.
3) No decontamination will be completed at these units.

Waste Inventory of Site Units at Closure Time

	Quantity	Units	Tons of Waste	Tons of Reagent	
DRUM HANDLING UNIT (1)(5)					
1,120 drums at 55 gal/drum	61,600	gal	309	494	802.94
EVAPORATION POND UNIT (2)(5)					
2 ponds at 2ft by 225ft by 87ft each	78,300	ft^3	2,936	4,698	7,634.25
LIQUID WASTE RECEIVING AND STORAGE UNIT (3)(5)					
4 tanks at 9,000 gals/tank	36,000	gal	162	1530	1,692.00
STABILIZATION UNIT (4)(5)					
4 bins at 100cy/bin, each 1/3 full	3,600	ft^3	180	288	468.00
ROLL-OFF STORAGE UNIT (4)(5)					
132 containers at 40cy/container	142,560	ft^3	7,128	11,405	18,532.80
TRUCK WASH UNIT (1)(5)					
1 full refuse water tank at 9000 gal	9,000	gal	45	72	117.31
LANDFILL (No waste to moved from the landfill at closure)					

Notes:
1) 7.48 gallons/cu. ft, waste density - 75 lbs/cu. ft., 1.6 tons reagent per 1 ton of waste
2) Waste density - 75 lbs/cu. ft, 1.6 tons reagent per 1 ton of waste, waste does not have free liquids
3) 85 lbs of reagent per gallon of liquid, liquid density is 9 lbs/gal
4) Waste density - 100 lbs/cu. ft, 1.6 tons of reagent per 1 ton of waste, waste does not have free liquids
5) Reagent costs and mixing rates based on telephone survey of hazardous waste disposal sites. All companies provided information on condition of anonymity.

Cost Estimate of Landfill Closure Items

Task	Quantity	Units	Unit Cost	Notes	Total Cost
Landfill Closure Items					
Leachate Treatment Facility Construction					
Leachate Treatment Facility Operations					
Leachate Pumping and Treatment	551	ton	$145.00	1, 16	$79,826
Sump Vadose Zone Sampling and Analysis	4	each	$2,000	1,5	$8,000
Well Vadose Zone Monitoring System Sampling and Analysis	20	each	$2,000	1, 17	$40,000
Landfill Cover System Construction	1	each		2	$2,372,508
Soil Sampling and Analysis	1	each		4	$104,040
Certification of Closure Inspection	1	each		6	$3,000
Certification of Closure Report	1	each		6	$15,000
Final Plat Survey	30	hr	$80.00	7	$2,400
Landfill Post-Closure Items					
Facility Inspection	2,880	hr	$70.00	8,9,15	$201,600
Routine Landfill Cover Maintenance and Repair	30	yr	$20,000	8,10	$600,000
Severe Landfill Cover Erosion Damage Repair	30	yr	$10,000	8,11	$300,000
Perimeter Diversion Ditch Maintenance and Repair	30	yr	$10,000	8,18	$300,000
Leachate Pumping and Treatment	1,652	ton	$145.00	8,12	$239,476
Leachate Collection System Maintenance	960	hr	$70	8,13	$67,200
Well and Sump Vadose Zone Maintenance	960	each	$70	8,14	$67,200
Sump Vadose Zone Sampling and Analysis	120	each	$2,000	8,19	$240,000
Vadose Zone Monitoring Wells Sampling and Analysis	720	each	$2,000	8,17,19	$1,440,000
Notation of Property Deed	1	each	$2,500	20	$2,500
Certification of Post-Closure Inspection	1	each		6	$3,000
Certification of Post-Closure Report	1	each		6	$150,000

Notes:

1) Closure period estimated to be 1 year.
2) See Landfill Cover Construction Cost Estimate for details.
3) Estimated leachate flow rates for Phase 1A is 376 gal/day (1.568 ton/day) for 1 year (365 days)
4) See Site Unit Soil Sampling and Chemical Analysis cost estimate for details.
5) Vadose zone monitoring to be comleted quarterly (4 times/year). For closure period of 1 year represents 4 sampling rounds.
6) See Closure and Post-Closure Inspection and Report Cost Estimate spreadsheet.
7) Based on project surveying experience.
8) Post-closure period is 30 years.
9) Inspections will be completed monthly at 8 hours per inspection for 30 years.
10) Estimate $20,000/year for maintenance.
11) Estimate $10,000/year for erosion damage repair.
12) Conservatively estimate that leachate will decrease linearly over the post-closure period.
13) Estimate 8 hours/quarter, 4 quarters/year for post-closure period.
14) Estimate 8 hours/quarter, 4 quarters/year for vadose zone maintenance during post-closure period.
15) Facility inspection includes: fence, locks, gates, warning signs, landfill cover, perimeter diversion ditch, leachate collection system, leak detection system, and vadose zone monitoring system.
16) Based on project experience.
17) There are 6 vadose zone monitoring wells.
18) Estimate $10,000/year for diversion ditch maintenance costs.
19) Vadose zone sampling and analysis performed 4 quarters/year for post-closure period.
20) Based on attorney quote.

Cost Estimate to Construct Landfill Cover System					
Task	Quantity	Units	Unit Cost	Total Cost	Percentage of Total Cost
Vegetation	1,486,534	sf	$0.01	$14,865	0.6%
Vegetative Cover (2.5 ft thick)	1,486,534	sf	$0.16	$237,845	10.0%
Geocomposite	1,486,534	sf	$0.45	$668,940	28.2%
60 mil Textured HDPE Geomembrane	1,486,534	sf	$0.38	$564,883	23.8%
GCL	1,486,534	sf	$0.38	$564,883	23.8%
Prepared Subgrade (0.5 ft thick)	1,486,534	sf	$0.04	$59,461	2.5%
Protective Soil (1.5 ft thick)	1,486,534	sf	$0.10	$148,653	6.3%
Subtotal Direct				$2,259,532	95.2%
Contingency (5% of Subtotal)				$112,977	4.8%
Total				$2,372,508	100.0%

Notes:
1) Cost estimate based on surface area of the Phase 1A excavation area. This area is much larger than the surface area of the Phase 1A waste; therefore, it is conservative.
2) Unit costs based on project experience in North America, and adjusted for thickness of material layer.

Leachate Disposal

Leachate Disposal Cost:	$145.00	per ton
Phase 1A Active Cell Leachate Production (Note 1):	339	gpd
Leachate Conversion Factor:	7.48	gal/cu. ft
Leachate Unit Weight:	62.4	lbs/cu. ft
Conversion Factor:	2000	lbs/cu. ft
Phase 1A Active Cell Leachate Production (Note 1):	1.41	tons/day
Leachate Disposal Cost After Closure:	$205.03	$/day
Leachate Disposal Cost After 30 year Closure	$0.00	$/day
Hauling Distance:	300	miles
Tanker Volume:	10,000	gallons
Cost per Mile:	$0.40	
Transport Cost per Tanker:	$120.00	
Floor Area:	3.4	acres
Slope Area:	7.9	acres
Leachate Generation (Slope):	32	gpad
Leachate Generations (Floor):	32	gpad
Leachate Volume (Floor):	108.8	gal/day
Leachate Volume (Slope):	252.8	gal/day
Leachate Volume (Floor):	39,712	gal/year
Leachate Volume (Slope):	92,272	gal/year

1) It has been conservatively assumed that the amount of leachate generated the first year after closure will be 131,984 gallons which is loosely based on the HELP modeling which is presented in Section 3.2.2 of Volume III. The actual volume is anticipated to be much less due to the evapotranspiration at the site and the residual water content of the waste.

2) It has been conservatively assumed that leachate generation will reduce by a third every year after placement of the cover system. It is anticipated that leachate production will effectively become nil due to the lack of infiltration through the cover shortly after its construction.

Leachate Disposal

Year	Gallons	Number of Tankers	Rounded Number of Tankers	Transport Cost	Waste Weight (Tons)	Disposal Cost	Total Cost
1	131984	13.1984	14	$1,680	550.52	$96,341	$98,021
2	87989	8.7989333	9	$1,080	367.01	$64,228	$65,308
3	58660	5.8659556	6	$720	244.68	$42,818	$43,538
4	39106	3.910637	4	$480	163.12	$28,546	$29,026
5	26071	2.6070914	3	$360	108.74	$19,030	$19,390
6	17381	1.7380609	2	$240	72.50	$12,687	$12,927
7	11587	1.1587073	2	$240	48.33	$8,458	$8,698
8	7725	0.7724715	1	$120	32.22	$5,639	$5,759
9	5150	0.514981	1	$120	21.48	$3,759	$3,879
10	3433	0.3433207	1	$120	14.32	$2,506	$2,626
11	2289	0.2288804	1	$120	9.55	$1,671	$1,791
12	1526	0.152587	1	$120	6.36	$1,114	$1,234
13	1017	0.1017246	1	$120	4.24	$743	$863
14	678	0.0678164	1	$120	2.83	$495	$615
15	452	0.045211	1	$120	1.89	$330	$450
16	301	0.0301406	1	$120	1.26	$220	$340
17	201	0.0200938	1	$120	0.84	$147	$267
18	134	0.0133958	1	$120	0.56	$98	$218
19	89	0.0089306	1	$120	0.37	$65	$185
20	60	0.0059537	1	$120	0.25	$43	$163
21	40	0.0039691	1	$120	0.17	$29	$149
22	26	0.0026461	1	$120	0.11	$19	$139
23	18	0.0017641	1	$120	0.07	$13	$133
24	12	0.001176	1	$120	0.05	$9	$129
25	8	0.000784	1	$120	0.03	$6	$126
26	5	0.0005227	1	$120	0.02	$4	$124
27	3	0.0003485	1	$120	0.01	$3	$123
28	2	0.0002323	1	$120	0.01	$2	$122
29	2	0.0001549	1	$120	0.01	$1	$121
30	1	0.0001032	1	$120	0.00	$1	$121
	395950				1652		$296,582

RED TPDF 6/08

State of New Mexico
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PETER MAGGIORE
SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

April 5, 2000

Mr. Patrick Corser, P.E.
Principal
Triassic Park Permit Application
Montgomery Watson Mining Group
P.O. Box 774018
Steamboat Springs, Colorado 80477

Dear Mr. Corser:

The Hazardous and Radioactive Material Bureau (HRMB) of the New Mexico Environment Department has completed its review of Sections 1, 2, and 11 (as revised December 7, 1999) of the Triassic Park Hazardous Waste Disposal Facility. HRMB's comments are attached.

As you know, HRMB's review of Section 8 was sent to Mr. Trey Greenwood under separate cover.

Please call me at 505/827-1558 ext. 1016 if you have any comments or questions.

Sincerely,

Stephanie Kruse

Stephanie Kruse
Project Leader
Triassic Park Project

cc: James Bearzi, NMED/HRMB
John Kieling, NMED/HRMB
Carl Will, NMED/HRMB
John Pellicer, Montgomery Watson
Dale Gandy, Triassic Park
David Neleigh, EPA

April 2000

NEW MEXICO ENVIRONMENT DEPARTMENT

HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU
COMMENTS

Triassic Park Hazardous Waste Disposal Facility
Permit Application
December 7, 1999 Revisions
Sections 1, 2, and 11

Section 1.0, General Description

1. Page 1-1, Section 1.1, 2nd paragraph. Please review this paragraph in the context of the section title. If this section contains a general description of the Facility, why discuss only the evaporation pond in the General Description section? Waste is also stored and treated and also goes directly to the landfill. Perhaps only the last sentence of the paragraph is needed.

2. Page 1-3, Section 1.1.11. Please clarify that sanitary liquid wastes will be disposed off-site.

3. Page 1-9, Section 1.3.1, 3rd paragraph. Are the calculations for derivation of storm run-off flows in the Engineering Report in Vol. III or in another supporting volume of the Permit application? If so, please cite. If not, please provide. (Staff notes on the review of the August 18, 1999 revision in Santa Fe with Pat Corser read, "Pat C. will provide calculations. Or will get into III, App. F.")

Section 2.0, Treatment, Storage, and Disposal

4. Page 2-4, Section 2.2.1.3. Please change "The Facility will contain seven separate containment areas" to "The drum handling unit will contain seven separate containment areas".

5. Page 2-5, Section 2.2.2, 3rd paragraph. Trucks should not pick up an accumulation of waste at the Roll-Off StorageArea. Should this paragraph be transferred to the landfill or truck wash, etc., section?

6. Page 2-5, Section 2.2.2, 4th paragraph. The first sentence states that the roll-off storage area is restricted to wastes that do not contain free liquids. However, the second sentence of Section 2.2.2.1 (page 2-6) states, "The roll-off storage area is designed to store any non-stabilized waste that may contain free liquids." Please explain this discrepancy.

HRMB COMMENTS

Triassic Park Hazardous Waste Disposal Facility
Permit Application
December 7, 1999 Revisions
Sections 1, 2, and 11

7. Page 2-5, Section 2.2.2, 1st paragraph. Please discuss measures that will provide for the segregation of containers which may hold PCB-contaminated soils or other solids.

8. Page 2-6, Section 2.2.2.1, 1st paragraph, 2nd sentence. "The roll-off storage area is designed to store any non-stabilized waste that may contain free liquids." This sentence contradicts the previous sentence (page 2-5, Section 2.2.2, 4th paragraph, 1st sentence), "This area is restricted to wastes that do not contain free liquids." Please correct the discrepancy.

9. Page 2-8, Section 2.2.8. Please correct Part A, Section XII, which identifies the design capacity of the roll-off storage unit in gallons.

10. Page 2-11, Section 2.3.8, 1st sentence. The written assessment attesting that the tank system has sufficient structural integrity and is acceptable for the storing and treating of hazardous waste should be included in the Permit application, in compliance with 20 NMAC 4.1.500 (incorporating 40 CFR 264.192(a)).

11. Page 2-12, Section 2.3.9, 2nd paragraph. 2nd sentence. Please add this sentence to Section 8.0, *Closure Plan*.

12. Page 2-13, Section 2.4, 4th paragraph. This paragraph is not clear to the reviewer. How will the determination be made that specific stabilized wastes can go directly to the Landfill for disposal without testing?

13. Page 2-13, Section 2.4, 6th paragraph. 150,000 cubic yards (amount treated per day) divided by 2,500 cubic yards (maximum amount per batch) = 60 batches per day. 60 batches per day divided by 4 bins = 15 batches per bin per day. Please assure HRMB that this is feasible.

14. Page 2-15, Section 2.4.7, 1st paragraph, 4th sentence. All designs for the stabilization bins must be final.

15. Page 2-15, Section 2.4.8, 1st sentence. Please see Comment No. 13.

16. Page 2-15, Section 2.4.8, 2nd sentence. Please change the 2nd sentence from "the preliminary tank design" to "the final tank design".

HRMB COMMENTS

Triassic Park Hazardous Waste Disposal Facility
Permit Application
December 7, 1999 Revisions
Sections 1, 2, and11

17. Page 2-16, Section 2.5. Please change "The overall landfill will be constructed in Phases. As shown on drawing 4." to read, "The overall landfill will be constructed in Phases, as shown on drawing 4."

18. Page 2-16, Section 2.5.1.1. Please add the identification of permitted wastes from Section 4.0 to this section.

19. Page 2-16, Section 2.5.1.1. Please add waste containing organic concentrations of at least 10 percent by weight to the list of unacceptable wastes.

20. Page 2-17, Section 2.5.1.1,2nd sentence. The area of Phase 1A given in this sentence (553,200 cubic yards) does not agree with Part A, Section XII (533,000 cubic yards). Please correct this typographical error.

    Please remove the last two words of the sentence.

21. Page 2-20, Section 2.5.1.8,3rd paragraph, 3rd sentence. Changes at closure in response to gas build-ups beneath the barrier layer of the Landfill cover may require a modification to the Permit.

22. Page 2-23, Section 2.5.3.6, 1st sentence. The 1st sentence refers to Section 4.3.1.2. Please be aware that Section 4.0, the Waste Analysis Plan, has been revised and all references to particular subsections of 4.0 should be rechecked.

23. Page 2-25, Section 2.5.3.9,3rd bullet. The third bullet reads, "Utilizing if during a heavy rain event, water ponds on the surface of the daily cover." Please clarify this bullet.

24. Page 2-28, Section 2.6.1.1,1st paragraoh. Please provide references for the documents cited at the end of the section.

25. Page 2-30, Section 2.6.1.2,1st sentence. Add "in" between "presented" and "Drawing".

26. Page 2-32, Section 2.6.3. Please remove "and Quantity" from the heading.

27. Page 2-32, Section 2.6.3. Please indicate that the evaporation pond will not accept wastes covered by 20 NMAC 4.1.500 (incorporating 40 CFR 264, Subparts BB and CC).

HRMB COMMENTS

Triassic Park Waste Disposal Facility
PermitApplication
December 7, 1999
Sections 1, 2, and 11

28. Page 2-35, Figure 2-1. Figure 2-1 is the same as Figure 1-2. Is this figure discussed in the Section 2.0 text?

Section 11.0, 40 CFR 264 Subpart AA, BB & CC Regulations

29. Page 11-1, Section 11.2. Please discuss whether wastes with organic concentrations of 10 percent or greater by weight will be accepted for storage in containers and/or placement in the Landfill.

30. Page 11-1, Section 11.3, 2nd paragraph. "Potential air pollution from these containers will be controlled in accordance with the container level 2 standards specified in CFR 264.1086(d)." This sentence is repeated in Section 11.3.2.

    Please note that a container with a design capacity less than or equal to 0.1 m^3 is exempt from the requirements of Subpart CC (20 NMAC 4.1.500 (incorporating 40 CFR 264.1080(b)(2)). A container with a design capacity greater than 0.1 m^3 and less than or equal to 0.46 m^3 must meet Container Level I standards (20 NMAC 4.1.500 (incorporating 40 CFR 264.1087(b)(1)(i)).

31. Page 11-1, Section 11.3.1. The second sentence reads, "The waste determination shall be made at the point where the Facility first takes possession of the waste." Please change this sentence to indicate that the waste determination will be made at the point of waste origination (20 NMAC 4.1.500 (incorporating 40 CFR 264.1082(c)(1)).

32. Page 11-2, Section 11.3.5, 1st sentence. Add "be" between "will" and "limited".

33. Page 11-2, Section 11.3.6. The correct cite is 40 CFR 264.1088(b).

State of New Mexico
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PAUL R. RITZMA
DEPUTY SECRETARY

RFD TPDF 5/00

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

April 7, 2000

Mr. Patrick Corser, P.E.
Principal
Triassic Park Permit Application
Montgomery Watson Mining Group
P.O. Box 774018
Steamboat Springs, Colorado 80477

Dear Mr. Corser:

The Hazardous and Radioactive Material Bureau (HRMB) of the New Mexico Environment Department has completed its review of Sections 5, 6, 7, and 9 (as revised January 7, 2000) of the Triassic Park Hazardous Waste Disposal Facility. HRMB's comments are attached.

HRMB's review of Section 10 will be sent under separate cover.

Please call me at 505/827-1558 ext. 1016 if you have any comments or questions.

Sincerely,

Stephanie Kruse

Stephanie Kruse
Project Leader
Triassic Park Project

cc: James Bearzi, NMED/HRMB
John Kieling, NMED/HRMB
Carl Will, NMED/HRMB
John Pellicer, Montgomery Watson
Dale Gandy, Triassic Park
David Neleigh, EPA

April 2000

HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU COMMENTS

Triassic Park Hazardous Waste Disposal Facility
January 7, 2000 Revisions
Sections 5, 6, 7, and 9

Section 5.0, Procedures to Prevent Hazards

1. Page 5-2, Section 5.2.1, carry-over paragraph, 1st sentence. "Sections 5.2.2 through 5.2.9" should be changed to "Section 5.2.2 through 5.2.10."

2. Page 5-2, Section 5.2.1.1, 3rd paragraph, 2nd sentence. With regard to the inspection checklists, it was agreed at the review of the August 18, 1999 revision of the Permit Application in Santa Fe that additional checklists would be included. Mr. Pat Corser was provided with examples of these checklists.

3. Page 5-4, Section 5.2.5, 1st paragraph, last sentence. "(4) the Gathodic Protection Systems" should read "the Cathodic Protection Systems".

4. Page 5-5, Section 5.2.7, 1st sentence. Table 5-1 says that a Facility guard will make the rounds of the Facility daily to check for any abnormalities. Please revise this sentence to agree with Table 5-1.

5. Page 5-6, Section 5.2.10. Please include a discussion of appropriate sampling and analysis of the wash water collected at the truck wash area.

6. Page 5-7, Section 5.3.5, last sentence. "Staked" should be "stacked".

7. Page 5-7, Section 5.3.4. NMED remains concerned about the possible insufficiency of water in case of fire outside of buildings or in the Landfill. Discussion with NMED's Solid Waste Bureau regarding water supply at similarly situated solid waste landfills determined the following:

    A regional landfill near Wagon Mound, New Mexico has a 5 000 gal tank; and

    The Lea County (New Mexico) Landfill has a 10 000 gal tank.

    At a minimum, the Landfill must meet the requirements of the New Mexico State Fire Marshal's Office.

8. Page 5-7, Section 5.4, 1st full paragraph, 2nd sentence. These employees should also receive the annual 8-hour refresher course.

9. Page 5-8. Section 5.4.1, 1st full paragraph, last sentence. See Comment 6.

10. Page 5-8, Section 5.4.2.1, 2nd paragraph. Please add the run-off/run-on inspection to Table 5-1.

11. Page 5-8, Section 5.4.2.2. Please add a sentence addressing maintenance as needed.

12. Page 5-12, Section 5.5, carry-over paragraph. References to Section 4.0 should be checked, following approval of the latest revision.

13. Page 5-12, Section 5.5.2, 1st sentence. Please change "40 CFR 261.2" to "40 CFR 261.21".

14. Page 5-14, Table 5-1. Please add the inspection schedule for the stormwater retention basin and associated ditches to Table 5-1.

Section 6.0, Contingency Plan

15. Section 6.0. This section should include a discussion of inspections for emergency equipment, including a table similar to Table 5-1.

16. Page 6-1, Section 6.0, 2nd paragraph, 2nd sentence. Please delete this sentence. A final contingency plan is required as part of the permit application. Please indicate the specific information (referring to the list in the next paragraph) that will be submitted to NMED 60 days prior to initiation of operations (e.g., the list of Emergency Coordinators, signed agreements with local authorities).

17. Page 6-5, Section 6.3.4, 2nd bullet, last line. Should not this line include hazards to human health and/or the environment inside the Facility as well as outside?

18. Page 6-7, Section 6.3.5.1, 3rd paragraph. Please change "effected" to "affected".

19. Page 6-8, Section 6.3.5.2, 5th bullet. Please change "the regional administrator" to "the NMED Secretary".

HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU COMMENTS

Triassic Park Hazardous Waste Disposal Facility
January 7, 2000 Revisions
Sections 5, 6, 7, and 9

Section 7.0, Personnel Training

20. Page 7-5, Section 7.1.5, 7th bullet. Please replace "fingerprint testing confirms" with "the initial and annual full chemical analysis and fingerprint analysis confirm".

21. Page 7-5, Section 7.1.6, 1st sentence. Please include ditches in the list.

22. Page 7-6, Section 7.2.1.1, 1st paragraph. Please review this section. The outline of the RCRA training class course contents contained in paragraph 2 seems very ambitious for an 8-hour session.

July 9, 2000

COMMENTS

SECTION 1.0

1. **P. 1-1, Section 1.1, 2nd paragraph, 3rd sentence.** Delete Toxic Substances Control Act (TSCA)-regulated". Amend paragraph to read, "...polychlorinated biphenyl (PCB) wastes that are not regulated by TSCA, i.e., PCB wastes at concentrations of less than 50 parts per million (ppm) in liquids and 500 ppm for bulk PCB remediation waste."

SECTION 2

2. **P.2-3, Section 2.1.2, 5th line.** Change "Section 4.3.2.1" to "Section 4.4.3.1".
   P.2-3, Section 2.1.2, 7th line. Ditto.

3. **P. 2-5, Section 2.2.1.1, 2nd paragraph.** Explain LDRS and LCRS. Two collection systems per cell?

4. **P. 2-5, Section 2.2.1.1, last paragraph.** Remove "TSCA cells" and substitute "cells which will hold PCB-contaminated waste".

5. **P. 2-5, Section 2.2.1.3, 4th line.** Delete "TSCA" from, "to accommodate only TSCA PCB wastes." Aprons on the ends of the TSCA areas...." to read, "Aprons on the ends of the cells which will store PCB-contaminated wastes...."

6. **P. 2-6, Section 2.2.2, 2nd paragraph, last sentence.** What area is this? Where is it discussed? This is the only reference to the 25 year/24 hour storm inundating permitted areas. Section 1 says it is not in the 100 year flood plain. Why is the 25 year flood inundating areas?

7. **P.2-14, Section 2.4, 4th paragraph, 2nd line.** Should "compared" read "conducted"?

8. **P. 2-17, Section 2.5.1.1, 1st paragraph.** Why not delete list and just refer to Section 4.1.2.? In any case, get rid of "TSCA" in line 2.

9. **P. 2-26, Section 2.5.3.9, 4th bullet.** This is incomplete. What is it supposed to say? An older version combines the 3rd and 4th bullets, reading: "if during a heavy rain event, water ponds on the surface of the daily cover, utilize vacuum trucks to remove as much of this water as possible before it can seep into the waste;"

10. **P. 2-33, Section 2.6.3, 5th line.** Delete "TSCA".

SECTION 3.0

Some references are included in Section 12.0. Some are not. Those that are not are:

McKee and Bump	Bump and McKee
Richards	Stoller
Brooks	Irmay
Hillel	

SECTION 5.0

11. **P. 5-9, Section 5.3.3, 1st paragraph.** Where/how is this equipment stored for outdoor areas?

12. **P. 5-13, Section 5.4.8, line 12.** Change " regeant" to "reagent".

13. **P. 5-15, Section 5.5.3, 3rd paragraph, lines 5 and 6.** Change "seperate" to "separate".

July 11, 2000

SECTION 11.0

14. **P. 11-1, Section 11.2.** Will wastes with organic concentrations greater than 10 percent by weight be accepted for storage and disposal directly in the landfill? [UTS prevent? **TREY.**]

15. **P. 11-1, Section 11.3.** The 1st and last sentences appear contradictory. Containers only need to meet Container Level 2 standards if they contain waste with volatile organic concentrations equal to or greater than 500 ppmw.

16. **P. 11-4, Section 11.3.7.2, 2nd bullet.** What is this about? What continuous monitoring?

August 10, 2000

1. Vol. III, 2.3, paragraph 2.

   Refers to Appendix E-34. There is no Appendix E-34.

2. 2.3 and 2.3.1 - refer to tank "elevated above" or "placed on" pad. Which?

3. -

4. Vol I, 2.3, paragraph 2.

   Compatibilities "assessed" in Vol III. Compatabilities are mentioned, but not assessed.

5. Vol. III, 8.1.2, paragraph 1, last sentence.

   DISCUSS.

6. Vol. III, 8.1.2, paragraph 1.

   Drawing 41 is Truck Roll-Off Area.

7. Vol. III, 8.1.3.

   Pls I.D. where specification section is located (IV, App. C).

8. Vol III, 8.2.3

   Drawing 44 is Truck Wash Area.

9. Vol. IIIm 8.2.1, last sentence.

   There is no Appendix H-3.

10. Drawing 40, Note 3.

    Are there 4 or 2 tanks to be permitted?

11. Vol III, 8.1.1, last paragraph

    DISCUSS.

12. Vol III., p. 6-3, paragraph 2. Not Drawing 24. 34? Anyway, there is no table on Drawing 34. Also, p. 6-6, 6.2.4 refers to a table on Drawing 34.

13. Liquid Waste Storage Tanks - No berm? So pad not secondary containment? But does have LDRS in pad?

14. Vol III, p. 6-2, 6.1.3, paragraph 1. Drawing 35 doesn't show location of leak detection and removal piping.

15. Vol III, 6.2.3, paragraph 1. No piping from liquid waste storage area. Delete "or in the double walled stabilization bins."

16. Vol III, 8.2.3. Drawing 44 is the Truck Wash Area.

17. Vol III, p. 8-2, 8.2.2. No pumping/piping/control features on Drawing 41.

18. Vol III, 6.1.3, p. 6-2, paragraph 1. Where do LDRS pipes come out? How is liquid removed?

19. Vol. III, 6-1, 6.1.1, last sentence. Put in Permit.

20. Vol I, 2.3.8. No "discussion" of excluded waste in Vol. III.

21. Vol I, 2.3.9. "limited piping system" - Hard-plumbed? Attached to what? Drawings?

22. Pls add sentence to WAP, Section 4.1.2, Prohibited Waste, - No hazardous waste containing volatile organic concentrations equal to or greater than 500 ppmw in tanks or evaporation pond.

23. Vol III, 6.1.3, paragraph 2, last sentence.

    DISCUSS.

24. 264.193 and 4.4.2.c. and 4.4.2.d.

    Portion of a tank system component not readily available for visual inspection?

25. Permit Condition 4.5

    No pr/temp gauges?

26. 4.5.2 Tank inspection for stabilization tanks.

    Anything similar for Liquid Waste Storage Tanks?

August 13, 2000

COMMENTS: CONTAINERS

1.Vol. I, Section 2.2, p. 2-4, paragraph 1, first sentence.

Drawing 39 is Liquid Waste Tanks.

2.Vol. I, Section 2.2.2, p. 2-6, paragraph 3, first sentence.

"Landfill operational staff...." This section discusses roll-off containers. Should the sentence read, "Facility operational staff..."?

3.Vol. III, Section 7.1.3, p. 7-3, paragraph 3, 5th sentence.

"Drawing No. 44 shows the rebar types and concrete details for the floor." Section 7.1.3 discusses the Drum Handling Building. Drawing 44 is Truck Wash Layout and Details. Say something like, "similar to the rebar types shown on Drawing 44"? Also, not much detail on floor provided on Drawing 44.

4Vol. III, Section 5.1.1, p. 5-1, paragraph 1, last sentence.

"The liner system incorporated in the unstabilized waste roll-off area is included as a precautionary measure." The drawing shows the liner under the entire Roll-Off Container Storage Area. Vol. 1, Section 2.2.2, p. 2-6, paragraph 2, 3rd sentence, reads, "The individual steel roll-off bins will be stored in the HDPE-lined areas of the roll-off storage unit." Which is correct?

August 20, 2000

Comments: Part 5 (Surface Impoundment)

1. Vol. I, Section 2.6.1, p. 2-29, paragraph 1, 1st sentence.

   264.221(c) refers only to the LDRS. Reference should be to 40 CFR 264.221.

2. Vol. I, Section 2.6.1, p. 2-29, first paragraph.

   I get 75, 240 sq ft. (285 x 132 x 2 - from Vol. III, Section 4.1.2, paragraph 3).

3. Vol. I, Section 2.6.1.1, p. 2-30, l. 1. "...to accept high concentrations of organic, therefore...."

   Should be something like, "...organic - materials? contaminants?..."

4. Vol. I, Section 2.6.1.2, p. 3-31, 1st sentence below bullets.

   "...presented Drawing 32...." Should be "presented in Drawing 32".

5. Vol. I, Section 2.6.1.4, p. 2-32. "...Run-off in the pond will be pumped out within 24 hours of a storm event with vacuum trucks. Contaminated water will be treated in the stabilization bins and treatment residuals will be disposed of in compliance with appropriate regulations."

   DISCUSS.

6. Vol. III, Section 4.1.2, p. 4-2. "2-ft freeboard".

   From the drawing, the berm is 11 ft in height. So is the maximum operational level 9 ft? Or 10 ft?

7. Vol. III, Section 4.1.3, p. 4-2. No plan drawing (similar to the Drawing 41 for the Truck Roll-Off Area) showing extent of liner? What is the extent of the liner? Where is this discussed?

8. Vol. III, Section 4.1.3, p. 4-3, "Leak Detection and Removal and Vadose Monitoring Sump Systems".

   Lines 2 and 8 refer to the landfill. Should refer to the evaporation pond.

9. Vol. III, Section 4.1.4, p. 4-3.

   Is the Discharge Pad used for incoming trucks also? Drawing No. 40 for the Roll-Off Container Storage Area shows incoming and outgoing flows of waste well. It would be nice if Drawing 31 showed something similar for the Surface Impoundment. (Is addressed in (O&M Plan.)

10. Vol. III, Section 4.2.1, p. 4-4, 1st paragraph, l. 5.

    "of the of site". One too many "ofs".

11. Vol. III, Section 4.2.8, p. 4-7, paragraph 2, l. 4.

    "affects" should be "effects".

12. Vol. III, Drawing Nos. 28 and 29.

    Please label, "Phase I".

13. Surface Impoundment - permit for treatment only? or treatment and storage?

14. Again, I find little about construction or maintenance of the berm. Is it earthen? How wide is it? Where is this discussed?

15. Volume I, RAP, Section 3.7.2, - refers only to Landfill.

    [Will discuss RAP in relation to the evaporation pond in Comments <u>re</u> the landfill - Stay tuned!]

16. 264.228(a)(2)(ii). "Stabilize remaining wastes to a bearing capacity sufficient to support final cover...."

    DISCUSS.

Comments: Operations and Maintenance Plan

1. Section 2.1, p.2, paragraph 4.

   [Will discuss this section after I have reviewed the landfill sections.]

2. Section 2.2, p. 2, paragraph 1, l. 1.

   See Comment No. 2 in Surface Impoundment section.

3. Section 2.2, p. 2, paragraph 2.

   See Comment No. 5 in Surface Impoundment section.

4. Section 2.6, p. 3, paragraph 2. "...4 to 8 feet high berm"

   Vol. III, Section 5.1.2, p. 5-1, says, "...from 6 ft to 10 ft...." Vol. I, Section 2.2.2.1, paragraph 4, says, "...from 4 feet to 8 feet." Please make necessary corrections and let me know.

5. Section 3.1.1, p. 5, Subsection C.1.

   Table references are to the WAP? There is no table - now - listing minimal parameters to be shown in the waste stream profile. Instead of referring to Table 4.3, refer to Sections 4.3.3 and 4.5.2.

6. Section 3.1.1, p. 6, C. 6

   "...has been treated...." should read, "has treated".

7 Section 3.1.1, p. 6, D, l. 3.

   "...tested for compatibility with the landfill and surface impoundment containers...." What surface impoundment containers? How about the stabilization bins?

8. Section 3.1.1, p. 6, E.

   WAP has changed. Required/supplemental analyses have kind of gone by the boards (whatever that means). Best to refer to Section 4.5.5.5 for discussion of incoming waste that is directly landfilled. Refer to Tables 4.2 and 4.3.

9. Section 3.1.3, p. 7, A. "Confirmatory analyses will be performed according to Section 4.1.8.1."

   There is no longer a Section 4.1.8.1. What does this refer to?

10. Section 3.1.3, p. 7, B.

    Refer to Section 4.5.4, rather than to Table 4.5.

11. Section 3.2.1, p. 7, .D.

    I think (but wouldn't swear to - I get this from context while reading the regs) that shipping papers are for train shipments.

12. Section 3.2.2, p. 8, B.

    Not biennially, but annually. (This is from the WAP Guidance, and is part of the QA/QC procedure.)

13. Section 3.2.4, p. 9, M.

    Ck Section 4.1.2 for how to word this. The 50 ppm cut-off refers to liquid PCB-contaminated waste. There is no cut-off for bulk PCB-contaminated remediation waste.

14. Section 3.3, p. 9, A.
    No Table 4.7 now. I think these areas are listed in Section 10.0?

15. "...Leachate that doesnot meet applicable LDR requirements will be treated before landfilling.

    Treated by stabilization.

16. Section 3.3, p. 10, E. "...For most materials, the TCLP extraction method will be performed, followed by an analysis of the leachate for the appropriate parameters...."

    DISCUSS.

17. Section 3.4.5, p. 12, L. "...Contaminated water that does not meet applicable LDR requirements will be treated before landfilling."

    See Comment No. 15 above.

18. Section 3.5.3, p. 13, A.

Also, wastes that require compliance with 264, Subparts BB and CC will not be placed in the evaporation pond.

19. Section 3.5.3, p. 13, C. "Tanker trucks will be unloaded directly into the evaporation pond through a series of hoses, valves and pipes."

Where are these shown?

20. Section 3.5.3, p. 13, D., l. 1.

"be" should be "by".

21. Section 3.5.3, p. 13, H.

See Comment No. 5 in Surface Impoundment section.

22. -

23. Section 3.8.5, p. 18, E.

264.1086(c)(4)(iii) for Container Level 1 standards and 264.1086(d)(4)(iii) for Container Level 2 standards.

24. Section 3.9.3, p. 20, A., l. 1.

One too many "will be"s.

25. Section 3.9.3, p. 20, I. "Individual bins will be physically separated from each other by a minimum of 1 foot...."

Vol. I, Section 2.2.2, p. 2-6, paragraph 2, says, "...physically separated from each other by 4 feet side to side, and 2.5 feet end to end,...." (What does this mean?) K., below, says, "Roll-off containers will be spaced 4 feet apart...."

DISCUSS.

26. Section 3.9.3, p. 21 N.

Fix wording.

27. Section 3.9.4, p. 21, F.

See Comment No. 23 above.

28. Section 4.2, p. 22, C.

Needs to be finished.

29. Section 4.1, p, 22, D.

And transducers.

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2044 A Galisteo, P.O. Box 26110
Santa Fe, New Mexico 87502-6110
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GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

PAUL R. RITZMA
DEUPTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

September 6, 2000

Larry Gandy, Vice President
Gandy Marly, Inc.
1109 East Broadway
P.O. Box 827
Tatum, New Mexico 88267

Dear Mr Gandy:

RE: **Notice of Deficiency (NOD) - Technical Adequacy Review of Triassic Park RCRA Part B Permit Application Revision April 2000.**
EPA ID No. NM0001002484

The Hazardous Waste Bureau (**HWB**) of the New Mexico Environment Department (**NMED**) has completed its technical adequacy review of the treatment/storage/disposal permit application from Gandy Marly, Inc. (**GMI**) for the proposed Triassic Park Waste Disposal Facility. This application is required under the Resource Conservation and Recovery Act (**RCRA**), as incorporated within the New Mexico Hazardous Waste Management Regulations, 20.4.1 NMAC. The application describes the disposal of hazardous waste in a Phase 1 landfill, and the storage and treatment of hazardous waste at the surface. Our review includes all revisions submitted by GMI through April 2000.

As previously discussed in a telephone conversation between GMI and HWB on August 30, 2000, HWB has found the application to be technically deficient. The enclosed Attachments A and B constitute the NOD by listing the requested information necessary for HWB to partially finalize preparation of a draft permit. Attachment A contains requests for specific information from Volumes I and III of the application, particularly regarding the landfill construction and operation. Attachment B contains additional information requests. Issues that will remain outstanding after resolution of this NOD will be those regarding the Waste Analysis Plan, inspection checklists, Construction Quality Assurance Plan, and the closure cost estimates.

Also attached for your information are copies of formal and informal correspondence between your contractor, Montgomery Watson (**MW**), and the HWB project staff, generally in the form of a faxes or electronic mail. These correspondence are concerned with other issues that arose during the permit application review process. MW has resolved, or has committed to resolve, these issues to the satisfaction of the HWB. The correspondence is organized according to the HWB staff person involved and is contained in Attachment C.

Please submit the information listed in Attachments A and B to HWB within sixty (60) days of receipt of this NOD. Failure to submit the information within this designated time may result in the denial of the Permit Application. We understand some information listed in this NOD may require more than 60 days to develop. For this reason, HWB will consider a petition to extend the deadline for portions of the required information if you provide a written justification and expected submittal dates for each portion.

If you have any questions about this NOD, please contact Ms. Stephanie Kruse, or me at (505) 827-1558.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

Enclosures
cc: w/attachments
- Greg Lewis, NMED WWMD
- Stephanie Kruse, HWB
- Susan McMichael, NMED OGC
- Dale Gandy, GMI
- Ken Schultz, GMI
- Pat Corser, MW
- David Neleigh, EPA Region 6
- TP File – Red 2000

cc: w/o attachments
- John Kieling, HWB
- Steve Pullen, HWB
- Glenn von Gonten, HWB
- David Cobrain, HWB

C:/MF/TP/NOD.9.6.2000
9/6/2000 sdp

APPENDIX A

NOTICE OF DEFICIENCY: TRIASSIC PARK HAZARDOUS WASTE DISPOSAL FACILITY PERMIT APPLICATION

NOTICE OF DEFICIENCY

Hazardous Waste Bureau staff have reviewed the Landfill sections of Vols. I and III of the Triassic Park Hazardous Waste Disposal Facility permit application, and have noted several deficiencies. These deficiencies, along with staff comments and requests for clarification, are detailed below:

Landfill Sections

Volume I

1. **P. 2-17, Section 2.5, Landfill.**

   Phase 1A implies the existence of a Phase 1B. There is no discussion in the permit application of Phase 1B, which, under Phase 1A, is the site of the collection basin (according to the drawings). Will Phase 1B be included in the development of Phase II? Or will it be developed for waste disposal later on in this initial permitting action? (Probably a good place to insert details on this clarification is in Section 3.1.4, Waste Filling Sequence.)

   From review of the Permit Application, staff's current working assumption is that removal of the collection basin located in Phase 1B will be done as part of the Permit modification to develop Phase II. If Triassic Park intends to remove the basin before this permit modification, this must be made clear.

   Triassic Park must clarify this issue.

2. **P. 2-17, Section 2.5.1.1, Nature and Quantity of Waste.**

   The first sentence says that the Facility will accept TSCA PCB waste. This is not strictly correct. Liquid waste with PCB concentrations under 50 ppm is not regulated by TSCA. Bulk PCB-contaminated remediation waste is regulated under TSCA, but TSCA regulations permit this waste to be disposed in a hazardous waste landfill under certain conditions. There is no upper concentration limit on these wastes.

   The list of waste which the Facility will not accept is not complete nor is it completely accurate. It might be better to refer to the list in the Waste Analysis Plan, Section 4.2.

   The last bullet is incorrect (see above).

   Triassic Park must correct this list.

3. **P. 2-18, Section 2.5.1.1.**

Staff's current working assumption is that the Phase 1A landfill area of 47 acres is the upper, outer limits of the landfill sides, i.e., the area which will receive final cover, while the fill area of 15.6 acres is measured at the landfill floor, including the unlined area occupied by the contaminated water basin. Is this correct?

4. **P. 2-19, Section 2.5.1.3, Leachate Collection and Removal System (LCRS), 4th paragraph. "Pumps will be hard piped to the leachate storage tanks,..."**

Will landfill leachate be stored only in the leachate storage tanks? Will leachate from the evaporation pond be stored in the leachate storage tank?

Triassic Park must clarify these points.

5. **P. 2-21, Section 2.5.1.6, Run-On/Run-Off Control. "Run-off from the Facility, but not from the active portion of the landfill (including run-on/run-off from the landfill perimeter ditch), will be directed to the stormwater retention basin. The retention basin will be pumped after rainfall events that result in the accumulation of water in the basin."**

Should the first sentence read, "Run-off from the Facility (including run-on/run-off from the landfill perimeter bench), but not from the active portion of the landfill,..."?

Should the second sentence refer to the collection basin rather than the stormwater retention basin"?

Triassic Park must make corrections as necessary.

6. **P. 2-26, Section 2.5.3.9, Response Action Plan: Reducing the Head on the Landfill Liner, last bullet.**

This sentence is incomplete. Triassic Park must make the necessary corrections.

Vol. III

7. **P. 3-1, Section 3.1.2, Landfill Layout and Phasing: Ultimate Landfill Configuration, 1st paragraph. "...The final cover area for Phase 1A is approximately as shown in Drawing No. 23,..."**

   Drawing No. 23 is labeled, "Final Cover Details", and does not show the final cover area. Triassic Park must make the necessary correction.

8. **P. 3-1, Section 3.1.2, Ultimate Landfill Configuration, 3rd paragraph. "As shown on Drawing Nos. 6, 7, and 22, the final cover system will reach a maximum elevation of approximately 4,205 ft."**

   Drawing No. 6 shows the ultimate excavation plan. Triassic Park must make the necessary correction.

9. **P. 3-2, Section 3.1.3, Subgrade Excavation, Liner System, LCRS, LDRS, and Vadose Zone Sump Design: Liner System: 16-foot <u>wide</u> compacted clay liner (CCL) around landfill perimeter**

   The 2nd sentence of text states, "...As shown on Drawing No. 23, a 16-foot <u>thickness</u> of this sand material will be removed and replaced with a compacted CCL component...." Triassic Park must bring these two statements and the drawing into accordance.

10. **P. 3-3, Section 3.1.3, Liner System: Geosynthetic Clay Liner, 2nd paragraph. "Manufacturer published information on the compatibility of the GCL with typical leachate materials is provided in Appendix H-5."**

    There is no Appendix H (Appendix H in Vol. II is the Waste Profile Form). Triassic Park must provide Appendix H.

11. **P. 3-3, Section 3.1.3, Liner System: 60-mil thick high density..., 2nd paragraph.**

    See Comment 10.

12. **P. 3-4, Section 3.1.3, Liner System: 60-mil HDPE geomembrane...., 2nd paragraph.**

    See Comment 10.

13. **P. 3-5, Section 3.1.3, Liner System:Leachate Collection and Removal, Leak Detection and Removal, and Vadose Zone Monitoring Sump Systems, 1st and 2nd paragraph.**

See Comment 10.

14. **P. 3-6, Section 3.1.3, Liner System: Crest Riser Pad Arrangement. 2nd paragraph.**

See Comment 10.

15. **P. 3-6, Section 3.1.4, Waste Filling Sequence, 2nd paragraph. "...Liner installation in Phase 1A will take place in two stages: the slope and floor area below the access ramps and the slope area above the access ramps. Once the waste fill approaches the limits defined in Drawing No. 10, the cut slope will be advanced southward into Phase 2 and the remaining floor and slope areas of Phase 1 will be lined....As the waste fill extends beyond and above the access ramps, a ramp will be established in the south waste fill slope to provide access to the newly lined floor areas of Phase 1...."**

These sentences are unclear with regard to the timing, primarily because the section seems to discuss development of all three phases of the landfill and development of Phase 1A indiscriminately. This is also true for the drawings. (The timing of the south fill slope ramp is a good example.)

For purposes of permitting the initial phase of landfill development, which is staff's immediate concern, staff's working assumptions are as follows:

Lining the slope and floor area below the access ramps covers all the area which will receive hazardous waste under the initial (permitted) stage of Phase 1A. This will be done before the facility initiates operations and will be certified by the Construction Quality Assurance (CQA) officer.

The timing of the second part of liner installaton to be accomplished in Phase 1A - lining the slope area above the access ramps - therefore must coincide with the beginning of Phase II development - which will also include removal of the contaminated water basin and the clean water basin in Phase II. Development of Phase II will be carried out under a permit modification, which will include the second liner installation stage in Phase 1A development. Is this correct?

Staff assumptions with regard to removal of the contaminated water collection basin and the stormwater collection basin are that this will be covered by the permit modification request. Is this correct?

If this is not correct, and these activities will occur before the permit modification, then:

The second stage of Phase 1A liner development and liner development for Phase 1B must be certified by the CQA officer; and

The following information must be provided in the permit application:

Details of how run-on will be prevented after the slope areas above the access ramps are used for waste disposal;

Details of the removal of the two collection basins, and details regarding how contaminated water and stormwater will be handled in the changeover period; and

Details for lining the remaining floor of Phase 1A and the floor of Phase 1B.

Also: There will already be a ramp on the south waste fill slope, which will be constructed before the initiation of operations. Is this correct? Or will this also be constructed under the permit modification for Phase II?

Triassic Park must clarify these points.

Also: Triassic Park must identify the acreage of the initial stage of Phase 1A, e.g., the area identified as lined on Drawing 10.

16. **P. 3-6, Section 3.1.4, last sentence.**

The sentence should read, "Daily cover soil thicknesses will be at least 0.5 ft".

17. **P. 3-7, Section 3.1.5, Interim and Final Covers, 1st full paragraph.**

Where is the source of the interim soil cover? Please provide a description of the soil and explain why it is appropriate for use as soil cover. Please provide a drawing which shows how run-off from interim cover areas reach the perimeter drainage ditch system.

18. **P. 3-9, Section 3.1.6. Landfill Storm Water Control Features.**

Contaminated water basin. A lined contaminated water basin is shown on Drawing 10. It is not shown on any other drawing. It is discussed in the Operations and Maintenance Plan. It is not discussed at all either in Vol. I or Vol. III.

Triassic Park must identify the contaminated water basin and discuss maintenance in Vol. I and must provide information on its construction, dimensions, capacity, and timing of its construction and removal in Vol. III. Please correct drawings as appropriate.

Stormwater collection basin. The stormwater collection basin is shown as unlined on Drawings 8-10 and as lined on Drawing 13. Vol. III, Section 3.1.6, p. 3-5, 2nd paragraph, indicates that this basin is lined.

Triassic Park must correct as appropriate.

Berms. Drawing 13 - Collection Basin Plan and Details - shows a surface water diversion berm blocking the bottom of the south ramp. How do vehicles using the south ramp enter the landfill floor? Drawing 24 shows the Interphase Berm Section. Staff assumes that this is the berm that separates the stormwater collection basin from the contaminated water basin.

As with the evaporation pond berm, no information is provided on the landfill berms (and there is no reference to these drawings) anywhere in the text. Triassic Park must provide information on the dimensions, construction materials, and maintenance of these berms.

19. **P. 3-17, Section 3.2.10, Surface Water Drainage Analyses, 1st sentence. "Design parameters for HDPE lined Channels 7 and 8 located above the landfill access ramps are presented on Drawing No. 25...."**

All ditches except 7 and 8 are shown on Drawing 25. (Design parameters for 7 and 8 are provided on Drawing 25 (2 of 2)).

20. **P. 3-27 Section 3.2.10, 2nd paragraph. "The clean water collection basin...will contain the run-off from the 15 acres of unlined area of the Phase 1A...."**

Does this refer to the slopes above the access ramps? Triassic Park must clarify.

APPENDIX B

NOTICE OF DEFICIENCY: TRIASSIC PARK HAZRDOUS WASTE DISPOSAL FACILITY PERMIT APPLICATION

OUTSTANDING ISSUES

1. April 14, 2000 correspondence from HWB to MW regarding the Revised Draft Section 10, Corrective Action. In this correspondence HWB suggested that portions of the application would conflict with the final permit and that if the application was to be approved in its entirety that the conflicting portions would have to be removed. GMI should abide by the suggestion of the April 14 letter or propose an alternative.
2. April 14, 2000 faxed table of MW responses to HWB's March 16, 2000 "comments" regarding the Draft Vadose Zone Monitoring System Work Plan. General Comment #8 "abandonment of boreholes" remains unresolved. HWB understands that there may be some difficulty locating the boreholes in question, but GMI should formally respond to the inquiry.

Sept 12

State of New Mexico
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PETER MAGGIORE
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PAUL R. RITZMA
DEUPTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

September 12, 2000

Larry Gandy, Vice-President
Gandy Marley, Inc.
1109 East Broadway
P.O. Box 827
Tatum, New Mexico 88267

RE: NOTICE OF DEFICIENCY (NOD) - Technical Adequacy Review of Triassic Park RCRA Permit Application - Part B Vol. I, Section 4.0, Waste Analysis Plan ; Vol. IV, Appendix B, Construction Quality Assurance Plan; Vol. I, Sections 2.5.3.8 and 2.5.3.9; Vol. II, Appendix G, Response Action Plan; and the revised Inspection Checklists.
EPA ID No. NM0001002484

Dear Mr. Gandy:

New Mexico Environment Department Hazardous Waste Bureau (NMED-HWB) staff have completed review of the following portions of the Triassic Park Hazardous Waste Disposal Facility permit application submitted by Gandy Marley, Inc. (GMI): Vol. I, Section 4.0, *Waste Analysis Plan* submitted via e.mail on August 30, 2000; Vol. IV, Appendix B, *Construction Quality Assurance Plan*, revised April 2000; Vol. I, Sections 2.5.3.8 and 2.5.3.9, revised April 2000; and Vol. II, Appendix G, *Response Action Plan*; and the revised Inspection Checklists submitted via e.mail on July 31, 2000. Deficiencies noted are detailed in an enclosure.

Please submit the information required in the enclosure within 60 days of receipt of this letter. Failure to submit the information within this time period may result in the denial of the permit application. GMI may request an extension of this deadline for portions of the required information; the request must be accompanied by a written justification and expected submittal dates for each portion.

If you have any questions, please contact Stephanie Kruse of my staff at 505/827-1558, ext 1012.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

Enclosure

cc:w/enclosure
Greg Lewis, NMED/HWB
Stephanie Kruse, NMED/HWB
Glenn von Gonten, NMED./HWMB
Susan McMichael, NMED/OGC
Dale Gandy, GMI
Ken Schultz, GMI
Trey Greenwood,
Pat Corser, Montgomery Watson
David Neleigh, EPA, Region VI

cc:w/o enclosure
John Kieling, NMED/HWB

NOTICE OF DEFICIENCY

Vol. I, Section 4.0, Waste Analysis Plan

Deficiencies

1. Section 4.1.2, Prohibited Waste, p. 1, 1st bullet. **"...Soils.., except for bulk PCB-contaminated remediation waste...."**

   GMI must decide whether it will accept all bulk PCB-contaminated remediation wastes or whether it is restricting itself to soils.

   Section 4.1.2, p. 2. **"...Before the facility accepts wastes containing PCB concentrations greater than 500 ppm,..."**

   GMI should insert "other" between "accepts" and "wastes".

2. Section 4.1.2, p.2, 1st bullet. **"organic liquids/sludges. - Liquids/sludges with an organic concentration of 10 percent or greater by weight or liquids/sludges that have not been treated (prior to receipt at the facility) to applicable LDR treatment standards."**

   Because GMI intends to accept and manage containers which must meet 40 CFR 264, Subpart BB, standards, the phrase, "with an organic concentration of 10 percent or greater by weight or liquids/sludges", should be deleted.

3. Section 4.1.2, p. 2, 3rd bullet. **"radioactive/nuclear materials. - "**

   To make this definition all-inclusive, GMI should add, "or other naturally occurring materials which contain radioactivity concentrations above the levels regulated under 20.3.1.14 NMAC."

4. Section 4.2, Criteria for Waste Management at the Facility, p. 3, 3rd bullet.

   The phrase, "or it exceeds the 40 CFR, Subpart BB allowable concentrations for air emissions" should be deleted. See Deficiency No. 2.

5. Section 4.3.3, Representative Sample Analysis and Evaluation, p. 6, 1st full paragraph.

   The 4th and 5th sentences are redundant and slightly inconsistent with p. 6, 3rd full paragraph, and should accordingly be deleted.

6. Section 4.3.3.3, Additional waste acceptance conditions, P. 7, 5th bullet.

   This bullet should be deleted. See Deficiency No. 2.

7. Section 4.4.2, Visual Inspection, 1st sentence. "**...(at the rate defined in Section 4.4.3.1)....**"

   This reference should be to the next paragraph (or should be omitted), which discussed the visual inspection rate. Section 4.4.3.1 discusses the sampling rate.

8. Section 4.5, Waste Analysis.

   GMI must revise the text of Section 4.5 throughout that refers to "...other nationally recognized standards." Analytical methods must be specified in the permit application, as required by 20.4.1.500 NMAC, incorporating 40 CFR 264.13(b)(2) and 40 CFR 270.14(b)(3). Methods acceptable to NMED include EPA Publication SW-846 and certain ASTM methods approved by EPA, and these methods must specified in Tables 4-1 through 4-3. The use of other methods are hazardous waste- or constituent-specific and must be justified to the satisfaction of NMED before use.

9. Section 4.5.1.2, Additional analysis to ensure compliance with the LDR treatment standards, p. 15, 1st paragraph.

   As we discussed, please replace the first paragraph with the following paragraph (based on 20.4.1.800 NMAC, incorporating 40 CFR 268.40(a)):

   > "The facility will ensure that LDR treatment standards are met by identifying the appropriate treatment standard requirement as follows:
   >
   > - **Total waste standards:** All hazardous constituents in the waste or in the treatment residue must be at or below the values for these constituents contained in the Table in 40 CFR 268.40;
   > - **Waste extract standards:** The hazardous constituents in the extract of the waste or in the extract of the treatment residue must be at or below the values found in the Table in 40 CFR 268.40; or
   > - **Technology standards:** The waste must be treated using the technology specified in the Table in 40 CFR 268.40.

10. Section 4.5.1.2, p. 18, 3rd bullet.

GMI should change "268.48" to "268.40".

11. Section 4.5.1.3, Additional analysis to ensure compliance with regulatory and operational limits, p. 18, 3rd bullet.

GMI should delete the last sentence. See Deficiency No. 2.

12. Section 4.5.5.2, Waste analysis requirements specific to storage units, p. 21, 2nd paragraph.

Section 11.0 of the permit application indicates that the facility will meet Container Level 1 and Level 2 standards only. Accordingly, GMI must remove the reference to Level 3 standards.

13. Section 4.5.5.5, Waste analysis requirements specific to the landfill, p. 24, 6th bullet.

GMI must revise Section 4.5.5.5 by adding discussion that documents that GMI will meet the performance standards for incompatible waste specified in 40 CFR 264.313 and 40 CFR 264.17(b) and (c) by separating incompatible waste in non-adjacent landfill "grid cells" and by treating the potentially incompatible waste by stabilization prior to placement in the landfill.

14. Section 4.5.6, Waste Analysis Requirements for Waste Generated On-Site, p. 25, 5th paragraph. **"Leachate generated from the landfill will be pumped out of the unit sumps into tanks or tanker trucks."**

Vol. I, Section 2.5 (and possibly Vol. III, Section 3.0) of the permit application indicates that leachate from the landfill will be hard-piped to the leachate storage tank. GMI must make these statements consistent with one another.

15. Section 4.5.6, p. 27, contaminated soil, last sentence. **"Contaminated soils that are managed as hazardous wastes will be analyzed and managed in accordance with the Phase IV, Part 2 LDR rule."**

GMI should replace "the Phase IV, Part 2 LDR rule" with "the alternative LDR treatment standards for contaminated soil contained in 40 CFR 268.49".

16. Section 4.5.6.2, Selection of waste analysis parameters, p. 28, 4th paragraph.

See Deficiency No. 8. **"Leachates will be analyzed separately at least once a month at the point of generation. These leachates will be analyzed for all constituents**

specified in 40 CFR 264 Appendix IX using appropriate methods specified in SW-846."

GMI must indicate that the monthly sampling and analysis of leachate at the point of generation is for all F039 underlying constituents, and that a biennial sampling and analysis will be conducted for 40 CFR Appendix IX constituents.

17. Section 4.7, Analytical Methods, p. 34.

    See Deficiency No. 8.

18. Section 4.7.2.3, Laboratory Q QC Samples, p. 36, 2nd paragraph.

    GMI must delete the first sentence and establish data quality objectives (DQOs) in the permit application. DQOs may also be specified in the permit. Because GMI will be required to take certain specified actions as a result of any release of hazardous waste or hazardous constituents to the vadose zone, the DQOs must include the lowest detection limits that can be practicably achieved following the specified analytical methods; these detection limits should be included in a table in the laboratory QA manual.

19. Section 4.7.2.5, Analytical procedures, p. 39, 2nd paragraph.

    GMI should revise this section, and elsewhere in Section 4.0, to delete all references to the "applicable" edition of SW-846. It is unclear what GMI means by this term; in any case, NMED requires GMI to use the most current edition of SW-846, as updated.

    Also: See Deficiency No. 8. SW-846 provides test procedures and guidance for use in conducting the evaluations and measurements needed to comply with RCRA. If GMI is unable to meet its analytical requirements using SW-846, then it will be required to submit a request to NMED to use alternate methods.

20. Section 4.7.2.4, p. 40, 1st paragraph following list. **"Editions used will be...updated at the time of facility operation."**

    GMI must delete "at the time of facility operation". See Deficiency No. 21.

21. Section 4.7.3, Requirements for Off-Site Laboratories, p. 41, 4th bullet.

    See Deficiency No. 8.

22. All tables must be completed and emailed to NMED for review.

Editorial Comments

23. Typographical errors should be corrected in the phrases indicated below:

- Section 4.1.2, p. 2, 2nd full sentence. **"A copy of this permit will be transmitted to New Mexico Environment Department...."**

  The word, "the", should be inserted before "New Mexico Environment Department".

- Section 4.5.1.3, Additional analysis to ensure compliance with regulatory and operational limits, p. 18, 4th bullet. **"...the stabilization bins ar subject to the requirements...."**

  (Also: the words in parentheses should be changed to agree with the preceding changes in the first sentence.)

- Section 4.5.1.3, 5th bullet. **"...d-oes not contain...."**

- Section 4.5.2, Representative Sample Analysis, p. 19, 1st paragraph. **"...to ensure that that the representative...."**

- Section 4.5.5.5, p. 24, 3rd bullet. **"...the waste has been treated bvy the appropriate specified treatment technology...."**

- Section 4.5.5.4, Waste analysis requirements specific to the stabilization tanks, p. 22, 2nd paragraph, 1st sentence. **"...as part of the representative samply...."**

- Section 4.5.6, p. 26, 4th paragraph. **"Leak detection and removal/vadose zone monitoring for evaporation pond leacdhate..."**

- Section 4.5.6.1, Waste analysis requirements for waste generated on-site, p. 27, 1st bullet, l. 7. **"IDE will be stored...."**

  ("IDE" should be "IDW".)

  Section 4.5.6.2, 5th paragraph. **"...compliance with the LDR UST...Leachates that do not meet the UST...."**

  ("UST" should be "universal treatment standards (UTS)"

24. When submitting the final revision of Section 4.0, GMI must revise the text by removing the editorial strikeout/highlight marks and checking for additional typos. GMI must include all figures and tables in the final submittal.

Construction Quality Assurance Plan for Landfill, Surface Impoundment and Associated Facilities

Deficiency

25. GMI must include the figure and appendices in the final submittal.

Inspection Checklists

26. Cover page: Inspection Checklist - Operational Days

The third paragraph must be revised to meet the requirements specified in 20.4.1.500 NMAC, incorporating 40 CFR 264.15(d), which specify that certain information, such as the date, time, name of the inspector(s), observations made, and the date and time of repairs and remedial actions taken must be recorded. It is not acceptable to note only the "indication of a problem".

GMI must also revise the Inspection Corrective Action Report form to include the above noted inspection items specified in 20.4.1.500 NMAC, incorporating 40 CFR 264.15(d).

27. P. 3, General Site

GMI must revise this inspection form, and other similar forms, by adding a column for "Remedial Actions/Repairs" next to the "Description" column (see 20.4.1.500 NMAC, incorporating 40 CFR 264.15(d)).

Ditches Nos. 1 through 7 should be listed.

Rather than having only one line for all loading and unloading areas, it would be preferable to include these inspections (p. 4, item a.) with each permitted unit, i.e., the drum handling unit, the roll-off container storage area, the liquid waste storage tank area, the evaporation pond, and the landfill, and other units such as the sampling station, etc. This also applies to inspection of access ramps (p. 4, item a).

28. P. 5, Drum Handling Unit

GMI should correct the apparent typo in the last listed item that reads, "Less than 12' from".

GMI must inspect the concrete floor to ensure that it is free of cracks or gaps and the epoxy coating in not damaged (Vol. I, 2.2.1.1).

Each of the seven cells has its own trench and sump system, which must be inspected. Accordingly, GMI must list each system (Nos. 1 through 7) in item d. on p. 7.

29. P. 5, Drum Handling Unit (Volatile Organic Wastes) (Weekly)

GMI must revise this section by deleting inspection item "c" (Determine volume of waste). GMI must add the following inspection item "c" (Cover and closure devices, such as lids, bungs, caps, etc. are secure) to meet the inspection requirement specified in 20.4.1.500 NMAC, incorporating 40 CFR 264.1086 (c)(1)(ii). GMI must add in the response column that "If cover or closure device is not properly secured, then secure, repair, or replace."

30. P. 8 and 9, Roll-Off Storage Unit - Non-Stabilized and Stabilized

GMI must inspect the concrete pad and perimeter and separator berms (secondary containment) for signs of leaks and deterioration.

GMI must inspect the spacing of roll-off container columns and rows.

31. P. 11, Liquid Waste Receiving and Storage Unit (Daily)

GMI must revise this section by specifying Tanks Nos. 1 through 4, not just Tanks Nos. 1 and 2, to be consistent with the rest of the permit application.

GMI must also revise this section by adding several additional inspection items that have been omitted to meet the requirements specified at 20.4.1.500 NMAC, incorporating 40 CFR 264.195(a)(2). These omitted items include, but are not limited to, inspection of the overfill controls and data from monitoring and leak detection equipment.

GMI must include the annual sonic tank test to ensure that the thickness of the inner shell and outer wall is maintained (Vol. I, 2.4.6).

32. P. 12, Stabilization Unit (Daily)

GMI must revise this section to meet all of the inspection requirements specified in 20.4.1.500 NMAC, incorporating 40 CFR 264.195.

Please explain the difference between the daily inspection of the steel bins for cracks or dents, punctures, and excessive wear (item g. on p. 13) and the monthly inspection of the steel bins (where empty) for the same problems (item a. on p. 14). In both cases, "ware" should be "wear".

GMI must include the annual **sonic** tank test and the annual cathodic protection system test.

33. P. 15, Evaporation Pond (Daily)

Please explain item f. - Liquids present in secondary containment for leachate storage tanks and g. - Liquid levels above max storage capacity in leachate storage tanks. NMED is unaware of any leachate storage tanks associated with the evaporation pond. GMI must add "Average Daily Flow Rate" to the list of inspection items. This additional item is required for GMI to determine whether they have exceeded the Action Leakage Rate (ALR).

34. P. 16, Evaporation Pond (Weekly)

GMI should revise "Weekly" to read, "Weekly and after Storms".

Please explain how item b. -sloughing or damage to berms will be inspected. NMED understands that the earthen berm will be covered by the liner. How will sloughing be detected? By slumping?

GMI should revise this section to meet all of the inspection requirements specified at 20.4.1.500 NMAC, incorporating 40 CFR 264.226. Omitted items include, but are not limited to: a sudden drop in liquid level (20.4.1.500 NMAC, incorporating 40 CFR 264.226(b)(2)) and the amount of liquids removed from sump (20.4.1.500 NMAC, incorporating 40 CFR 264.226(d)(1)) .

GMI must include inspection of the protective netting in the weekly inspection to protect local and regional bird life.

35. P. 18, Landfill (Daily)

Items f., g., and h. - It is NMED's understanding that there is only one leachate storage tank.

MARCH 27, 2000
COMMENTS

Certified Mail
Return Receipt Requested

March 27, 2000

Hart M. "Trey" Greenwood, President
DelHart, LLC
520 East Harkness
Carlsbad, New Mexico 88220

RE: COMMENTS: SECTION 8.0, CLOSURE AND POST-CLOSURE OF PERMITTED UNITS, TRASSIC PARK WASTE DISPOSAL FACILITY PERMIT APPLICATION

Dear Mr. Greenwood:

The New Mexico Environment Department (NMED) Hazardous and Radioactive Materials Bureau (HRMB) has completed its review of draft Section 8.0, "Closure and post-closure of permitted units," (revised December 8, 1999) of the Gandy Marley, Inc. Permit Application for the Triassic Park Waste Disposal Facility. HRMB's comments are attached.

After you have had a chance to review these comments, please call me at 827-1558 ext. 1016 to discuss a time-frame for submittal of revisions to Section 8.0.

Sincerely,

Stephanie Kruse, Supervisor
Triassic Park Project

Cc: James Bearzi, NMED/HRMB
Carl Wills, NMED/HRMB
David Cobrain, NMED/HRMB
Dale Gandy, Triassic Park
David Neleigh, EPA

HRMB COMMENTS
March 2000

SECTION 8.0 (revised December 8, 1999)
TRIASSIC PARK HAZARDOUS WASTE DISPOSAL FACILITY

1. Page 8-1, Section 8.1, paragraph 1. "Liquids generated during closure (decontamination solutions and evaporation pond liquid) will be treated onsite...."

Should leachate from the Surface Impoundment and the Landfill be included?

2. Page 8-1, Section 8.1, paragraph 1, line 2. Insert at the end of the first sentence "in compliance with 40 CFR 264, Subpart G."

3. Page 8-1, Section 8.1, paragraph 2. Add the following sentence at the end of the paragraph, "All laboratory samples will be analyzed for the hazardous constituents specified in 40 CFR Part 261, Appendix VIII and all other constituents considered by NMED to be a threat to human health and the environment."

4. Page 8-1, Section 8.1, paragraph 3, line 1. Capitalize "secretary."

5. Page 8-1, Section 8.1, paragraph 3, line 2. Replace "Facilities" with "Facility or a unit or units."

6. Page 8-1, Section 8.1.1, bullet 3. Replace "facilities" with an appropriate term, e.g., "equipment."

7. Page 8-2, Section 8.1.1.2, paragraph 3, second sentence. "The use of wash water will be limited to minimize the amount of waste generated." Limited how? The determining factor is the necessity to clean until sampling and analysis indicates the contaminants have been removed.

8. Page 8-2, Section 8.1.1.2, paragraph 4, subsection 1.0 (Sampling Program) Add item 1.6, Field Screening Methods.

9. Page 8-3, Section 8.1.1.2, fourth and fifth sentences. "The liner and collection sump system will be removed at closure but will not be decontaminated. Since this material will be considered a hazardous waste, it will be disposed of in the landfill." This material should be sampled and analyzed.

10. Page -3, Section 8.1.1.3, line 1. Change "membrane" to :geomembrane".

11. Page 8-3, Section 8.1.1.4, paragraph 1. Delete the last two sentences beginning with "Ten such individual samples...."

12. Page 8-4, Section 8.1.1.4, Table 8.1. Provide itemized estimates including unit volumes and unit costs and estimated totals for each item including labor, laboratory, project management, subcontractor, reporting and offsite waste disposal costs.

13. Page 8-5, Section 8.1.1.4, paragraph 1, line 1. Change ". . . locations that correspond to the floor drain sumps...." to "...locations that correspond to all of the floor drain sumps...."

14. Page 8-5 Section 8.1.1.4, paragraph 1, lines 2-3. Change ". . . an additional sample will be collected in the dock area" to "Eight additional samples will be collected in the dock area and samples will be collected at 20-foot intervals beneath the drainage trenches."

15. Page 8-5, Section 8.1.1.4, paragraph 2, line 4. Replace "contaminate" with "contaminant."

16. Page 8-5, Section 8.1.2.2, line 4. "The stabilized waste will be placed in roll-off containers and cured in accordance with the provisions of the WAP prior to disposal in the landfill."

This is not discussed in the Waste Analysis Plan. Please add here or in the WAP. How long does it take to cure? How is the completion of curing determined?

17. Page 8-5, Section 8.1.2.3, line 4. Replace "268.7(d)" with "§268.45." Insert "debris treatment" between "LDR" and "requirements".

18. Page 8-6, Section 8.1.2.4, paragraph 1, line 2. Change "...samples will be collected and analyzed for constituents that may have...." to "...samples will be collected and analyzed for constituents defined in section 8.1 paragraph 2 of this permit application."

19. Page 8-6, Section 8.1.2.4, paragraph 1, line 4. Change "contaminate" to "contaminant".

Change "...at a frequency equivalent to one per 400 square feet." to "...at a frequency of one per 400 square feet over the entire surface impoundment unit area."

20. Page 8-6, Section 8.1.2.4, paragraph 1, lines 4-6. Delete the sentences beginning with "Ten such individual samples will be combined...." and "This will result in a testing frequency of one composite sample per...."

21. Page 8-6, Section 8.1.2.4, paragraph 1, lines 6-7. Change the sentence "In addition, a sample will be obtained from the leachate collection sump and the tanker pad fill line." to "In addition, a sample will be obtained from each leachate collection sump and beneath the tanker pad fill lines at the influent location and at 10 foot intervals beneath the transfer piping. Samples also will be collected adjacent to each side of the concrete containment pad."

22. Page 8-6, second Section 8.1.2.4, Filling and Revegetating. Change the section number from 8.1.2.4 to 8.1.2.5.

23. Page 8-6, Section 8.1.2.5, line 1. Change "...Evaporation Pond will be filling the depression with soil to the...." to "...Surface Impoundment will be filling the depression with clean soil to the....."

24. Page 8-6 Section 8.1.2.5, line 2. Add the following sentence between the two existing sentences: "The surface impoundment location will be graded to ensure that the direction of surface water runoff is not toward the landfill units."

25. Page 8-6, Section 8.1.3.1, first sentence. Add a reference notation for the standard operating procedures which will be developed for the management of waste in the liquid waste tanks.

26. Page 8-7, Section 8.1.3.2, line 2. Replace "LDR requirements as" with "LDR debris treatment requirements under 40 CFR §268.45."

27. Page 8-7, Section 8.1.3.2, line 3. Change "40 CFR 267(d)" to "40 CFR §268.7(d)."

28. Page 8-7, Section 8.1.3.2, line 5. Insert "debris treatment" between "LDR" and "requirements".

29. Page 8-7, Section 8.1.3.3, lines 1-2. Change "samples will be collected and analyzed for constituents that may have...." to "...samples will be collected and analyzed for constituents defined in section 8.1 paragraph 2 of this permit application."

30. Page 8-7, Section 8.1.3.3, line 5. Change "...obtained beneath the sumps in the concrete base for the liquid waste storage units." to "...obtained beneath each sump in the concrete base for the liquid waste storage units, beneath each tank after demolition, and adjacent to each side of each tank pad. In addition, samples will be obtained at a frequency of one per every 400 square feet at the unit and at locations where visual or field screening evidence of contamination is present."

31. Page 8-7, Section 8.1.4.1, sentence 1. Add a reference notation for the standard operating procedures.

32. Page 8-7, Section 8.1.4.1, line 4. Curing of stabilized waste is not discussed in the WAP.

33. Page 8-7, Section 8.1.4.2, line 4. Change "...however, this will be cleaned and rinsed prior to . . ." to ". . . however, the building will be decontaminated prior to...."

34. Page 8-7, Section 8.1.4.2. Please indicate that there will be a sampling and analysis plan for the equipment and building structure. All decontaminated units/structures/equipment should receive verification sampling (e.g., Section 8.1.3.2.)

35. Page 8-8, Section 8.1.4.4, line 2. Change "...soil samples will be collected and analyzed for hazardous constituents that...." to "...soil samples will be collected and analyzed for RCRA characteristic properties and the constituents defined in section 8.1 paragraph 2 of this permit application."

36. Page 8-8, Section 8.1.4.4, line 4. Change "Individual samples will be collected at a frequency equivalent to one per 400 square feet." to "Individual samples will be collected at locations specified by NMED at closure and at a frequency of one sample per 400 square feet in the entire stabilization unit area."

37. Page 8-8, Section 8.1.4.4, paragraph 1, lines 5-6. Delete the sentences beginning with "Ten such individual samples will be combined...." and "This will result in a testing frequency of one composite sample...."

38. Page 8-8 Section 8.1.5, paragraph 1, line 4. Change "Section 8.1" to "for the drum handling unit in Section 8.1.1".

39. Page 8-8 Section 8.1.5, paragraph 1, line 6. Change "(Section 8.1.1.2)" to "(Sections 8.1.1.2, 8.1.1.3 and 8.1.1.4).

40. Page 8-8, Section 8.1.5, paragraph 1. "The major steps of inventory removal,..will be identical to those described in Section 8.1.1. Details of the sampling and analysis program will be specified in a sampling and analysis plan providing information similar to that to be developed for the drum handling unit (see Section 8.1.2)...."

This statement should also be included in the liquid waste storage tanks and roll-off container storage discussions.

41. Page 8-8, Section 8.1.6, lines 1 and 2. Unless the Application is revised to explain what Phase IA is, replace "Phase IA" with "Phase I." (If there is no Phase IB, it is confusing to refer to IA.)

42. Page 8-8 Section 8.1.6, paragraph 2, line 1. Change "...final cover will be constructed that is less than...." to "...final cover will be constructed with a permeability that is less than..."

43. Page 8-8, Section 8.1.6, paragraph 2, line 4. Replace "3.0" with "3.1.5."

44. Page 8-9, Section 8.1.6, first bullet, line 2. Resolve discrepancies with other parts of the Application. The Application Volume III, Section 3.1.5., does not specify the slope of the cover. Volume III, Drawings 21 through 23, show a slope of 6 per cent.

45. Page 8-9, Section 8.1.6, second bullet, line 1. Insert between "will" and "consist" "have a transmissivity of greater than or equal to 2.2 x 10^{-4} meters squared per second and." Insert "and" between "geocomposite" and "consist".

46. Page 8-9, Section 8.1.6, third bullet, line 1. Insert before "HDPE" "60 mil." Insert after "GCL" "with a permeability of less than or equal to 5 x 10^{-9} centimeters per second."

47. Page 8-9, Section 8.1.6, paragraph 2 below the bulleted items, line 6. Change "...latest technology...." to "...best available technology...."

48. Page 8-9, Section 8.1.6, paragraph 2 below the bulleted items, line 8. Change NMRD to NMED.

49. Page 8-9, Section 8.1.6, paragraph 3 below the bulleted items, line 8. Specify when the sampling and analysis plan will be submitted.

50. Page 8-9, Section 8.1.6, paragraph 5 below the bulleted items, sentence 1. Change "It is proposed that 16 individual samples be obtained along the haul roads and that they be combined into 4 composite samples for testing." to "It is proposed that samples be obtained along the haul roads at 100 foot intervals and at locations where visible staining is observed."

51. Page 8-9, after Section 8.1.6. Please add a section addressing closure of the potential Solid Waste Management Units listed in the Corrective Action Section. A Sampling and Analysis Plan should be prepared for NMED approval to address sampling which may be necessary at any of these units, and to address at a minimum the truck wash and the storm water retention pond and associated ditches.

52. Page 8-10, Section 8.1.6, second paragraph, line 1. Insert after "landfill" "in compliance with 40 CFR §264.115."

53. Page 8-10, Section 8.1.6, second paragraph, line 3. Insert after "benchmarks" "in compliance with 40 CFR §264.116."

54. Page 8-10, Section 8.1.6, second paragraph, line 7. Insert after "property" "in compliance with 40 CFR §264.119(b)(1)."

55. Page 8-10, Section 8.1.6, third paragraph, line 3. Insert after "landfill" "in compliance with 40 CFR §264.119(a)."

56. Page 8-10, Section 8.2, first paragraph, line 2. Move "only" in the second sentence so that the sentence reads; " Post-closure care is anticipated to be needed only for the landfill...."

57. Page 8-11, Table 8.2. Change the inspection times for Facility "Fence," "Locks and gates," and "Warning signs" to monthly as stated in the text on page 8-10, Section 8.2.1.

58. Page 8-12, carry-over sentence. Add "are met" after "precipitation and run-off from the landfill area."

59. Page 8-12, Section 8.2.4.1, paragraph 1, sentence 1. Change "The leachate collection and removal system will be operated until leachate is no longer detected." to "The leachate collection system will be operated when necessary until the completion of post-closure care."

60. Page 8-12, Section 8.2.4.1, paragraph 1, sentence 2. Add the sentence, "The site log will be kept on-site or at a location approved by the Secretary.", after sentence 2.

61. Page 8-12, Section 8.2.4.1, paragraph 3, lines 7-8. Change "...registered professional engineer's assessment." to "...registered professional engineer's assessment and upon approval by NMED."

62. Page 8-12, Section 8.2.4.3, paragraph 2, line 1. Change "...maintenance will be similar to those...." to "...maintenance will be equivalent to those...."

63. Page 8-13, Section 8.2.5.1, line 1. Delete the word "systems."

64. Page 8-13, Section 8.2.7, line 3. Insert after "post-closure plan" "in compliance with 40 CFR §264.120."

65. Page 8-13, Section 8.2.8, paragraph 2, line 3. Change "...or roll-off storage area, then a post-closure care permit application for those portions of the...." to "...or roll-off storage area, then the post-closure care permit will be amended to include those portions of the...."

66. Page 8-13, Section 8.2.8, paragraph 2, line 4. Change "...meet the closure performance standard will be submitted to NMED no later than 90 days" to "...meet the closure performance standard. The post-closure care plan amendments will be submitted to NMED no later than 90 days...."

67. Page 8-14, Section 8.3, paragraph 2, line 4. In the last sentence, please note that the landfill will close under the requirements of 40 CFR 264.310.

68. Page 8-14, Section 8.3, paragraph 3, lines 4-5. Change "...selected constituents are within three standard deviations of the mean constituent concentration in clean background soil will...." to "...concentrations of contaminants of concern are within a statistically significant range relative to clean background soil as determined by NMED will..."

69. Page 8-14, Section 8.3, paragraph 2, last sentence. Please delete the last sentence, "Clean background soil samples will be collected from the surrounding area outside the Facility fence line. Please add language stating that background will be determined on-site before the initiation of construction.

70. Page 8-14, Section 8.4, paragraph 2, line 6. Change "...shipped off site." to ".....shipped off site for proper disposal at a permitted facility."

71. Page 8-15, Section 8.4, paragraph 2, line 2. Insert between "closure" and "of the entire Facility" "of a hazardous waste management unit or."

72. Page 8-15, Section 8.4, paragraph 3, line 3. Insert at the end of the sentence ", with approval from NMED and if the owner or operator complies with 40 CFR §264.113(d)."

73. Page 8-15, Section 8.5, line 2. Change ".certification that the hazardous waste management unit...." to "...certification that each hazardous waste management unit...."

74. Page 8-15, Section 8.5, line 3. Insert at the end of the first sentence ", in compliance with 40 CFR §264.115."

75. Page 8-15, Section 8.5, lines 3-4. Change "The certification will be signed...." to "The closure certification for each unit will be signed...."

76. Page 8-15, Section 8.5, line 6. Insert at the end of the last sentence ", in compliance with 40 CFR §264.120."

77. Page 8-15 Section 8.7.1, paragraph 2, lines 4-5. Delete the sentence "In reality it is expected that Facility personnel will perform many closure tasks."

78. Page 8-16, Section 8.8, line 3. Change "...40 CFR 264.145 the standards for...." to "40 CFR 264.145 defines the standards for . . .."

79. Page 8-16, Table 8-3. Provide itemized estimates including unit costs and estimated totals for each item including labor, laboratory, project management, subcontractor, reporting and offsite waste disposal costs.

80. Page 18, Figure 8-1. Provide a key to symbols. Label the units on the x-axis.

APRIL 14, 2000
COMMENTS

ENVIRONMENT DEPARTMENT
Hazardous & Radioactive Materials Bureau
2044 Galisteo Street
P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-1557
Fax (505) 827-1544

GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

PAUL R. RITZMA
DEPUTY SECRETARY

April 14, 2000

Patrick Corser
Montgomery Watson
P.O. Box 774018
Steamboat Springs, Colorado 80477

RE: REVISED DRAFT SECTION 10, CORRECTIVE ACTION (CA), DATED JANUARY 7, 2000 - TRIASSIC PARK WASTE DISPOSAL FACILITY PERMIT APPLICATION

Dear Mr. Corser:

The New Mexico Environment Department (the Department) Hazardous and Radioactive Materials Bureau (HRMB) has completed its review of the above referenced submittal. The Department has determined that the CA Section does not sufficiently specify all of the corrective actions that must occur in the event of a release. The Department has also determined that much of the CA Section is inconsistent with anticipated draft Permit language.

The above referenced deficiencies and inconsistencies are identified in the attached comments. These comments are provided for informational purposes only and GMI should not revise the CA Section to incorporate the comments. GMI should, however, remove the inconsistent portions by withdrawing all language including and below the first full paragraph on page 10-2. The Department will proceed with establishing CA requirements in the draft Operating Permit. If GMI finds it needs to reference CA requirements in its Application, it should simply reference the Corrective Action Module of the Permit.

The Department would like to thank GMI for undertaking the unusual process of submitting CA commitments in its Permit Application.

If you have any questions regarding this letter or the attached comments, please contact Steve Pullen of the HRMB at (505) 827-1558 ext. 1020.

Sincerely,

Stephen Pullen

for Stephanie Kruse,
Project Manager
Triassic Park Project

cc: w/attachment

James Bearzi, NMED/HRMB
Carl Will, NMED/HRMB
Dale Gandy, GMI
David Neleigh, EPA
John Kieling, NMED/HRMB
Steve Pullen, NMED/HRMB
John Pellicer, MW

NMED Comments
April 2000

CORRECTIVE ACTION (CA)- SECTION 10
(draft)
Triassic Park Waste Disposal Facility Permit Application

The New Mexico Environment Department (the Department) provides the following comment on eleven (11) issues associated with the Corrective Action Section. The 11 issues constitute neither a comprehensive nor a definitive list of Department concerns, but they suffice to show that the CA Section is deficient and that the Department should proceed with establishing the corrective action requirements in the draft Permit. As stated in the associated cover letter, these comments are provided solely as a response to the CA Section and for informational purposes. Gandy-Marley, Incorporated (GMI) should not augment its Application based on these comments, but should remove those portions that the Department anticipates will be inconsistent with the Permit and has identified below.

Of the 11 issues identified in the CA Section, Issues 1 through 3 are the general deficiencies. Issues 4 through 8 are commitments that conflict with the anticipated CA module of the Permit, and thus require removal. Issues 9 through 11 are considered appropriate and may remain in the Application.

General Deficiencies
- **Issue #1** The distinction between CA responses for regulated units (RU) and solid waste management units (SWMU)
- **Issue #2** A response to the detection of non-contaminated fluids in the Vadose Zone monitoring System (VZMS)
- **Issue #3** The recognition of the response actions in other portions of the Application

Conflicting Commitments
- **Issue #4** Investigation commitments
- **Issue #5** Response actions beyond an investigation
- **Issue #6** Notification commitments
- **Issue #7** Record keeping commitments
- **Issue #8** Contaminant level that would trigger a response

Other issues
- **Issue #9** Distinguishing contaminated from non-contaminated fluids
- **Issue #10** Identification of existing release sites
- **Issue #11** Identification of future SWMUs

GMI agreed at a September 23, 1999 meeting, held to discuss the groundwater monitoring waiver and the associated VZMS, that it would provide as part of its Permit Application a plan for responding to releases to the VZMS. GMI agreed that the following three response commitments would be provided:

- a methodology to distinguish contaminated fluids from waste management units and presumably non-contaminated fluids from other sources **(Issue #9)**;
- an investigation of the extent of contamination **(Issue #4)**; and,
- the removal of contamination and an approach to stop the release **(Issue #5)**.

GMI's draft CA Section contains the following descriptions and commitments:
- a statement that there are no previous releases at the proposed site **(Issue #10)**;
- an identification of all future SWMUs as determined in the RCRA Facility Assessment **(Issue #11)**;
- a commitment to notify the regulatory authority according to the Contingency Plan (CP) **(Issue #6)**;
- a commitment to keep records according to the CP **(Issue #7)**;
- a commitment to perform a RCRA Facility Investigation (RFI) should a release occur **(Issue #4)**; and,
- a commitment to perform a Corrective Measures Study (CMS) should a release pose an unacceptable risk **(Issue #5)**.

General Deficiencies

(Issue #1) The CA Section does not make the required distinctions between corrective actions for the RUs and SWMUs. Of the units proposed in GMI's Permit Application, the landfill and the evaporation pond are regulated units (RU) and have special regulatory considerations because they have hazardous wastes intentionally placed on the land (albeit on top of barriers).

CA regulations for both RUs and SWMUs are stipulated at 20 NMAC 4.1.500 (incorporating by reference 40 CFR §264.100 and §264.101). §264.100 requires an owner/operator (O/O) to take the corrective action needed to ensure that groundwater impacted by RUs attain the appropriate groundwater protection standard. The groundwater monitoring requirement for GMI's RUs is currently waived for reasons provided in the Department's letter to GMI dated January 12, 2000. However, because a VZMS takes the place of the groundwater monitoring system, and as a condition of GMI's groundwater monitoring waiver, the Application, or alternatively the Permit, must maintain the same level of protectiveness by having special vadose zone CA requirements for the RUs.

40 CFR §264.101 requires an O/O to institute corrective action as necessary to protect human health and the environment for all releases of hazardous wastes or constituents from all SWMUs. This regulation, and EPA's corresponding Subpart S Guidance, will form the basis for the corrective action requirements for all the SWMUs identified in the CA Section. The Department believes that the CA process for RUs and SWMUs are so distinct that it anticipates two sections in the Permit addressing the issues, Modules 10A and 10B respectively.

(Issue #2) The CA Section does not sufficiently address what response GMI would take if non-contaminant fluids were detected in the VZMS. A previous GMI submittal, the

VZMS Work Plan, proposes that if non-contaminated fluids were detected, the permittee would propose "no-further-action" (NFA). This proposal is not considered by the Department to be sufficiently protective.

For the VZMS to effectively monitor for releases from a waste management unit, the wells and sumps should not be allowed to retain non-contaminated fluids. Among other things, the Department is concerned that non-contaminated fluids allowed to remain in the system would either create a reverse gradient precluding contamination from entering the system, or it would dilute entering contamination to below detection limits. The Department anticipates that the Permit will have similar requirements for the notification, investigation and removal for non-contaminated fluids as for contaminated fluids.

In conversation between HRMB and GMI representatives on April 10, 2000, GMI agreed that the response to non-contaminated fluids being detected in the VSMZ would be addressed in the VZMS WP. GMI also agreed that the response would be, at a minimum, a commitment to investigate the extent of the non-contaminated fluids and to remove those fluids to maintain the effectiveness of the system.

(Issue #3) The CA Section does not sufficiently cross reference other portions of the Application that also address corrective action. The Application's CP addresses releases to all environmental media including soils. The Department recognizes that the CP generally addresses surficial releases requiring an immediate response, and the CA Section generally addresses subsurface releases requiring a more deliberative evaluation. These two response plans should be distinguished and should cross-reference each other.

Conflicting Commitments

(Issue #4) The CA Section commits to investigating the extent of the contamination by performing a RFI. The CA Section lacks detail as to what constitutes a RFI, and the Department presumes GMI is referring to the RFI described in EPA's Subpart S Guidance. In general the Department feels this is an appropriate approach. However, the Department feels that the RFI process does not appropriately reflect the necessary urgency of responding to a contaminant release from a RU.

The Department's experience is that, in general, the RFI process takes approximately one year to propose, perform and report. The Department considers the regulatory requirements and time restraints specified in the Application's Response Action Plan (RAP) for leaks through the primary liner of the landfill, to also be an appropriate corrective action for releases through the secondary liner into the VZMS. To paraphrase the RAP, if a serious release has been detected, the permittee will "submit a written assessment to the Department within 14 days of the determination as to the amount and source of liquids; information on possible size, location and cause of the leak; ... and any immediate and short term actions to be taken;...". Furthermore, the permittee will "submit a report to the Department within 30 days ... describing how effective the response actions have been at reducing the leakage rate ... ". The Department anticipates that the Permit will have a combination of RAP and RFI requirements for RUs, and slightly less urgent RFI requirements for SWMUs.

(Issue #5) The CA Section's commitment to remove contamination is via a CMS process. Like the RFI, the CMS process is not extensively described in the CA Section and the Department assumes GMI is referring to the process described in EPA guidance. Here too the Department believes this may be appropriate, but that elements of the RAP should be combined with CMS processes to establish a more comprehensive response action.

The elements of the RAP that should be incorporated into the response action, besides the reporting requirements mentioned earlier, include:

- increasing the pumping rate on the leachate collection system pump (this may also apply to the Leak Detection Removal System and the vadose zone monitoring pumps);
- removal of all standing water from the surface of the landfill (and possibly all fluids from the evaporation ponds); and,
- assessment of operations to determine if waste receipt should be curtailed or wastes should be removed for liner inspection, repair or control.

(Issue #6) The CA Section commits to notifying the regulatory authority according to the CP. The CP states that the emergency coordinator (EC) will follow the off-site notification requirements when it is determined that a release poses an "immediate threat". The Department is concerned that the CP is obviously meant to address emergencies that occur at the surface (i.e., it makes no specific mention of a release detected in the VZMS) and that the EC will not consider the detection in the VZMS an immediate threat.

(Issue #7) Regarding record keeping commitments for corrective actions. Again, the Department is concerned that GMI is referencing the CP as describing those commitments, yet the CP makes no specific reference to subsurface releases.

(Issue #8) The CA Section suggests that corrective measures might be initiated should released hazardous wastes "pose a concern to human health or the environment". The Department anticipates that corrective measures will be required in the Permit for any and all releases from SWMUs, including RUs, that exceed the anticipated Permit mandated standard of background concentrations. The background standard is consistent with Section 8 of the Application, Closure and Post-closure of Regulated Units.

Other Issues

(Issue #9) The methodology to distinguish fluids from the waste management units and other sources was not addressed in the CA Section, but is addressed in the draft VZMS Work Plan (WP) dated February 11, 2000. The Department identified its concerns regarding that WP in correspondence to you dated March 16, 2000. The Department believes that the VZMS WP is the appropriate location to address the fluid distinction issues, and only mentions it here because it was suggested to be included in the CA

Section in the September 23rd meeting. The Department proposes that the corrective action process be defined as those actions taken when a release is confirmed.

The WP also contains corrective action commitments that the Department deemed inappropriate. The WP states that if the fluids are not from a waste management unit, GMI would take "no-further-action", and, if fluids are from a unit, a "detection monitoring" program would be developed. Besides being inappropriate response actions, the WP is not the appropriate location for CA commitments, and the WP should be changed to reference the Corrective Action Module of the Permit.

If fluids detected in the VZMS are contaminated, the WP's suggestion to initiate detection monitoring is considered by HRMB to be non-protective. Detection monitoring, as described in 40 CFR § 264.98, is a method of measuring groundwater in the uppermost aquifer at the point-of-compliance for a statistically significant detection of contamination in reference to groundwater protection standards. GMI's detection monitoring proposal is inappropriate for the following reasons: contamination will have already been confirmed; the measuring point is not in the upper-most aquifer and not at a point-of-compliance; and, concentrations will not be compared to groundwater standards. Any detection of contamination in the VZMS will indicate a significant release, and will require investigation and control measures.

(Issues #10 and #11) The CA Section's identification of no existing release sites and potential future SWMUs is appropriate.

GLENN'S COMMENTS

Glenn's
Comments

Review of Triassic Park Permit Application - Section 3 (revi:

- The cover letter indicates that this revision to Section ... s March 2000 comments and incorporates new/additional data from 1999-2000, plus a structure contour map of the Top - Lower Dockum.

- This revision did not provide a redline-strikeout version or list or table to indicate where the above specified revisions are located.

- This revision did not include revised figures. Figures 3-1 through 3-11appear to be unchanged from the 1998 version of Section 3. However, Figures 3-12 through 3-26 have been changed and do not correspond to the 1998 Version of Section. Gandy Marley should immediately submit a complete set of the revised figures and should revise the text to ensure that the text and figure citations are in agreement. Additional discrepancies, such as inconsistencies between the text, the table of contents, and the figures titles should also be addressed at this time.

- This revision did include a new section on the results of the 1999 drilling program and a structure contour map of the Top - Lower Dockum. However, despite the language of the cover letter, it does not appear that this revision directly addressed HRMB's comments of March 2000. Again a redline/strikeout version or table indicating where changes have been made is needed to ensure that this revision has, in fact, addressed HRMB's comments. Specifically, HRMB's request for a conceptual site model (Comment # 3) does not appear to have been addressed.

- § 3.4.1.1 (p. 3-6) GM should provide a figure with the five shall core-holes and the two deep bore holes located north and south of the proposed site.

- Figure 3-12 is not discussed the text of Section 3.

- § 3.4.3.2 (p. 3-12) Paragraph 3 of this section indicates that ground water was detected via geophysical logs; however, the text states that there is no saturated in the Upper Dockum in this area. GM should revise this section to resolved this inconsistency.

- § 3.6.1 (p. 3-15) The text specifies a total of 16 water wells, but the discusses only 12. GM should revise this section to resolved this inconsistency.

- § 3.6.1.1 GM should revise this section, and elsewhere as appropriate, to use consistent hydraulic conductivity units (i.e. cm/sec vs. ft/day).

- § 3.6.1.2 GM should revise this section to eliminate the repeated text in this section.

- § 3.6.3.1 HRMB suggests that the "worst case" scenario should assume that migration will occur in the facies with the highest hydraulic conductivity values. Therefore, the calculations should use the highest hydraulic conductivity value that was either calculated or measured from any of the Upper Dockum samples.

- GM should revise this section to indicate where the hydraulic conductivity and porosity values came from.

Subject: **GMI Cost Estimate**
Date: Fri, 11 Aug 2000 12:03:48 -0600
From: david cobrain <david_cobrain@nmenv.state.nm.us>
Organization: nmed-hrmb
To: "Patrick.G.Corser@us.mw.com" <Patrick.G.Corser@us.mw.com>
CC: diane dwire <Diane.L.Dwire@us.mw.com>, Stephanie Kruse <stephanie_kruse@nmenv.state.nm.us>, John Kieling <John_Kieling@nmenv.state.nm.us>, James Bearzi <james_bearzi@nmenv.state.nm.us>

Pat,

During review of the financial assurance documentation, it has come to my attention that Gandy-Marley (GMI) anticipates construction and operation of a leachate treatment facility after closure of the GMI Triassic Park Facility. I was unable to locate any reference in the permit application to a leachate treatment facility that was to operate after closure of the landfill. Please provide information regarding where this leachate treatment facility is referenced in the permit application. In addition, please provide the following information so that NMED's evaluation of the financial assurance cost estimate can continue:

1) the construction drawings for the leachate treatment facility,
2) the details of the estimated $400,000 cost of construction of the leachate treatment facility,
3) the method of treatment to be employed at the leachate treatment facility and information regarding the estimated per gallon cost ($0.08) for leachate treatment,
4) a cost estimate for closure and post-closure care at the leachate treatment facility,
5) the basis for the estimated volume of leachate to be treated (listed as 401,500 gallons at closure and 6,022,500 gallons during the Post-closure Care period in the Cost Estimate of Landfill Closure Items table) during Closure and the Post-closure Care period,
6) the method and cost estimate for disposal of treated leachate generated at the leachate treatment facility.

Please be aware that the leachate treatment facility may require a RCRA operating permit therefore the following item also will be required:

7) cost estimate for preparation of an application for a RCRA operating permit to treat the leachate after closure of the Triassic Park landfill.

Please call with questions. Thank you.
Dave Cobrain

Subject: **Storm Water Runoff Basin**
Date: Fri, 25 Aug 2000 14:09:25 -0600
From: david cobrain <david_cobrain@nmenv.state.nm.us>
Organization: nmed-hrmb
To: diane dwire <Diane.L.Dwire@us.mw.com>, "Patrick.G.Corser@us.mw.com" <Patrick.G.Corser@us.mw.com>
CC: Stephanie Kruse <stephanie_kruse@nmenv.state.nm.us>, John Kieling <John_Kieling@nmenv.state.nm.us>, James Bearzi <james_bearzi@nmenv.state.nm.us>

Diane,

Chapter 8 (Closure and Post-closure of Permitted Units), Section 8.1.6 of the Permit Application indicates that the Stormwater Runoff Basin will be sampled at a frequency of 1 sample per 40,000 square feet. I discussed the sampling frequency with Pat Coarser and Stephanie Kruse in a phone call earlier this month and agreed to the sampling frequency after Pat informed me that the Storm Water Runoff Basin will be lined. I am unable to locate any documentation in the Permit Application text or design drawings regarding the Storm Water Runoff Basin liner. Please send the Permit Application references or design drawings for the Storm Water Runoff Basin liner or let me know where I might find those references in our copy of the Permit Application. This information is required in order to approve the sampling frequency in Chapter 8 of the Permit Application and also to use in calculating the financial assurance portion of the Application. Please call with questions. Thank you,
Dave Cobrain

AUGUST 31, 2000
COMMENTS

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2044-A Galisteo Street
Santa Fe, New Mexico 87505
Telephone (505) 827-1557
Fax (505) 827-1544

GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

PAUL R. RITZMA
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

August 31, 2000

Pat Corser
Montgomery Watson
1475 Pine Grove Road, Suite 109
P.O. Box 774018
Steamboat Springs, Colorado 80477

RE: REQUEST FOR SUPPLEMENTAL INFORMATION AND RESPONSE TO COST ESTIMATE SUBMITTAL: RCRA PERMIT APPLICATION FINANCIAL ASSURANCE CLOSURE AND POST-CLOSURE COST ESTIMATE TECHNICAL ADEQUACEY FOR GANDY MARLEY, INC. TRIASSIC PARK LANDFILL EPA ID NUMBER NM0001002484

Dear Mr. Corser:

The New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) has reviewed the financial assurance cost estimate for closure and post-closure care of the proposed

Gandy Marley, Inc. Triassic Park RCRA Subtitle C landfill for technical adequacy. HWB has determined that supplemental information and changes to the cost estimate are required in order for HWB to approve of the landfill closure and post-closure cost estimates.

HWB requests that the changes included in Attachment A be incorporated into the cost estimate and that the additional information listed in Attachment A be provided to clarify selected details of the cost estimate. Changes to the financial assurance cost estimate must be incorporated into Section 8 (*Closure and Post-closure of Permitted Units*) of the Triassic Park Waste Disposal Facility Permit Application and any other applicable sections or attachments to the Permit Application.

Please call Dave Cobrain of my staff at 505-827-1561 if you have questions regarding this response to the financial assurance cost estimate.

Sincerely,

John E Kieling

John Kieling
Program Manager
Permits Management Program

Attachment

cc: James Bearzi, HWB
Dale Gandy, Gandy Marley, Inc.
Diane Dwire, Montgomery Watson
Stephanie Kruse, HWB
Dave Cobrain, HWB
Pam Allen, HWB

file: Red/GMI/00
track: GMI/08-31-00/Corser/Kieling/Financial Assurance Cost Estimate Response and RSI

ATTACHMENT A

REQUESTED CHANGES TO THE CLOSURE AND POST-CLOSURE CARE FINANCIAL ASSURANCECOST ESTIMATES AND REQUEST FOR SUPPLEMENTAL INFORMATION

TECHNICAL ADEQUACY REVIEW OF RCRA PERMIT APPLICATION FINANCIAL ASSURANCE COST ESTIMATE FOR THE PROPOSED GANDY MARLEY, INC., TRIASSIC PARK LANDFILL SUBMITTED BY GANDY MARLEY, INC.

August 31, 2000

The following changes should be made to tables 8-3 and 8-4 of Section 8 (*Closure and Post-closure of Permitted Units*) of the Triassic Park Waste Disposal Facility Permit Application. The following changes to the cost estimate also should be made to any other applicable references to closure and financial assurance within Section 8 of the Permit Application and to all other applicable sections or attachments to the Permit Application. Changes and additional line items requested by HWB for inclusion in Tables 8-3 and 8-4 are listed in **bold type.**

TABLE 8-3 CLOSURE COST ESTIMATE	COST ($)	**HWB Changes to Cost Estimate ($)**
DRUM HANDLING UNIT		
Stabilization and Disposal of Remaining Drum Waste Inventory	$36,071	36,064
Decontamination of Equipment and Buildings	$7,200	7,200
Stabilization and Disposal of Decontamination Water	$14,630	14,660
Chemical Testing of Decontamination Water		6,120
Dismantling and Moving Structure and Equipment	$155,371	23,775
Dismantling and Disposal of Concrete Floor and Secondary Containment	$21,922	**122,570**
Soil Sampling and Chemical Analysis	$138,720	138,720
Excavation of Contaminated Soils	$7,307	7,596
Disposal of Contaminated Soils		15,930
Earth Backfill for Excavated Contaminated Soils	$1,827	4,500
Revegetation		**91,960**
Certification of Closure Inspection	$3,000	3,000
Certification of Closure Report	$5,000	**20,000**
Subtotal	$391,047	**492,095**

EVAPORATION POND	COST ($)	**HWB Changes to Cost Estimate ($)**
Stabilization and Disposal of Remaining Liquid Waste Inventory	$342,954	**342,952**
Decontamination of Equipment	$240	240
Stabilization and Disposal of Decontamination Water	$7,315	7,315
Chemical Testing of Decontamination Water		**4,080**
Removal and Disposal of Liner and Leachate Collection System	$81,984	**99,880**
Soil Sampling and Chemical Analysis	$128,520	128,520
Excavation of Contaminated Soils	$13,664	**18,019**
Disposal of Contaminated Soil		**37,790**
Earth Backfill for Excavated Contaminated Soils	$3,416	**15,372**
Revegetation		93,620
Certification of Closure Inspection	$3,000	3,000
Certification of Closure Report	$5,000	**20,000**
Subtotal	$586,093	770,788

LIQUID WASTE RECEIVING AND STORAGE UNIT	COST ($)	**HWB Changes to Cost Estimate ($)**
Stabilization and Disposal of Remaining Waste Inventory	$52,668	**105,336**
Decontamination of Equipment and Buildings	$2,400	2,400
Chemical Testing of Decontamination Water		**6,120**
Stabilization and Disposal of Decontamination Water	$7,315	**14,630**
Removal and Disposal of Tanks and Concrete Pad	$2,862	**21,139**
Soil Sampling and Chemical Analysis	$22,440	**61,200**
Excavation of Contaminated Soils	$218	**461**
Disposal of Contaminated Soil		967
Earth Backfill for Excavated Contaminated Soils	$54	**491**
Revegetation		**37,200**
Certification of Closure Inspection	$3,000	3,000
Certification of Closure Report	$5,000	**15,000**
Subtotal	$95,957	**267,944**

STABILIZATION UNIT	Cost ($)	HWB Changes to Cost Estimate ($)
Stabilization and Disposal of Remaining Waste Inventory	$18,922	120,336
Decontamination of Equipment and Buildings	$4,560	4,560
Chemical Testing of Decontamination Water		6,120
Stabilization and Disposal of Decontamination Water	$14,630	14,668
Dismantling and Salvaging Tanks, Ancillary Equipment, and Building	$60,959	24,905
Removal and Disposal of Tanks and Concrete Pad	$14,700	57,980
Soil Sampling and Chemical Analysis	$16,320	40,800
Excavation of Contaminated Soils	$2,150	2,272
Disposal of Contaminated Soil		4,766
Earth Backfill for Excavated Contaminated Soils	$538	2,421
Revegetation		73,200
Certification of Closure Inspection	$3,000	3,000
Certification of Closure Report	$5,000	15,000
Subtotal	$140,779	370,028

ROLL-OFF STORAGE AREA	Cost ($)	HWB Changes to Cost Estimate ($)
Stabilization and Disposal of Remaining Waste Inventory	$749,295	925,056
Decontamination of Equipment	$2,400	0
Chemical Testing of Decontamination Water		0
Stabilization and Disposal of Decontamination Water	$14,630	0
Demolition and Disposal of Liner System	$80,960	192,407
Soil Sampling and Chemical Analysis	$144,840	144,840
Excavation of Contaminated Soils	$20,240	21,353
Disposal of Contaminated Soil		44,781
Earth Backfill for Excavated Contaminated Soils	$5,060	22,770
Revegetation		136,620
Certification of Closure Inspection	$3,000	3,000
Certification of Closure Report	$5,000	15,000
Subtotal	$1,025,425	1,505,827

TRUCK WASH UNIT	Cost ($)	HWB Changes to Cost Estimate ($)
Decontamination of Equipment and building		1,200
Chemical Testing of Decontamination Water		4,080
Off site disposal of Decontamination Water		2,250
Tank Removal and Salvage		4,520
Demolition and Disposal of Building and Unit		16,769
Soil Sampling and Chemical Analysis		20,400
Excavation of Contaminated Soils		285
Disposal of Contaminated Soil		598
Earth Backfill for Excavated Contaminated Soils		414
Revegetation		4938
Certification of Closure Inspection		3,000
Certification of Closure Report		5,000
Subtotal		63,454

LANDFILL CLOSURE ITEMS	Cost ($)	HWB Changes to Cost Estimate ($)
Landfill Excavation Backfill	$4,120,000	7,210,000
Landfill Cover	$2,372,508	4,831,235
Leachate Treatment Facility Construction	$400,000	*
Leachate Treatment Facility Operations	$32,120	*
Sump Vadose Zone Sampling and Analysis	$8,000	8,000
Well Vadose Zone Monitoring System Sampling and Analysis	$40,000	48,000
Soil Sampling and Analysis	$104,040	104,040
Final Plat Survey	$2,400	3,600
Certification of Closure Inspection	$3,000	3,000
Certification of Closure Report	$5,000	15,000
Total	$7,087,068	*
Total from unit closures	$2,239,301	3,470,136
Total Closure Cost	$9,326,369	*

In addition, the leachate treatment facility may require a RCRA operating permit therefore the following item also will be required:

10) A cost estimate for preparation of an application for a RCRA operating permit to treat the leachate after closure of the Triassic Park landfill.

Prepared for:

TRIASSIC PARK WASTE DISPOSAL FACILITY
Post Office Box 827
1109 E. Broadway
Tatum, New Mexico 88267

PART A AND PART B
PERMIT APPLICATION FOR
TRIASSIC PARK WASTE DISPOSAL FACILITY

December 1997
(Revised October 2000)

Prepared by:

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11.0 40 CFR 264 SUBPART AA, BB & CC REGULATIONS

This section provides a brief summary of the air requirements, as presented in 40 CFR 264 subpart AA and BB. In addition, this section provides a brief summary of other regulations which may be applicable to the Facility.

11.1 40 CFR 264 SUBPART AA - AIR EMISSIONS FOR PROGRESS UNITS

The Facility will not be subject to the 40 CFR 264 Subpart AA regulations because the Facility will not utilize distillation, fractionation, thin-film evaporation, solvent extraction, air or steam stripping operations.

11.2 40 CFR 264 SUBPART BB – AIR EMISSION STANDARDS FOR EQUIPMENT LEAKS

Because wastes with organic concentrations greater than 10 percent by weight will not be accepted for storage in the liquid waste storage unit, treated in the evaporation pond or ~~,~~ treated in the stabilization unit~~,~~ ~~stored in containers, or placed in the landfill,~~ these units will not be subject to 40 CFR 264 Subpart BB regulations. Therefore, equipment such as pumps, compressors, pressure relief devices, sampling equipment, connecting system, and valves will not contain or contact hazardous wastes with organic concentrations of 10 percent or greater by weight.

11.3 40 CFR 264 SUBPART CC – AIR EMISSIONS STANDARDS FOR TANKS, SUFACE IMPOUNDMENTS AND CONTAINERS

The Facility will not be subject to the Subpart CC requirements for tanks and evaporation ponds because these units will not be used to manage wastes containing volatile organic concentrations greater than 500 parts per million by weight (ppmw).

Drums and roll-off containers may hold hazardous waste that contains greater than 500 ppmw volatile organic compounds. These wastes will be stored in containers with appropriate covers (see Section 11.3.2).

11.3.1 Waste Determination

A waste determination will only be conducted for each waste stream to be placed in a unit that is exempt from the Subpart CC requirements for air emission controls (e.g. the evaporation pond). The waste determination shall be made at the point of waste origination~~where the Facility first takes possession of the waste~~. In general, the Facility will use generator-supplied information (manifests, shipping papers, certification notices etc.) prepared in accordance with 40 CFR 264.1083 ~~265.1084(a)(5) and (a)~~ to make this determination, however, the Facility may choose to test a representative sample of the waste. For waste to be placed in units that comply with Subpart CC requirements for air emission controls, no formal waste determination is required.

11.3.2 Applicability to Containers

There are two types of containers expected to be used at the Facility to store wastes: (1) drums and (2) roll-off containers. These containers may hold hazardous waste that contains greater than 500 ppmw volatile organic compounds. ~~All~~ These drums and roll-off containers stored at the Facility will have covers and meet DOT requirements for packaging of hazardous waste for transport under 49 CFR 178. Potential air pollution, from ~~these~~ containers that hold hazardous waste with greater then

500 ppmw volatile organic compounds, will be controlled in accordance with the ~~container level 2~~ standards specified in CFR 264.1086(d) ~~(d)~~.

11.3.3 Applicability to the Evaporation Pond

The Facility will not accept waste to be placed in the evaporation pond that contains greater than 500 ppmw volatile organics. Therefore, the evaporation pond is exempt from air emission control requirements specified in Subpart CC.

11.3.4 Applicability to Tanks

The waste storage tanks will not be subject to the Subpart CC requirements for inspection, monitoring, and emission controls because this unit will not be used to manage wastes containing volatile organic concentrations greater than 500 parts per million by weight (ppmw)

11.3.5 Applicability to the Stabilization Process

The concentration of volatile organics in the waste to be stabilized will be limited to less than 500 ppmw. Final design documentation will be included as part of the operating record for the Facility.

11.3.6 Inspection and Monitoring

A written plan and schedule will be developed and implemented to perform all inspection and monitoring in accordance with 40 CFR 26~~4~~5.108~~8~~9(~~f~~b)~~(2)(i)~~.

11.3.7 Recordkeeping and Reporting

Recordkeeping and reporting will be conducted in accordance with 40 CFR 264.1089 and 264.1090, respectively.

11.3.7.1 Recordkeeping

The following records will be kept:

- waste determinations;
- inspection and monitoring results;
- design specifications for closed vent systems and control devices;
- control device exceedances and corrective action; and,
- leak repair information.

11.3.7.2 Reporting

~~Facility personnel will provide reports to the appropriate regulatory authority under the following conditions:~~

~~i~~If the Facility becomes aware that an exempt unit has received hazardous waste containing greater than 500 ppmw volatile organic compounds, the regulatory agency will be notified within 15 days. ~~; and~~ In accordance with 40 CFR 270.30, if continuous emission monitoring is used at the exempt unit holding hazardous waste with greater than 500 ppmw volatile organic compounds~~,~~

~~if continuous emission monitoring is used,~~ a semi-annual report will be provided that indicates each time the ~~monitoring~~ unit is operated in non-compliance over a 24 hour (or more) period of time. This report will not be provided if the ~~monitoring system~~unit remains in compliance during the entire 6-month reporting period.

11.4 OTHER APPLICABLE REGULATIONS

There are a number of other federal regulations which will apply to the Facility. Once the Facility has received a final permit and the configuration and operational aspects are finalized (it is possible that some minor changes to the Facility configuration and operation will occur as a result of the final permit) other regulations will be evaluated. Some of the regulations that will be evaluated are:

- National Pollution Discharge and Elimination System;
- Clean Water Act;
- Clean Air Act; and
- Occupational Safety and Health Administration regulations.

The regulations listed above will be evaluated for their applicability to the Facility. In addition to these federal regulations, the Facility will evaluate numerous state, county, and local regulations. GMI will ensure that the Facility is designed, constructed, and operated in compliance with all applicable regulations.

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10.0 CORRECTIVE ACTION

It is unlikely that releases of hazardous waste or hazardous waste constituents have occurred on the site of the proposed Facility. This is based on an evaluation of (1) the site history; (2) reconnaissance of the site conducted as part of site characterization activities; and (3) a records review, which are described in the following paragraphs.

The current property owner is Marley Ranches Inc. Marley Ranches has owned the property since 1967 and has used it primarily for grazing of livestock. The previous owner, owned the property for two generations. Under the previous owner the property was used primarily for grazing of livestock.

The primary site characterization activities included drilling programs conducted in July 1993, September 1993, and July 1994. Supplemental investigations were also carried out in July 1995 and August 1999. Reconnaissance of the site was conducted as part of the site characterization activities and no evidence found of hazardous waste releases or hazardous constituents.

New Mexico Oil Control Division records were reviewed. An intermittent land use in the area is exploratory drilling for oil and gas wells. The record review indicated that there are no abandoned wells within the proposed Facility boundary, and the nearest production well is approximately 3 miles from the proposed site. In addition, aerial photographs of the site were reviewed. The review did not provide any indication of releases or structures or activities that could be a source of releases.

The New Mexico Environment Department conducted a RCRA Facility Assessment (RFA) in 1995. An RFA Report was prepared in September 1995. The RFA report identified several potential future SWMUs, including:

- the drum handling unit;
- roll-off storage area;
- the liquid waste receiving and storage unit;
- the stabilization unit;
- the evaporation pond;
- the landfill;
- the truck wash unit;
- the maintenance shop;
- the chemical laboratory;
- the stormwater retention basin;
- the untarping, sampling, and weigh scales area;
- the truck staging area;

- the future debris encapsulation unit;
- the future waste processing area;
- all roads, including those leading to the Facility;
- the clay processing area; and,
- the dust control/clay processing water basin.

No releases have occurred at these areas of concern because the structures do not exist and no Facility activities have occurred. The corrective action requirements, as specified in 40 CFR 264 Subpart F and the requirements specified in the corrective action module of the permit will not be implemented unless evidence of a release from a waste management unit is identified in the course of future groundwater or vadose zone monitoring, field investigation, environmental audits, or other means.

The Facility will respond to any emergency in accordance with the Contingency Plan provided in Section 6.0, including notification and reporting. Specifically, any release which threatens human health or the environment must be reported to NMED within 24 hours of its detection, and any time the Contingency Plan is implemented. However, in some cases, such as small amounts of materials being released from SWMUs into contained buildings or onto impervious surfaces that are immediately cleaned up, a release from a SWMU will not trigger reporting under the Contingency Plan.

All releases and response actions will be documented in the Facility operating record. Corrective action in response to any release will be implemented in accordance with the corrective action module of the permit.

~~No releases have occurred at these areas of concern because the structures do not exist and no Facility activities have occurred. An RCRA Facility Investigation (RFI) will not be conducted unless evidence of a release from a waste management unit is identified in the course of future groundwater or vadose zone monitoring, field investigation, environmental audits, or other means. The Facility will respond to any emergency in accordance with the Contingency Plan provided in Section 6.0, including notification and reporting. Specifically, any release which threatens human health or the environment must be reported to NMED within 24 hours of its detection, and any time the Contingency Plan is implemented. However, in some cases, such as small amounts of materials being released from SWMUs into contained buildings or onto impervious surfaces that are immediately cleaned up, a release from a SWMU will not trigger reporting under the Contingency Plan. All releases and response actions will be documented in the Facility operating record. The following information will be provided:~~

~~the location of the release to the environment relative to the SWMU;~~

~~the type and function of the unit;~~

~~the general dimensions, capacities, and structural description of the unit;~~

~~the period during which the unit was operated;~~

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- ~~information on the wastes that have been or are being managed at the SWMU; and,~~

- ~~results of any sampling and analysis to determine whether releases of hazardous waste or hazardous waste constituents have occurred or may occur.~~

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~~The Facility will also notify the administrative authority verbally, within 24 hours of discovery, of any release of hazardous waste or hazardous waste constituents that has the potential to migrate off site. The Facility will take immediate action to protect human health and the environment unless the Facility is unable to obtain access to a release that has migrated off site.~~

~~Additionally, when a release has occurred, an RFI will be conducted. The purpose of the RFI is to determine the extent and nature of releases of hazardous waste and hazardous waste constituents. The RFI consists of the following four tasks:~~

- ~~review of pertinent literature and documentation;~~

- ~~preparing of the RFI Work Plan;~~

- ~~conducting the investigation; and,~~
- ~~preparing the Final Report and Summary.~~

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~~The results of the RFI may indicate that no further action is required. At this point, the GFacility will write NMED requesting a Class III permit modification to remove the subject SWMU from further investigation. However, if the RFI indicates that a SWMU has released hazardous waste or hazardous waste constituents that pose a concern to human health or the environment, a Corrective Measures Study (CMS) will be required. A CMS consists of three tasks:~~

- ~~preparing a CMS Plan;~~

- ~~conducting the CMS; and,~~

- ~~preparing a CMS Final Report and Summary, which includes a preferred alternative and a schedule for implementation.~~

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~~The RCRA permit will be modified to include appropriate corrective action requirements.~~

9.0 WASTE MANAGEMENT

The purpose of this section is to describe the Facility Waste Minimization (WM)/ Pollution Prevention (P2) Program, which will be an organized, comprehensive, and continuous effort to systematically reduce waste generation during the life of the Facility. As such, the program will be ever-changing and expanding to incorporate new or more effective WM/P2 opportunities as they are developed. The level of detail in this description of the WM/P2 Program is commensurate with the level of detail currently available with respect to day-to-day operation of the Facility.

The Facility is committed to the prevention of all forms of pollution and the minimization of all wastes generated at its hazardous waste landfill. Source reduction of waste is the company's highest waste minimization priority, followed by recycling and reuse.

For an industrial facility, such as the Facility, a Waste Minimization Program is an important link to providing increased protection of public health, employee health, and the environment. As part of its WM/P2 Program, the Facility will develop a detailed WM/P2 Program Plan as soon as the intricate details of Facility operation are more clearly defined.

It is anticipated that only insignificant amounts of waste will be generated from site operations. Leachate and wastewater may be generated from the wastes placed in the landfill and from precipitation events. Other wastes that may be generated include waste oils and other maintenance wastes, office wastes, soil and debris from spills, personal protective equipment, excess chemicals, and freon. Not all of these wastes are expected to be hazardous. All site-generated waste will be stored, treated, recycled, reused, and/or disposed in accordance with applicable regulations. Waste minimization/pollution prevention efforts will be focused on all forms of waste, not just those wastes defined as hazardous in the New Mexico Hazardous Waste Management Regulations.

Waste minimization focuses on reducing the amounts and toxicity of waste materials generated from any process or other plant activity and on reusing, recycling, or reclaiming waste materials for future use and benefit. It should be noted that the terms waste minimization and pollution prevention will be used somewhat interchangeably throughout this section. However, the terms have distinctly different meanings, as defined below:

Waste Minimization

Waste minimization is the reduction, to the extent feasible, of the amounts and toxicity of waste materials after they are generated from any process or other activity. Primary waste minimization techniques include reuse, recycling, or reclamation of waste materials for future use and benefit.

Pollution Prevention

Pollution prevention is the use of any process, practice, or procedure to prevent the generation of waste. Examples of primary pollution prevention techniques include material substitutions (e.g., nonhazardous materials used in place of hazardous materials), process changes, and procedural improvements.

9.1 BRIEF HISTORY OF WM/P2 IN THE UNITED STATES

Current trends in environmental policy and regulation indicate a move from pollution control to pollution prevention and waste minimization in the private sector. Throughout the 1980s, the United States became increasingly aware of the environmental damage and restoration costs associated with past improper disposal of hazardous wastes. In the 1984 HSWA to RCRA, Congress declared that it is:

> *. . . the national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste that is nevertheless generated, should be treated, stored, or disposed of so as to minimize present and future threat to human health and the environment. From HSWA, Congress clearly intended a hierarchy of actions for managing the nation's waste problems, with priority given to reduction or elimination of waste over treatment, storage, and disposal of waste after it has been generated.*

The Pollution Prevention Act of 1990 expanded this concept to include all forms of environmental pollution. This statute calls pollution prevention a "National Objective" and establishes a hierarchy of environmental protection priorities as national policy. The order of priority is summarized as follows:

1. Reduction or elimination of waste prior to generation (source reduction) is the best option.

2. Recycling and reuse of waste that is generated is the second best option in cases when pollution cannot be prevented.

3. Treatment (reclamation or toxicity reduction) of waste that is generated is the next best option in cases where feasible prevention and recycling opportunities are not available or possible.

4. Disposal of generated waste is the least desirable option.

9.2 PURPOSE AND OBJECTIVES OF THE FACILITY WASTE MINIMIZATION/POLLUTION PREVENTION PROGRAM

The purpose of this section is to describe the Facility WM/P2 Program. This Program will establish the strategic framework for integrating waste minimization and pollution prevention into all Facility activities. The objectives of the Program are the following:

- raising employee awareness about the reasons for and benefits of a WM/P2 Program and instilling a desire to minimize waste at the lowest organizational levels possible;

- describing planned initiatives that support and promote WM/P2 through various training opportunities, including recycling, reuse, and recovery programs, and good housekeeping practices;

- adapting and implementing existing technologies as rapidly as possible to reduce waste generation at the source and to recycle waste products; and,

- reducing all forms and categories of waste to the lowest extent practical.

9.3 BENEFITS OF THE FACILITY WASTE MINIMIZATION/POLLUTION

The Facility WM/P2 Program, like all effective waste minimization programs, will yield numerous benefits and advantages, which are either tangible or intangible. Some of these benefits are listed below:

- reduced waste management costs, including labor and disposal costs;
- reduced regulatory compliance costs, including inspection costs and possible fines;
- reduced raw material costs;
- reduced potential for releases of hazardous chemicals and wastes;
- increased worker safety; and,
- reduced civil and criminal liabilities under environmental laws.

9.4 ELEMENTS AND GOALS OF THE FACILITY WM/P2 PROGRAM

As previously mentioned, the Facility will continue to expand and refine its WM/P2 Program during the life of the Facility. The elements of the Program include those methods commonly used to form the baseline, or starting point, for effective WM/P2 Programs. The elements and goals of the Program are listed below as action-items to be completed during the initial phases of Facility operations. Such listings are standard practice in the industry since many of the elements, waste generation levels for example, cannot be determined until after the Facility begins operation. The personnel tasked with oversight of this program will also oversee the planning, development, and implementation of the WM/P2 reduction methods and activities outlined below.

- develop and establish a written policy statement that describes why the WM/P2 Program is being implemented, how it will be implemented, and who will implement it. The policy statement will be issued from the highest level of management. The policy will be provided to each employee at the start of employment and will be reviewed during RCRA training and annual refresher training;
- assign Facility personnel to oversee, plan, develop, and implement the elements of the WM/P2 Program;
- establish support for the program at all levels in the company;
- determine a waste generation baseline at the site and establish a tracking method and waste minimization goals;
- establish a procurement control program to ensure the purchase of environmentally friendly materials and products while preventing the procurement of prohibited items from the site; the Facility will endeavor to reduce or eliminate the use of hazardous materials from its operations;

- minimize the quantities of virgin products and raw materials allowed such as sorbents and other materials used in the stabilization process into the landfill. The Facility will endeavor to utilize other wastes (e.g., fly ash) in the stabilization process rather than virgin materials;

- establish reuse, recycling, recovery, and conservation programs to minimize the volume of generated waste requiring disposal or treatment; examples of such programs include paper, aluminum cans, cardboard, scrap metals, oil, batteries, and surplus materials and chemicals;

- establish good-housekeeping practices that promote WM/P2; an example of this type of practice is the requirement to remove packaging materials from chemicals, products, and equipment before they are introduced into the disposal area or contamination-control areas to avoid cross contamination;

- establish a WM/P2 awareness program and train employees, as appropriate;

- prepare a WM/P2 plan and update it annually or as appropriate;

- perform an assessment of waste minimization/pollution prevention opportunities; an example of this type of opportunity is: installation of air conditioning refrigerant reclamation systems; and,

- determine the feasibility of implementing the WM/P2 projects and proceed as appropriate with project implementation.

9.5 PROPOSED ELEMENTS OF THE FACILITY WM/P2 PROGRAM PLAN

The Facility will establish a WM/P2 Program Plan when operational details of the Facility, such as the chemical and equipment procurement processes and the actual level of waste generation, are determined. The WM/P2 plan will include the following elements, as appropriate:

- the written policy statement for WM/P2;

- a description of the roles and responsibilities of Facility personnel with respect to WM/P2 and a brief description of how Facility groups will work together to reduce waste generation and energy consumption;

- a plan or method for publicizing and gaining support for the program and communicating the successes and failures of waste minimization efforts (i.e., employee awareness program);

- a description of how employees will be informed about WM/P2 requirements and expectations (possibly within the context of other Facility training courses);

- a description of waste-generating processes, including a clear definition of the types and quantities of materials generated from each process;

- a description of recycling, reclamation, treatment, and disposal programs used by the Facility and the types of wastes and materials that are included in these programs;

- descriptions of other WM/P2 programs and initiatives;

- reporting requirements;
- a description of WM/P2 goals for the Facility;
- a description of the Facility's chemical and material procurement process;
- a review of the costs of waste management and disposal, both onsite and at other facilities;
- criteria for prioritizing candidate WM/P2 processes, activities, and waste streams for future implementation; and,
- an evaluation of the effectiveness of the WM/P2 Program and activities.

8.0 CLOSURE AND POST-CLOSURE OF PERMITTED UNITS

This closure plan describes specific activities required for closure of the drum handling unit, roll-off storage area, stabilization unit and associated liquid waste receiving and storage unit, evaporation pond, and landfill, in compliance with RCRA closure requirements. It is currently planned that all of these units will be cleaned closed with the exception of the landfill. The closure activities are designed to minimize the need for further maintenance and any potential impacts to human health and the environment. Closure activities are described in Section 8.1. A post-closure care plan for the landfill is included in Section 8.2. Section 8.3 presents the closure performance standard; and Section 8.4 discusses the closure schedule. Closure certification and modifications are discussed in Sections 8.5 and 8.6, respectively. Closure and post-closure cost estimates are discussed in Section 8.7 and compliance with financial assurance requirements is discussed in Section 8.8.

8.1 CLOSURE ACTIVITIES

At the end of the active life of the Facility, all units and structures of the Facility will be closed and dismantled in compliance with 40 CFR 264, Subpart G. Any solid hazardous waste and debris will be placed in the landfill, and non-hazardous waste will be sent off site for reuse, recycle, or disposal in compliance with 40 CFR 264, Subpart G. Liquids generated during closure (decontamination solutions~~, and~~. leachates, and evaporation pond liquid) will be treated onsite (stabilization unit) unless it is determined that shipment offsite for treatment is more cost effective. The landfill will be capped with a final cover, and post-closure care will be initiated for the landfill. These closure activities are described in detail in the following sections. The unit-specific closure descriptions are presented in the order in which the units are anticipated to be closed.

An off site laboratory will be used for analysis of hazardous waste and soil samples at closure. The off site laboratory will be an EPA approved laboratory with an internal QA/QC program and specific procedures for each analytical method. All laboratory samples will be analyzed for the hazardous constituents specified in 40 CFR Part 261, Appendix VIII and all other constituents considered by NMED to be a threat to human health and the environment.

Prior to the commencement of closure activities, GMI will notify the Secretary of NMED at least 60 days prior to the date GMI expects to begin closure of the ~~Facilities~~units. The schedule for closure is described in more detail in Section 8.4~~ and shown in Figure 8-1, Closure Schedule~~.

8.1.1 Drum Handling Unit

The following steps will be necessary to complete closure of the drum handling unit:

- removal of remaining waste and other material in the storage area;
- decontamination of equipment in the area;
- sampling of any areas or ~~facilities~~ equipment suspected, based on visual observations, of being contaminated;
- dismantling of the building structure;
- dismantling of the concrete floor and secondary containment; and,
- sampling of soil beneath the floor to determine if contamination is present.

8.1.1.1 Removal of Inventory

Closure of the drum handling unit will commence with removal of any inventory or other materials stored in the area according to standard ~~operating~~ procedures. Remaining inventory will be removed within 90 days after receipt of the final volume of hazardous wastes at the unit. For the purposes of this plan, GMI will arrange for all waste remaining in inventory to either be disposed of directly in the landfill, treated at the onsite treatment unit prior to disposal in the landfill, or returned to the generator if either of the previous two options are not available. If required, the hazardous materials could be returned to the generator utilizing the same method of transportation that was used to deliver the material to the site (e.g., end dump trucks).

Closure cost estimates and waste volumes for disposal are based on the worst-case scenario of all wastes requiring stabilization at the onsite treatment unit prior to landfilling. In the case of the drum handling unit, it is assumed that all 1,120 drums contain sludge that must be stabilized. For these calculations, the maximum inventory of the drum handling unit at the time of closure is assumed to be the maximum permitted capacity of the unit.

8.1.1.2 Decontamination of Equipment and Dismantling of Building Structure

Equipment in the area, such as drum-moving equipment, that may have contacted hazardous waste will either be decontaminated or disposed of as hazardous waste. Large equipment, such as the fork trucks, will be decontaminated. Disposal as waste will be the preferred option only for items, such as wood pallets, that are difficult to decontaminate.

The building structure is not anticipated to be contaminated with hazardous waste; however, it will be cleaned and rinsed prior to, or during, dismantling. The dismantled building structure will either be reused elsewhere or recycled as scrap metal.

A high-pressure detergent wash and water rinse will be used to clean off all visible ~~residue~~residues. Cleaning will continue until sampling and analysis of the wash water indicates that contaminants have been removed. The use of wash water will be limited to minimize the amount of waste generated. Wash water use will be limited by using only the necessary amount to decontaminate the facility and equipment. All decontamination solutions will be collected in containers or portable tanks. The decontamination solutions will either be treated onsite or trucked to an approved off site facility for treatment. The expected volume of decontamination solutions that will be generated during closure of the drum handling unit is included in the liquid waste amounts shown in Table 8-1.

Clean closure of the building will be ensured by the development and implementation of a sampling and analysis plan (SAP). The plan will be provided to the New Mexico Environment Department for approval 90 days prior to implementation. At a minimum, it will specify the following aspects of the sampling and analysis activities:

- *1.0 Sampling Program*
  - *1.1 Sampling Locations*
  - *1.2 Sample Matrix*
  - *1.3 Sample Containers, Type and Size*
  - *1.4 Sampling Tools*
  - *1.5 Sample Management*
  - *1.6 Field Screening Methods*
- *2.0 Analytical Methods*
  - *2.1 Analytes for Analysis*
  - *2.2 Analysis Procedures (Specified SW-846 Methods)*
- *3.0 Quality Assurance*
  - *3.1 Organization*

3.2 Sample Management

3.3 Analytical System
3.3.1 Instrument Maintenance
3.3.2 Instrument Calibration
3.3.3 Personnel Training
3.3.4 Reagents and Standards
3.3.5 Corrective Actions
3.4 Data Quality Objectives
3.5 Performance and System Audits

4.0 Data Management
4.1 Data Collection
4.2 Data Reduction
4.3 Data Reporting

The sampling and analysis plan will specify the use of equipment, methods, and techniques current at the time the plan is prepared. Applicable provisions of the then-current version of SW-846 (or other applicable standard reference then in effect) will be specified. Applicable reporting requirements will also be specified, as appropriate.

8.1.1.3 Dismantling of Concrete Floor and Secondary Containment

Secondary containment for the drum handling unit will be provided by a geomembrane lined trench and collection sump system. Drums will be stored on a coated concrete floor that drains to the trench and sump system. Because the concrete will be coated, decontamination at closure is proposed so that the concrete will be broken up and disposed of as non-hazardous debris. The liner and collection sump system will be removed at closure but will not be decontaminated. Since this material will be considered a hazardous waste, upon certification of compliance with LDR requirements, it will be disposed of in the landfill. The expected volume of solid hazardous waste that will be generated during closure is provided in Table 8-1.

8.1.1.4 Soil Sampling

After removal of the building, any contaminated soils will be removed for disposal and the area resampled until the sampling and analyses indicate that the area meets the performance standard provided in Section 8.3. Sampling will be performed in the vicinity of the loading dock and in open areas. Individual samples will be collected at a frequency equivalent to one per every ~~400~~2,000 square feet (i.e. one sample to be taken at the center of each 2,000 square foot grid). ~~Ten such individual samples will be combined to create a single composite sample for analysis. This will result in a testing frequency of one composite sample per 4,000 square feet.~~

Contaminated soils will be disposed of in accordance with the regulations applicable to the contamina~~te~~nt of concern. If the landfill portion of the Facility is still operational and the contaminated soil meets the waste acceptance criteria for the landfill it will be landfilled at GMI. If the GMI landfill cannot accept the waste it will be manifested and shipped to an appropriately licensed disposal facility.

TABLE 8-1
CLOSURE GENERATED WASTE QUANTITIES

Facility Unit	Inventory	Waste (tons)	Waste for Disposal[2] (tons)
Drum Handling Unit	1,120 drums	309	803
Evaporation Pond Unit	78,300 ft^3	2,936	7,634
Liquid Waste Receiving and Storage Unit	36,000 gal	162	1,692
Stabilization Unit	3,600 ft^3	180	468
Roll-Off Storage Unit	142,560 ft^3	7,128	18,533
Landfill[1]	NA	NA	NA

Notes
1) No waste will be moved from the landfill at closure time.
2) Waste for disposal include waste and reagents quantities added together.

In addition, seven samples will be collected from specific locations that correspond to ~~the~~ all of the floor drain sumps (see Drawings 37, 38 and 39 in Volume III). ~~An~~ Eight additional samples will be collected in the dock area and samples will be collected at 20 foot intervals beneath the drainage trenches. Sample results will be compared against the closure performance standard presented in Section 8.3.

Any contaminated soils will be removed for disposal and the area resampled until the sampling and analyses indicate that the area meets the performance standard provided in Section 8.3. Contaminated soils will be disposed of in accordance with the regulations applicable to the contaminant~~te~~ of concern. If the landfill portion of the Facility is still operational and the contaminated soil meets the waste acceptance criteria for the landfill it will be landfilled at GMI. If the GMI landfill cannot accept the waste it will be manifested and shipped to an appropriately licensed disposal facility.

8.1.2 Evaporation Pond

The primary steps required to complete closure of the evaporation pond are the following:

- removal of remaining liquid waste;
- removal and solidification of sludge;
- removal and disposal of liner and leachate collection system;
- sampling of soil beneath the unit to determine if contamination is present; and
- filling and revegetating the area.

8.1.2.1 Removal of Liquid Waste

The liquid in the evaporation pond will be allowed to evaporate naturally. At the beginning of closure of the evaporation pond, no further waste will be accepted into the pond. The water balance for the site indicates that there is a net loss of approximately 80 inches of water per year (90 inches of evaporation minus 10 inches of precipitation). The liquid in the evaporation pond has an approximate depth of 9 feet, and it is assumed that at closure there will be 2 feet of sludge in the bottom of the pond, leaving 7 feet of liquid (84 inches). Therefore, approximately 1 year is projected to be adequate time to evaporate all the liquid in the pond, assuming it is full to capacity at the time closure is initiated.

8.1.2.2 Removal and Solidification of Sludge

Following evaporation of the pond liquid, the sludge will be removed from the bottom with trash pumps or hand excavation equipment. Removal operations will continue until visual examination shows that all sludge has been removed. The removed sludge will be solidified in the treatment unit. The stabilized waste will be placed in roll-off containers and cured in accordance with the provisions of the Waste Analysis Plan in Section 4.0~~WAP~~ prior to disposal in the landfill. The expected volume of sludge that will be removed and disposed in the landfill is shown in Table 8-1. This information is based on an estimated sludge depth of 2 feet at the sump.

8.1.2.3 Removal and Disposal of Liner and Leachate Collection System

The pond liner and leachate collection system will be dismantled and removed as hazardous debris. Prior to removal, the liner will be washed to remove the visible contaminants. The method of treatment is consistent with debris treatment technologies as defined in 40 CFR 268.7(d). Upon certification of compliance with the LDR debris treatment requirements, as required by 20 NMAC 4.1.800 incorporating 40 CFR 268.~~7~~45~~(d)~~, the waste will be disposed in the landfill. The expected volume of solid hazardous waste and debris that will be generated during closure is provided in Table 8-1. The vadose zone monitoring wells associated with the evaporation pond will be left functional to continue monitoring the landfill, as specified in Section 3.0.

8.1.2.4 Soil Sampling

After removal of all waste, the evaporation pond liners, and the leachate collection system, soil samples will be collected and analyzed for a facility proposed subset of the constituents defined in Section 8.1 of the permit application and approved by NMED. ~~that may have been present in the stored wastes to determine if any contamination occurred from releases.~~ Individual samples will be collected at a frequency equivalent to one per ~~400~~2,000 square feet over the entire Surface Impoundment area (i.e. one sample to be taken at the center of each 2,000 square foot grid). ~~Ten such individual samples will be combined to create a single composite sample for analysis. This will result in a testing frequency of one composite sample per 4,000 square feet.~~ In addition, a sample will be obtained from ~~the~~ each leachate collection sump and ~~leachate collection sump and the tanker pad fill line~~beneath the tanker pad fill lines at the influent location and at 10-foot intervals beneath the transfer piping. Samples also will be collected adjacent to each side of the concrete containment pad.~~.~~ Sample results will be compared against the closure performance standard presented in Section 8.3.

Contaminated soils will be removed for disposal and the area resampled until the sampling and analyses indicate that the area meets the performance standard provided in Section 8.3. Contaminated soils will be disposed of in accordance with the regulations applicable to the contaminant~~te~~ of concern. If the landfill portion of the Facility is still operational and the contaminated soil meets the waste acceptance criteria for the landfill it will be landfilled at GMI. If the GMI landfill cannot accept the waste it will be manifested and shipped to an appropriately licensed disposal facility.

8.1.2.5~~4~~ Filling and Revegetating

The final step in closing the ~~Evaporation Pond~~Surface Impoundment will be filling the depression with clean soil to the approximate original grade and revegetating the disturbed areas~~.~~. The Surface Impoundment will be graded to ensure that the direction of surface water runoff is not towards the landfill units. A seed mixture appropriate for the area will be applied and the site will be watered as necessary to promote germination.

8.1.3 Liquid Waste Receiving and Storage Unit

The following steps will occur during closure of the liquid waste receiving and storage unit associated with the stabilization unit:

- removal and treatment of tank contents;
- dismantling and removal of tanks, ancillary equipment, and concrete containment area; and,

- sampling of soil beneath the unit to determine if contamination is present.

8.1.3.1 Removal of Inventory

Closure of the liquid waste receiving and storage unit will commence with removal of any inventory in the tanks according to standard ~~operating~~ procedures. The major steps of inventory removal, equipment decontamination, primary and secondary containment removal, and soil sampling will be identical~~fied~~ to these described in Section 8.1.1.1. Remaining inventory will be removed within 90 days after receipt of the final volume of hazardous wastes in the tanks. All wastes remaining in inventory can be treated at the onsite stabilization unit prior to disposal in the landfill. Closure cost estimates and waste volumes for disposal were based on the worst-case scenario of all four tanks being full to capacity at the start of closure. The maximum possible inventory for each tank at the time closure is initiated is equal to the permitted capacity of the tanks.

8.1.3.2 Dismantling of Tanks, Equipment, and Concrete Secondary Containment Area

The tanks and ancillary equipment will be dismantled and disposed in the landfill after certification of compliance with LDR ~~requirements~~debris treatment requirements under 40 CFR 268.45, as required by 20 NMAC 4.1.800 incorporating 40 CFR ~~267~~268.7 (d). The piping system used to transfer waste from the tanks to tankers will be considered part of the tanks and will be drained and dismantled as part of the tank closure. After removal of the tanks, the concrete containment will be washed and broken up for disposal as hazardous debris. Upon certification of compliance with the LDR debris treatment requirements, as required by 40 CFR 268.7(d), any hazardous materials will be disposed in the landfill. The expected volume of solid hazardous waste that will be generated during closure is provided in Table 8-1.

8.1.3.3 Soil Sampling

After removal of the tanks and containment, soil samples will be collected and analyzed for a facility proposed subset of the constituents defined in Section 8.1 of the permit application and approved by NMED. ~~constituents defined in Section 8.1 of this permit application that may have been present in the stored wastes to determine if any contamination occurred from releases.~~ Due to the limited footprint area of the liquid waste storage area, sampling will not be based on a per area basis. Rather, it is proposed that one sample be obtained beneath ~~the~~ each sump~~s~~ in the concrete base for the liquid waste storage units, beneath each tank after demolition, and adjacent to each side of each tank pad. In addition, samples will be obtained at locations where visual or field screening evidence of contamination is present. ~~The four samples, one for each tank, will not be composited but will be analysed individually.~~ Sample results will be compared against the closure performance standard presented in Section 8.3.

8.1.4 Stabilization Unit

The primary steps required to complete closure of the stabilization unit are the following:

- removal of remaining waste inventory;
- decontamination and removal of equipment and building structure;
- dismantling of the tanks and secondary containment area; and,
- sampling of soil beneath the floor to determine if contamination is present.

8.1.4.1 Removal of Inventory

Closure of the stabilization unit will commence with removal of any inventory remaining in the tanks according to standard ~~operating~~ procedures. The major steps of inventory removal equipment primary and secondary containment removal, and soil sampling will be identical to those described in Section 8.1.1.1. Remaining inventory will be stabilized and removed within 90 days after receipt of the final volume of hazardous wastes at the unit. The stabilized waste will be placed in roll-off containers and cured in accordance with the provisions of the Waste Analysis Plan in Section 4.0 ~~WAP~~ prior to disposal in the landfill. The maximum possible inventory for the tanks, at the time closure is initiated, is equal to the working capacity of the unit (approximately one-third full) because adequate space must remain for addition of reagents and for mixing.

8.1.4.2 Decontamination of Equipment and Dismantling of Building Structure

Equipment in the area, such as waste mixing equipment or other ancillary equipment that may have contacted hazardous waste, will either be decontaminated and certified as clean or disposed of as hazardous debris. The building structure (roof and walls) is not expected to be contaminated with hazardous waste; however, the building~~is~~ will be ~~cleaned and rinsed~~ decontaminated prior to dismantling. The building structure will be dismantled after cleaning and will either be reused or recycled as scrap metal. Building components and associated reagent silos that did not contact hazardous waste will be dismantled and removed from the site. The equipment and building will be subject to the requirements of the closure sampling and analysis plan.

A high-pressure detergent wash and water rinse will be used to clean off all visible residue. The use of wash water will be limited to minimize the amount of waste generated. All decontamination solutions will be collected in containers or portable tanks. The decontamination solutions will ~~either~~ be ~~treated onsite or~~ trucked to an approved off site facility for treatment. The expected volume of decontamination solutions that may be generated during closure of the stabilization unit is included in the liquid waste amounts shown in Table 8-1.

8.1.4.3 Dismantling of Tanks, Ancillary Equipment, Piping and Secondary Containment Area

The tanks, ancillary equipment, piping concrete, and secondary containment system will be dismantled and removed as hazardous debris. Upon certification of compliance with the LDR requirements, the waste will be disposed in the landfill. The expected volume of solid hazardous waste that will be generated during closure is provided in Table 8-1.

8.1.4.4 Soil Sampling

After removal of the stabilization unit structure, tanks, piping, the bag house, and the containment system, soil samples will be collected and analyzed for ~~hazardous~~ RCRA characteristic properties and the constituents defined in Section 8.1 paragraph 2 of this permit application. ~~constituents that may have been present in the stored wastes to determine if any contamination occurred from releases.~~ Individual samples will be collected at locations specified by NMED at closure and at a frequency ~~equivalent to~~ of one sample per ~~400~~2,000 square feet in the entire stabilization unit area (i.e. one sample to be taken at the center of each 2,000 square foot grid). ~~Ten such individual samples will be combined to create a single composite sample for analysis. This will result in a testing frequency of one composite sample per 4,000 square feet.~~ Sample results will be compared against the closure performance standard presented in Section 8.3.

8.1.5 Roll-off Storage Area

Closure of the roll-off storage area will be identical to closure of the drum handling unit, except that the roll-off storage area does not have a structure associated with it. The major steps of inventory removal, equipment decontamination, primary and secondary containment removal, and soil sampling will be identical to those described for the drum handling unit in Section 8.1. Details of the sampling and analysis program will be specified in a sampling and analysis plan providing information similar to that to be developed for the drum handling unit (see Sections 8.1.1.2, 8.1.1.3 and 8.1.1.4). Sample results will be compared against the closure performance standard presented in Section 8.3.

Estimated waste volumes for closure of the roll-off storage area are included in Table 8-1.

8.1.6 Landfill

This Part B Permit Application only includes the Phase IA~~A~~ portion of the landfill. Therefore, this Closure Plan only addresses Phase IA~~A~~. If future expansions are required, they will be addressed in future permit modifications and will include revised closure plans.

At closure of the landfill, a final cover will be constructed with a permeability that is less than or equal to the permeability of the bottom liner. The final cover will consist of a three-layer cap design consisting of a vegetative cover, a geocomposite drainage layer, and a geomembrane and GCL barrier layer over a prepared subgrade, as described in Section 3.1.5~~0~~ of Volume III. The final cover will meet the following requirements:

- the vegetative cover will have a minimum thickness of 2.5 feet and final upper slopes of between 3 and 5 percent after settlement and subsidence of the waste. Native grasses will be planted;

- the drainage layer will have a transmissivity of greater than or equal to 2.2 x 10^{-4} meters squared per second and consist of a HDPE geonet sandwiched between two geotextile layers (generally referred to as a geocomposite) and will be designed to allow lateral flow and discharge of liquids;

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- the bottom layer will consist of an 60 mil. HDPE geomembrane layer and GCL with permeability of less than or equal to 5 x 10^{-9} centimeters per second underlain by 6 inches of prepared subgrade and 1.5 feet of protective soil; and,

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- the cover will be designed to function with minimum maintenance, including minimal erosion. The vegetative cover will be designed with a surface drainage system capable of conducting run-off across the cap without forming rills and gullies.

In addition, remaining water and sediments in the contaminated water basin (as shown in Drawing 10~~, page 1 of 1~~) will be removed, tested and disposed of appropriately. Then, the contaminated water basin will be f~~F~~illed with soil and the cover will be constructed across this area. This will ensure that all lined areas of the landfill will be covered.

Prior to closure of the landfill, an assessment will be made of the landfill waste gas generating potential. This will be made from the quarterly landfill gas monitoring data that will be collected over the life of the landfill. Following closure, if it is concluded that gas generation may result in gas build-ups beneath the barrier layer of the cover or releases that exceed regulatory air quality standards, then provisions will be made to collect and monitor gas generation and release during the post-closure period. If this occurs, the best available ~~latest~~ technology available will be implemented into the construction of the cover system. In this case, the NM~~R~~ED secretary will be informed and shall approve a monitoring plan and any changes in the construction of the cover system.

Any leachate from the landfill will be pumped from the primary and secondary collection systems and, if detected, from the vadose zone monitoring sumps throughout the closure period and will continue throughout post-closure care. The leachate will be collected, sampled, and managed as hazardous waste, as appropriate. The leachate will be collected at a frequency appropriate to the rate at which it collects in the sump. As indicated in Table 8-2, the collection sump will be inspected monthly until the sump remains dry for six months. Thereafter, the sump will be inspected semi-annually. Details of the leachate sampling and analysis program will be specified in a sampling and analysis plan.

After the landfill cap is completed, soil samples will be collected from outside the perimeter of the landfill cap to determine if any soil contamination is present. The sampling locations will primarily correspond to the transportation corridor used by waste hauling trucks during the active life of the landfill. In addition, samples will be collected at the landfill stormwater retention basin and within ditches directing flow to the basin.

It is proposed that ~~16~~ individual samples be obtained along the haul roads at 100 foot intervals and at locations where visible staining is observed. ~~and that they be combined into 4 composite samples for testing.~~ Because the stormwater ~~runoff~~detention basin (Drawing 25) is lined with geomembrane, individual samples will be collected from there and it's associated drainage ditches at a frequency equivalent to one per 40,000 square feet over the entire area (i.e. one sample to be taken at the center of each 40,000 square foot grid). However, if the liner in the stormwater runoff basin is observed to be damaged, additional sampling may be required. –Sample results will be compared against the closure performance standards presented in Section 8.3. If any contaminated materials are identified they will be excavated and removed to the landfill prior to placement of the final cover.

~~Due to the large area and low risk of contamination in the stormwater runoff basin and associated drainage ditches, it is proposed that the subgrade sampling be limited to 1 per 40,000 square feet. This will result in a total of approximately 8 samples for testing.~~

No later than the submission of the certification of closure of the landfill in compliance with 40 CFR §264.115, the Facility will submit to the local zoning authority and to the NMED, a survey plat indicating the location and dimensions of the landfill with respect to permanently surveyed benchmarks in compliance with 40 CFR §264.116. This plat will be prepared and certified by a professional land surveyor. The survey plat will contain a prominent note that asserts the Facility's obligation to restrict disturbance of the hazardous waste disposal unit. The Facility will also record a notation on the deed to the Facility property in compliance with 40 CFR §264.119(b)(1), to notify any potential purchasers of the property that (1) the land has been used to manage hazardous wastes; (2) use of the land is restricted to activities that will not disturb integrity of the final cover system or monitoring system during the post-closure care period; and (3) the survey plat and record of waste disposal have been submitted to the local zoning authority and to the NMED.

A record of the type, location, and quantity of hazardous wastes disposed of within the disposal unit will be submitted to the local zoning authority and to the NMED no later than 60 days after certification of closure of the landfill in compliance with 40 CFR §264.119(a).

The vadose zone monitoring wells will be sampled and analyzed in accordance with the procedures that are presented in Section 3 of the permit application. The frequency of sampling and parameters to be tested are outlined in Section 3.

8.1.7 CLOSURE OF NON-WASTE MANAGEMENT UNITS

Other areas within the facility boundary which have the potential to become Solid Waste Mangement Units during the operational life of the facility will be closed in accordance with the requirements of the closure sampling and analysis plan. Those units having structures or liners, such as the truck wash and the storm water ~~retention pond~~collection basin (Drawing 10) will be sampled to verify the absence of contamination prior to removal. If the structures or liners show ~~to be~~ contaminated they will be managed in accordance with the requirements of this closure plan. If contamination is not present they will be disposed of as solid waste.

After removal of the structures, other appurtenances, and liner the areas will be contoured and revegetated as necessary.

8.2 POST-CLOSURE ACTIVITIES

Post-closure care involves long-term maintenance, monitoring, and reporting of activities that are carried out after closure is completed. Post-closure care is ~~only~~ anticipated to be needed only for the landfill after closure. However, if clean closure cannot be certified for any unit components or secondary containment areas associated with the drum handling unit, liquid waste storage area, stabilization unit, evaporation pond, or roll-off storage area, then those closure activities that have been completed will be certified and a permit modification request will be submitted to NMED to include post-closure activities for those portions of the units that do not meet the closure performance standard.

The post-closure care period for the landfill will begin after completion of closure activities and continue for an anticipated 30 years. Inspection, maintenance, and repair activities to be conducted during post-closure are described in the following sections. The schedule for performing inspections is shown in Table 8-2, Post-Closure Inspection Schedule.

8.2.1 Security Systems

As shown in Facility Drawing Number 4, the Facility perimeter fence encloses the entire 480-acres of the Facility. The fence and warning signs mounted on the fence will be inspected and maintained throughout the post-closure period. Monthly inspections will include checking the condition of fencing, locks, gates, and warning signs. Any signs of unauthorized entry will be reported to the local sheriff's office and NMED. Routine maintenance will be performed based on inspection findings to repair or replace damaged or deteriorating items.

TABLE 8-2
POST-CLOSURE INSPECTION SCHEDULE

INSPECTION ITEM – PROBLEM OR PROBLEM AREA	INSPECTION TIME
Facility	
Fence	monthly ~~quarterly~~
Locks and gates	monthly ~~quarterly~~
Warning signs	monthly~~quarterly~~
Landfill Cover	
Cracking, subsidence, ponding water, erosion, Burrowing animals, deep-rooted vegetation	quarterly
Perimeter Diversion Ditch	
Sediment and debris accumulation,	quarterly
Leachate Collection System	
Sump	quarterly until the sump remains dry for 6 months, then semi-annually
Pumps	quarterly
Riser pipes, grout seals, other visible portions of the system	quarterly
Leak Detection System	quarterly until the sump remains dry for 6 months, then semi-annually
Vadose Zone Monitoring System	quarterly

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8.2.2 Landfill Final Cover

The integrity and effectiveness of the landfill final cover will be maintained, including making necessary repairs to correct the effects of settling, erosion, water damage, animal damage, or other events. The landfill cover will be inspected quarterly. Inspections will include checking for signs of cracking, subsidence, ponding water, erosion, burrowing animals, or deep-rooted vegetation. Repairs will be scheduled in a timely manner upon noting deficiencies in order to ensure that the final cover maintains its effectiveness.

General maintenance will include the following activities:

- fertilizing the vegetation periodically;
- re-establishing damaged or sparse vegetative cover, including seeding and fertilizing;
- conducting erosion damage repair, including soil excavation, transport and placement, seeding and fertilizing;

- regrading as needed to overcome the effects of subsidence or to repair areas where ponding is occurring; and,

- providing rodent control as needed, including trapping and relocating animals and repairing damage caused by burrowing.

Soil for erosion repair and regrading will be excavated from unused areas onsite and transported to the cap area for use in maintenance activities.

8.2.3 Perimeter Diversion Ditch

The perimeter diversion ditch (as shown on Drawings 22 and 25) will be inspected and maintained throughout the post-closure period to ensure its designed functions to divert precipitation and run-on from the landfill area are met. Inspections will be conducted quarterly and will include checking for accumulated sediments and debris, and signs of erosion. Repairs will be scheduled in a timely manner, upon deficiencies being noted, to ensure that the diversion ditch maintains its effectiveness.

General maintenance activities will include diversion ditch cleaning to remove accumulated sediments and debris, and regrading, as needed, to repair the effects of erosion.

8.2.4 Leachate Management System

8.2.4.1 Leachate Collection System

The leachate collection ~~and removal~~ system will be operated when necessary to ensure leachate depth over the liner does not exceed 30 cm (1 foot) until the completion of post-closure care.~~leachate is no longer detected.~~ Leachate pumps will ~~initially~~ be operated at least quarterly. The site log will be kept on-site or at a location approved by the Secretary. The volume of leachate pumped will be recorded in a site log. After records indicate that the sump has remained dry for six months, the frequency of inspection and operation of the sump pumps will be changed to semi-annually. Any leachate collected will be pumped to an above-ground storage tank.

The leachate collection system will be inspected quarterly or semi-annually as described in the preceding paragraph. Pumps will be inspected for proper operation. The riser pipes, grout seals, and other visible above-ground portions of the system will be inspected for integrity. The level of liquid in the sumps will be measured prior to pumping out accumulated leachate.

Routine maintenance will be conducted to ensure that the leachate collection system remains operable. Locking caps and standpipe grouting will be repaired or replaced as necessary. Accumulated sediments or sand in the standpipes will be removed as necessary to enable the system to function properly. Based on the amount of leachate collected over time, a determination will be made about the integrity of the collection system. If a system is suspected of being clogged, an assessment by a New Mexico registered professional engineer will be made. All repairs will be made according to the New Mexico registered professional engineer's assessment and upon approval by NMED.

8.2.4.2 Management of Leachate

During the post-closure care period, leachate pumped from the collection system will be temporarily stored in an above-ground tank. The leachate will be sampled and managed at an off-site facility as hazardous waste, as appropriate. Details of the leachate sampling and analysis program will be specified in a sampling and analysis plan.

8.2.4.3 Leak Detection System

During the post-closure care period, the leak detection system beneath the landfill primary liner will initially be monitored and inspected quarterly to ensure that it is operating correctly and that any leachate that has migrated through the primary liner is collected and removed. As with the primary leachate system, the volume of leachate pumped from the secondary leak detection system will be recorded in a site log. After records indicate that the sump has remained dry for six months, the frequency of inspection and operation of the leak detection system will be changed to semi-annually.

Inspections and maintenance will be ~~similar~~equivalent to those described for the leachate collection system (see Section 8.2.4.1).

8.2.5 Vadose Zone Monitoring System

The vadose zone monitoring system will be maintained and monitored throughout the post-closure care period. The following sections outline the post-closure monitoring plan for this system. The vadose zone monitoring system is described in Section 3 and consists of vadose zone sump in the landfill and vadose zone wells along the eastside of the facility.

8.2.5.1 Sampling and Analysis

Vadose zone monitoring ~~systems~~ will be conducted ~~quarterly~~ semi-annually to test for the presence of contaminants in the unsaturated sediments hosting the landfill. Sampling procedures and analytical parameters will be defined according to the Vadose Zone Monitoring System Work Plan (Volume II, Appendix N) and will follow the same guidelines used during the active life of the Facility.

8.2.5.2 Inspection and Maintenance

The visible above-ground portions of the vadose zone monitoring system will be inspected ~~quarterly~~semi-annually for integrity. Routine maintenance will be conducted to ensure that the vadose zone monitoring system remains in operable condition. System equipment will be repaired or replaced as necessary.

8.2.6 Recordkeeping

A post-closure Facility record will be maintained. This record will include the dates and times of inspections, inspection findings, name of inspector, volumes of leachate pumped, disposition of leachate, sampling results of leachate and vadose zone samples, and dates and nature of any corrective actions taken.

8.2.7 Certification of Post-Closure

Within 60 days after completion of the established post-closure care period for the Facility, the permittee will submit to NMED a certification that the post-closure operations were performed in accordance with the approved post-closure plan in compliance with 40 CFR §264.120. The certification will be signed by the permittee and an independent New Mexico registered professional engineer.

8.2.8 Amendment of Plan

The permittee will submit a permit modification request for changes to the post-closure plan if changes in operating plans or Facility design, or events that occur during the active life of the Facility, affect the approved post-closure plan. The owner or operator may also request a modification to the post-closure plan at any time during the active life of the Facility or during the post-closure care period. Permit modification requests will be submitted at least 60 days prior to a proposed change in Facility design, or no later than 60 days after an unexpected event which affects the post-closure plan.

If clean closure cannot be certified for any unit components or secondary containment areas associated with the drum handling unit, tank storage area, stabilization unit, evaporation pond, or roll-off storage area, then ~~a~~the post-closure care permit will be amended to include those ~~application for those~~ portions of the units that do not meet the closure performance standard. The post-closure care plan amendments will be submitted to NMED no later than 90 days after the owner or operator determines that the hazardous waste management unit must be closed as a landfill.

8.2.9 Facility Post-Closure Contact

During the post-closure care period, the Facility contact organization will be the following:

Gandy Marley, Inc.
1109 East Broadway
Tatum, New Mexico 88267
(505) 398-4960

8.3 CLOSURE PERFORMANCE STANDARD

The RCRA closure performance standard (40 CFR 264.111) specifies that hazardous waste facilities are to be closed in such a way as to minimize the need for further maintenance at the Facility and protect human health and the environment by controlling, minimizing, or eliminating potential releases of hazardous waste to the environment. The Facility will adopt a clean-closure performance standard and ~~Any hazardous constituent left at a unit~~ will not impact any environmental media in excess of agency-established exposure levels ~~and that direct contact will not~~ or pose a threat to human health or the environment.

The Facility-specific clean-closure performance standard for the drum handling unit, roll-off storage area, tank storage area, stabilization unit, and evaporation pond is based on sampling soil from beneath the units. The landfill will not be clean-closed; therefore, the Facility-specific, clean-closure performance standard is not applicable.

Indicator parameters will be selected and approved by NMED for each unit at closure. These parameters will be representative of the wastes stored and/or treated in that unit during its operating life. The waste information used to make these selections will be based upon the Facility operating record. For soil, analytical results that show that these concentrations of contaminants of concern are within a statistically significant range relative to clean background soil as determined by NMED ~~selected constituents are within three standard deviations of the mean constituent concentration in clean background soil~~ will constitute demonstration of clean closure. ~~Clean background soil samples will be collected from the surrounding area outside the Facility fence line.~~Clean background samples will be obtained from the alluvium unit and from the Upper and Lower Dockum units from each of the vadose zone monitoring well borings for a total of six background samples per stratigraphic unit. If the alluvium is not present at a specific vadose zone monitoring well boring location, a surface sample from the southern portion of the site shall be substituted for the sample. Each sample will be submitted to analytical laboratory for chemical analysis of priority pollutant metals using EPA SW-846 analytical methods or equivalent methods approved by NMED.

8.4 CLOSURE SCHEDULE

Closure of all units at the Facility will be initiated when the landfill nears its final capacity because the other units exist only to support landfill disposal activities. In other words, the drum handling unit, roll-off storage area, liquid waste receiving and storage unit, stabilization unit, and evaporation pond will not continue to operate after the landfill has reached capacity and is no longer in use. Closure is expected to begin when the landfill is nearing final capacity, allowing enough capacity in the landfill to dispose of all solid wastes generated on site during closure activities. Expected waste volumes that will be generated during closure are shown in Table 8-1.

At the time of final Facility closure, the drum-handling unit will be closed first, as wastes from this area may need to be processed through the stabilization unit prior to disposal onsite. Concurrent with the closure of the drum-handling unit, the evaporation pond closure will begin because sludge from the pond must also be treated in the stabilization unit. After closure of the evaporation pond begins, the leachate from the landfill will be collected in tanks and shipped off site for proper disposal at a permitted facility. Following closure of the drum-handling unit and during evaporation of the liquid in the ponds, the liquid waste receiving and storage unit will be closed. After the pond sludge has been removed and treated, the stabilization unit will be closed, and last the roll-off storage area will be closed. The landfill cover will be constructed when all closure wastes have been placed in the landfill.

Notification will be provided to the NMED in writing at least 60 days prior to beginning closure of a hazardous waste management unit or of the entire Facility. Closure of the drum handling unit, liquid waste receiving and storage unit, stabilization unit, and roll-off storage area will proceed sequentially, and each closure will be completed within 180 days.

The closure regulations allow a period of 180 days from receipt of the final volume of waste at each unit for closure activities to begin, [per 40 CFR Section 264.113(b)(1)] ~~unless "...final closure activities will, of necessity, take longer than 180 days to complete."~~ The closure period can be extended with approval from NMED and if the owner or operator complies with 40 CFR §264.113(d).

8.5 CERTIFICATION OF CLOSURE

Within 60 days of completion of closure of each unit, and within 60 days of completion of final Facility closure, the Facility will submit to NMED, a certification that each ~~the~~ hazardous waste management unit has been closed in accordance with the approved closure plan in compliance with 40 CFR §264.115. The closure certification for each unit will be signed by the owner/operator and by an independent New Mexico registered professional engineer. Post-closure will also be certified at the end of the 30-year post-closure care period in compliance with 40 §CFR 264.120.

8.6 MODIFICATIONS TO THE CLOSURE PLAN

After this closure plan is approved, it will be amended whenever it is affected by changes in operating plans or Facility design. While conducting partial or final closure activities, unexpected events may be identified that also require amendment of the approved closure plan. Requests for modification will be made within 30 days of identifying an event that justifies plan modification.

8.7 CLOSURE COST ESTIMATES

The closure costs are described in the following sections.

8.7.1 Closure Costs

Table 8-~~1~~ 3 summarizes the closure cost estimates for the drum handling unit, roll-off storage area, liquid waste receiving and storage unit, stabilization unit, evaporation pond, and landfill closure. These estimates are based on ~~1999~~2000 dollars and will be updated annually as required in 40 CFR Part 264.142(b).

These estimates are based on costs for closure when each unit is at maximum capacity, which is the point in the Facility's active life when the extent and manner of its operation would make closure the most expensive. As required in 40 CFR Part 264.142(a)(2), cost estimates are based on the costs of hiring a third party to close the Facility. ~~In reality it is expected that Facility personnel will perform many closure tasks.~~ Costs for onsite disposal are used in this cost estimate because Facility closure will be scheduled when sufficient landfill capacity remains to handle closure wastes. The maximum volume of waste that the Facility is projected to generate through closure activities is ~~also~~ shown in Table 8-1.

TABLE 8-3 SITE CLOSURE COST ESTIMATE	Cost ($)
DRUM HANDLING UNIT	
Stabilization and Disposal of Remaining Drum Waste Inventory	$36,071
Decontamination of Equipment and Buildings	$7,200
Stabilization and Disposal of Decontamination Water	$14,630
Chemical Testing of Decontamination Water	$2,040
Dismantling and Moving Structure and Equipment	$22,196
Dismantling and Disposal of Concrete Floor and Secondary Containment	$123,310
Soil Sampling and Chemical Analysis	$138,720
Excavation of Contaminated Soils	$7,307
Disposal of Contaminated Soil	$0
Earth Backfill for Excavated Contaminated Soils	$1,827
Revegetation	$22,876
Certification of Closure Inspection	$3,000
Certification of Closure Report	$15,000
Subtotal	$394,176
EVAPORATION POND UNIT	
Stabilization and Disposal of Remaining Liquid Waste Inventory	$342,954
Decontamination of Equipment	$240
Stabilization and Disposal of Decontamination Water	$7,315
Chemical Testing of Decontamination Water	$2,040
Removal and Disposal of Liner and Leachate Collection System	$88,144
Soil Sampling and Chemical Analysis	$128,520
Excavation of Contaminated Soils	$13,664
Disposal of Contaminated Soil	$0
Earth Backfill for Excavated Contaminated Soils	$3,416
Revegetation	$23,520
Certification of Closure Inspection	$3,000
Certification of Closure Report	$15,000
Subtotal	$627,813
LIQUID WASTE RECEIVING AND STORAGE UNIT	
Stabilization and Disposal of Remaining Waste Inventory	$105,336
Decontamination of Equipment and Buildings	$2,400
Chemical Testing of Decontamination Water	$2,040
Stabilization and Disposal of Decontamination Water	$14,630
Removal and Disposal of Tanks and Concrete Pad	$14,605
Soil Sampling and Chemical Analysis	$61,200
Excavation of Contaminated Soils	$436
Disposal of Contaminated Soil	$0
Earth Backfill for Excavated Contaminated Soils	$109
Revegetation	$731
Certification of Closure Inspection	$3,000
Certification of Closure Report	$15,000
Subtotal	$219,487
STABILIZATION UNIT	

TABLE 8-3 SITE CLOSURE COST ESTIMATE	Cost ($)
Stabilization and Disposal of Remaining Waste Inventory	$21,024
Decontamination of Equipment and Buildings	$4,560
Chemical Testing of Decontamination Water	$2,040
Stabilization and Disposal of Decontamination Water	$14,630
Dismantling and Salvaging Tanks, Ancillary Equipment, and Building	$23,222
STABILIZATION UNIT (Continued)	
Removal and Disposal of Equipment and Concrete Pad	$34,590
Soil Sampling and Chemical Analysis	$32,640
Excavation of Contaminated Soils	$2,150
Disposal of Contaminated Soil	$0
Earth Backfill for Excavated Contaminated Soils	$538
Revegetation	$6,119
Certification of Closure Inspection	$3,000
Certification of Closure Report	$15,000
Subtotal	$159,514
ROLL-OFF STORAGE AREA UNIT	
Stabilization and Disposal of Remaining Waste Inventory	$832,550
Decontamination of Equipment	$0
Chemical Testing of Decontamination Water	$0
Stabilization and Disposal of Decontamination Water	$0
Demolition and Disposal of Liner System	$80,960
Soil Sampling and Chemical Analysis	$144,840
Excavation of Contaminated Soils	$20,240
Disposal of Contaminated Soil	$0
Earth Backfill for Excavated Contaminated Soils	$5,060
Revegetation	$38,507
Certification of Closure Inspection	$3,000
Certification of Closure Report	$15,000
Subtotal	$1,140,158
TRUCK WASH UNIT	
Stabilization and Disposal of Remaining Waste Inventory	$5,270
Chemical Testing of Decontamination Water	$2,040
Decontamination of Equipment	$0
Stabilization and Disposal of Decontamination Water	$0
Demolition and Disposal of Tanks, Concrete and Liner System	$12,321
Soil Sampling and Chemical Analysis	$16,320
Excavation of Contaminated Soils	$713
Disposal of Contaminated Soil	$0
Earth Backfill for Excavated Contaminated Soils	$178
Revegetation	$1,592
Certification of Closure Inspection	$3,000
Certification of Closure Report	$5,000
Subtotal	$46,435
LANDFILL UNIT	
Landfill Closure	
Landfill Excavation Backfill	$4,120,000
Landfill Cover	$2,372,508
Demolition and Disposal of Tanks, Concrete and Liner System	$2,426
Leachate Treatment Facility Construction	$0
Leachate Treatment Facility Operations	$0
Leachate pumping and treatment	$79,826
Sump Vadose Zone Sampling and Analysis	$8,000
Well Vadose Zone Monitoring System Sampling and Analysis	$40,000
Soil Sampling and Analysis	$104,040
Final Plat Survey	$2,400
Certification of Closure Inspection	$3,000
Certification of Closure Report	$15,000
Subtotal	$6,747,200
Total Closure Cost (all units)	**$9,288,347**

8.7.2 Post-Closure Costs

Table 8-~~3~~4, Landfill Post-Closure Cost Estimate, summarizes the post-closure cost estimate for the landfill. The costs include 30 years of monitoring and maintenance activities, as described in Section 8.2. These estimates are based on ~~1999~~2000 dollars and will be updated annually as required in 40 CFR Part 264.144(b).

TABLE 8-4
LANDFILL POST-CLOSURE COST ESTIMATE

Facility Inspection	$201,600
Routine Landfill Cover Maintenance and Repair	$600,000
Severe Landfill Cover Erosion Damage Repair	$300,000
Perimeter Diversion Ditch Maintenance and Repair	$300,000
Leachate Pumping and Treatment	$239,476
Leachate Collection System Maintenance	$67,200
Well and Sump Vadose Zone Maintenance	$67,200
Sump Vadose Zone Sampling and Analysis	$240,000
Vadose Zone Monitoring Wells Sampling and Analysis	$1,440,000
Notation of Property Deed	$2,500
Certification of Post-Closure Inspection	$3,000
Certification of Post-Closure Report	$150,000
Subtotal	$3,610,976
Total Closure Cost + Post-Closure Costs	$12,899,323

8.8 FINANCIAL ASSURANCE

The treatment, storage and disposal facility standards found in 40 CFR 264 require facilities to establish and maintain financial assurance for three areas prior to operation. 40 CFR 264.143 defines the standards for financial assurance for closure, 40 CFR 264.145 defines the standards for post-closure care, and 40 CFR 264.147 defines the liability requirements for coverage of accidental occurrences. The financial instruments selected to provide coverage for these three requirements must be implemented and submitted to the NMED at least 60 days prior to the initial receipt of waste.

8.8.1 Financial Assurance for Closure

Upon receipt of the final permit for the Facility, GMI will evaluate and select one of the financial instruments defined in 40 CFR 264.143 to provide financial assurance for the closure of the Facility. Selection of one of the following six financial instruments will consider the effectiveness and economics of the particular options. The instruments defined in the regulations are:

1. Financial test and corporate guarantee for closure
2. Closure trust fund
3. Surety bond guaranteeing payment into a closure trust fund
4. Surety bond guaranteeing performance of closure
5. Closure letter of credit
6. Closure insurance

The appropriate instrument will be selected, implemented, and submitted a minimum of 60 days prior to the initial receipt of waste as required by the regulations defined in this subpart.

8.8.2 Financial Assurance for Post-Closure Care

Similar to the financial assurance requirements for closure activities, the Facility is required to provide assurances for the post-closure care of the Facility. Upon receipt of the final permit, and 60 days prior to the initial receipt of waste, the owner/operators will provide the appropriate financial instrument to fulfill this requirement. Selection of the instrument to be used will be based upon economic and performance considerations. The financial instruments allowed by this subpart of the regulations are listed in Section 8.8.1.

8.8.3 Liability Requirements

As stated in 40 CFR 264.147, an owner or operator of a hazardous waste treatment, storage, or disposal facility must demonstrate financial responsibility for bodily injury and property damage to third parties caused by sudden accidental occurrences which arise from the operation of the facility. This section of the regulations requires that the owner/operator of such a facility provide the administrator one of the following instruments at least 60 days prior to the initial receipt of waste;

1. Liability insurance
2. Financial test
3. Letter of credit
4. Surety bond
5. Trust fund
6. Combination of the above

GMI will submit required documentation demonstrating financial assurance to meet the liability requirements at least 60 days prior to receiving the first hazardous waste at the Facility. The financial assurance mechanism will comply with requirements in 40 CFR Part 264.147.

7.0 PERSONNEL TRAINING

The personnel training program for the Facility will be developed in accordance with 40 CFR 264.16 as adopted by the State of New Mexico in the New Mexico Hazardous Waste Management Regulations, Part V. This plan documents training procedures to be used by the Facility for all new employees and refresher training for experienced workers to ensure that all employees perform their work in full compliance with 40 CFR 264.16.

As illustrated in Figure 7-1, personnel will be divided into three categories for the purposes of the RCRA training: Facility personnel, visitors, and off site emergency response personnel. Facility personnel will be further categorized based on whether or not they will handle hazardous waste. Personnel will receive training appropriate to their specific job responsibilities. All Facility personnel will be required to complete classroom training within six months of employment and annually according to the requirements of the CFR 264.16. Employees who will handle hazardous waste and supervisors of employees who will handle hazardous waste will be required to complete on-the-job training (OJT) and OSHA 40-hour training and annual refreshers. Employees assigned to the Facility will not be allowed to work without direct supervision until completing the training program relevant to the positions in which they are employed. New personnel will be required to complete their training program as soon as practicable, but no later than six months, following their effective date of employment at the Facility.

Section 7.1 describes job titles, qualifications, and duties; Section 7.2 describes training content and frequency; and Section 7.3 describes record keeping procedures.

7.1 JOB TITLES AND DUTIES

To facilitate safe and effective Facility operation, the training program is designed to provide training commensurate with job responsibilities. A list of qualifications, duties, and special training required for appropriate personnel will be developed and maintained onsite prior to commencement of operations. This section includes a description of the qualifications and responsibilities of the RCRA training officer, the EC, waste handlers, the site security officer, laboratory specialists, and maintenance personnel. Although other categories of personnel may work at the site, these six categories include key personnel with respect to ensuring safety and compliance and therefore are included in this section. It is important to note that one person may fulfill the responsibilities of more than one of the job categories outlined below.

7.1.1 RCRA Training Officer

The RCRA training officer will be responsible for developing and implementing a RCRA training program that is in compliance with 40 CFR 264.16, Personnel Training.

The RCRA training officer will possess the following qualifications:

- a four-year science or engineering degree or sufficient experience in hazardous waste management to oversee the training program;
- working knowledge of the New Mexico Hazardous Waste Act and the New Mexico Hazardous Waste Management Regulations;
- knowledge of site-specific hazardous waste management procedures;

- a thorough understanding of the purpose of the Contingency Plan and emergency procedures and the ability to implement them; and,

- 40-hour OSHA and annual refresher training.

The RCRA training officer will have the following responsibilities:

- developing and implementing the RCRA training program, including classroom training development and revision;

- establishing course curricula;

- conducting training;

- maintaining and updating, as needed, a list of all employees requiring training; this list will provide a personalized training history for each employee, which includes job title, training schedule, course attendance, and test results;

- reviewing any new job classifications to determine if on-the-job-training (OJT) is required (supervisors may also request that employees receive OJT);

- scheduling training;

- ensuring that all personnel with RCRA responsibilities are trained as soon as practicable following the effective date in a position and are annually updated; and,

- conducting an annual review to determine which personnel require OJT.

7.1.2 Emergency Coordinator

The EC will coordinate all emergency response activities and will have the authority to commit the resources necessary to implement the Contingency Plan contained in Section 6.0. The Facility will appoint a primary EC as well as secondary ECs to ensure that someone is always available to serve as the EC. The secondary ECs must meet the same qualifications and responsibilities, outlined below, as the primary coordinator.

The EC will possess the following qualifications:

- a four-year science or engineering degree or sufficient experience in hazardous waste management and emergency response to coordinate all aspects of emergency response;

- working knowledge of the New Mexico Hazardous Waste Act and the New Mexico Hazardous Waste Regulations;

- familiarity with all aspects of the Contingency Plan and emergency procedures, all operations and activities at the Facility, the location and characteristics of waste handled, the location of records within the Facility, and the Facility layout prior to acting as EC; and,

- 40-hour OSHA training, annual refreshers, and OSHA supervisor training.

The EC will have the following responsibilities:

- either being on the Facility premises or being available to respond to an emergency by reaching the Facility within a short period of time;
- notifying all appropriate Facility personnel upon awareness of an emergency situation;
- notifying all appropriate state or local agencies with designated response roles;
- identifying the character, exact source, amount, and extent of any released materials;
- assessing possible hazards to human health and the environment that may result from a release, fire, or explosion;
- notifying local authorities if a release, fire, or explosion has occurred that could threaten human health or the environment;
- notifying the National Response Center if a release, fire, or explosion occurs that could threaten human health or the environment;
- taking all reasonable measures during an emergency to ensure that fires, explosions, and releases do not occur, recur, or spread to other hazardous waste at the Facility;
- if appropriate, when the Facility ceases operations in response to a release, fire, or explosion, monitoring for leaks, pressure build-up, gas generation, or ruptures in equipment;
- providing for the treating, storing, or disposing of recovered waste, contaminated soil or surface water, or any other material that results from a release, fire, or explosion at the Facility;
- ensuring that no waste that may be incompatible with the released material is treated, stored, or disposed until cleanup procedures are completed and that emergency equipment is cleaned and fit for its intended use prior to resumption of operations;
- notifying NMED and appropriate local authorities before operations are resumed;
- noting in the operating record the time, date, and details of any incident that requires implementing the Contingency Plan; and,
- submitting a written report to the NMED within 15 days of implementing the Contingency Plan.

7.1.3 Waste Handlers

Waste handlers will perform sampling, screening, unloading, transfer, storage, and loading of material.

The waste handlers will possess the following qualifications:

- high school diploma or equivalent; and,
- two years of experience in hazardous waste operations.

The waste handlers will have the following responsibilities:

- verifying waste received;
- testing emergency equipment;
- inspecting Facility and emergency equipment;
- managing containers in such a way as to prevent leaks, spills, and ruptures;
- inspecting container storage areas, tanks, the evaporation pond, and the landfill;
- inspecting roll-off containers and drums for cracks or holes.
- repair of defects on roll-off containers and drums.
- inspection of non-regulated but potential SWMU units;
- maintaining run-off management system, control wind dispersal, and ensure compliance with other operational requirements specific to the RCRA permit;
- assisting in maintaining the operating record; and,
- preparing biennial reports, unmanifested waste reports, and other reports as necessary.

7.1.4 Site Security Officers

The site security officers will control access to the Facility, ensure site security, and possess high school diplomas or equivalent.

The site security officers will have the following responsibilities:

- controlling entry, at all times, through gates or other entrances to the active portion of the Facility;
- ensuring site security;
- inspecting the perimeter fence to prevent unknowing entry and prevent the unauthorized entry of persons or livestock onto the active portion of the Facility; and,
- initially locating and then maintaining warning signs that indicate "Danger - Unauthorized Personnel Keep Out" in both English and Spanish, which will be posted on the perimeter fence and will be legible from a distance of 25 feet.

7.1.5 Laboratory Specialist

The laboratory specialist will help to assure that wastes received at the Facility are consistent with waste profiles supplied by generators.

The laboratory specialist will possess the following qualifications:

- a four-year science degree or sufficient experience to adequately perform acceptance testing;
- working knowledge of the New Mexico Hazardous Waste Act and the New Mexico Hazardous Waste Regulations; and,
- familiarity with the Waste Analysis Plan and waste analysis practices and procedures.

The laboratory specialist will have the following responsibilities:

- developing sampling, characterization, and testing procedures for waste received and generated at the Facility;
- directing or performing sampling, characterization, and testing for the Facility;
- determining if waste is acceptable for treatment, storage, and disposal according to waste profile information submitted by the generator;
- determining if the initial and annual full chemical analysis and fingerprint ~~testing~~analysis confirm~~s~~ generator information provided on the waste profile and manifest; and,
- implementing the laboratory QA/QC program.

7.1.6 Maintenance Personnel

Maintenance personnel will maintain all equipment, buildings, ~~and~~ roads and ditches.

Maintenance personnel will possess the following qualifications:

- high school diploma or equivalent; and,
- two years experience in an industrial setting.

Maintenance personnel will have the following responsibilities:

- developing maintenance procedures; and,
- performing maintenance-type activities, including repairs, preventive maintenance, and corrective actions associated with RCRA inspections.

7.2 TRAINING CONTENT AND FREQUENCY

Section 7.2.1 describes the training program for Facility personnel, Section 7.2.2 describes training for visitors, and Section 7.2.3 describes training for off site emergency response organizations.

7.2.1 Training Program for Facility Personnel

All new employees will be required to successfully complete the training program related to their position. Training programs will include RCRA classroom training, OJT, OSHA 40-hour training, and annual refresher training for all three programs. The OJT and OSHA 40-hour training sessions will be required only for those personnel who will handle hazardous waste and the supervisors of personnel who will handle hazardous waste. Employees will not be permitted to assume unsupervised job duties until successful completion of all the required elements of their training program. As soon as practicable following a new employee's hire date, successful completion of the training program specific to his or her position must be accomplished, and certification of the completion will be recorded and kept on file by the RCRA training officer.

7.2.1.1 Classroom Training

The initial classroom training will consist of at least one 8-hour session. Annual refresher training will consist of at least one 4-hour session. The outline of the annual refresher is the same as the outline for the initial classroom training; however, the refresher training will be an abbreviated version of the initial training at an accelerated pace. The RCRA classroom training will include the following goals:

- developing a basic understanding of the regulatory requirements for a treatment, storage, and disposal facility;
- promoting understanding of policies and procedures necessary to protect human health and the environment;
- ensuring proper management of hazardous waste; and,
- educating employees regarding response to emergencies.

The outline for the RCRA training class will consist of the following elements:

- an introduction to RCRA, including a general description of RCRA and Hazardous and Solid Waste Amendments (HSWA); the definition of hazardous waste; waste generator requirements; treatment, storage, and disposal requirements; and labeling, inspection, record keeping, and reporting requirements;
- requirements associated with the RCRA permit for the Facility;
- Facility-specific waste management, including general procedures for receipt and handling of waste from off site as well as management of waste generated onsite;
- decontamination procedures;

- emergency procedures, including response to fires, explosions, and releases, and shutdown of operations;
- emergency equipment location and use;
- emergency systems- such as- the- communication and alarm systems and the fire suppression system;
- Contingency Plan;
- evacuation plan;
- waste minimization;
- occupational health and safety, including items such as personal protective clothing and equipment, general industrial safety, and employee Right-to-Know (the Hazard Communication Standard);
- transportation of hazardous waste, including marking, labeling, placarding, loading, use of shipping papers, record keeping, and other DOT requirements; and,
- maintenance of documentation.

Facility tours and audio-visual aids in conjunction with lectures and procedure manuals will be utilized in the classroom training. A written test will be administered at the completion of classroom training. A grade of 80 percent or better will be required to demonstrate mastery of the course material. The course curriculum will be reviewed at least annually by the RCRA training officer to ensure that it is current and appropriate.

7.2.1.2 Job-Specific Training

The RCRA classroom training will be supplemented with OJT tailored to each employee's actual job responsibilities. All employees who handle hazardous waste and supervisors of personnel who handle hazardous waste will be required to complete OJT; employees who will not handle hazardous waste and will not directly supervise personnel who will handle hazardous waste will not receive OJT. The purpose of OJT is not to demonstrate to personnel how to perform their duties, but rather to demonstrate how to perform their duties safely and in compliance with RCRA.

OJT will be conducted in the work area by the line supervisor or foreman subsequent to classroom training. The length and complexity of the OJT will vary according to the employee's responsibilities; however, it is anticipated that OJT will take approximately 1 to 2 hours.

A checklist developed by the work area supervisor will be used for OJT. Prior to initial use of the checklist, it must be reviewed and approved by the RCRA training officer. All employees performing similar duties will have consistent OJT. The OJT checklist will be reviewed at least annually to ensure that it is current and appropriate for the subject job classification.

The OJT checklist will include the following elements:

- information about procedures relevant to the individual's position, where these procedures are located, and which personnel have the authority to implement the procedures; key operating parameters and waste feed cut-off systems;

- location and use of communications or alarm systems;

- response to releases;

- emergency and routine shutdown of operations;

- Facility Contingency Plan and emergency procedures;

- evacuation procedures and location of emergency exits;

- response to leaks, spills, and overflows;

- Waste Analysis Plan procedures; and,

- inspection and maintenance procedures.

After the OJT checklist has been completed, it will be signed by both the employee and the supervisor. The checklist will be provided to the RCRA training officer, who will be responsible for maintaining training records.

7.2.1.3 OSHA 40-Hour Training

All personnel who handle hazardous waste and the supervisors of personnel who handle hazardous waste will complete OSHA 40-hour training as required by 29 CFR 1910.120. It is anticipated that, at least initially, the OSHA 40-hour training will be provided by an outside vendor. Personnel who have documentation of course completion for the 40-hour and refresher training will not be required to retake the 40-hour training.

7.2.2 Training for Visitors

Visitors who are expected to be in the Facility for only a short period of time and who will not be handling hazardous waste will be provided a short briefing on basic emergency procedures such as decontamination, emergency signals and alarms, and evacuation routes. Visitors will not be allowed onsite unless they are escorted by Facility personnel or unless other arrangements have been made with Facility personnel. The briefing will include the following information:

- what hazards that may be encountered at the Facility;

- how emergencies are signaled or announced, how help is summoned , what information is to be given, and to whom the information is given;

- where to report during an emergency;

- how to safely evacuate from the Facility;

- what standard operating procedures for visitors are;

- where check-in/check out locations are; and,
- what safety equipment is required.

7.2.3 Training for Off Site Emergency Response Organizations

Training will be established for off site emergency response organizations through agreements with local agencies and contracts with vendors. This training will include, as appropriate, the following:

- site layout and site-specific hazards;
- the Contingency Plan;
- Facility emergency procedures;
- Facility decontamination procedures; and,
- appropriate response techniques.

7.3 RECORD KEEPING

In accordance with 40 CFR 264.16, records regarding job title, job description, training, and other appropriate documentation will be kept by the RCRA training officer.

7.3.1 Job Titles, Descriptions, and Duties

Job titles will be designated for each position at the Facility related to hazardous waste management and the name of each employee filling each job. Job descriptions will detail job duties and responsibilities for that position. The description will include the skills, education, and qualifications required for each position. A written description for each position will be maintained to determine the types and amounts of both introductory and continuing training to be given to each employee at the Facility.

7.3.2 Training Documentation

Records that document RCRA classroom training and OJT given to and completed by Facility personnel will be kept by the RCRA training officer. Training records on current employees will be kept until closure of the Facility. Training records on former employees will be kept for at least three years from the date the employee last worked at the Facility.

7.3.3 Other Documentation

Other documentation to be maintained at the Facility, includes the following:

- documentation of the annual review of the curriculum for RCRA classroom training;
- documentation of the annual review of the OJT checklists; and,
- RCRA classroom training test results.

Insert Figure 7-1, Facility RCRA Training Program

6.0 CONTINGENCY PLAN

The purpose of the Contingency Plan is to minimize potential hazards to human health and/or the environment in the event of a fire, explosion, or unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to the air, soil, or water. Should any of these unplanned events occur, the procedures in this Contingency Plan will be immediately implemented. When these procedures are followed, the possibility of additional occurrences, recurrences, or spread of the initial emergency in such a way as to require additional emergency response measures will be minimized.

This Contingency Plan was specifically developed for the Facility. A final contingency plan will be provided to NMED and other response agencies 60 days prior to initiation of operations. The plan will be kept at the Facility, and controlled copies will be submitted to and updated at all police and fire departments, hospitals, and state and local emergency response organizations that may be called upon to provide emergency services. A list of these organizations is provided in Appendix J of Volume II. Initial site tours with all local emergency response organizations will be conducted to familiarize them with the facility prior to the start of operations.

The plan specifies Facility personnel who will be responsible for implementation of the plan. The plan also specifies the actions these individuals will take in the event of an emergency at the Facility. The plan includes a (1) description of the Facility layout; (2) the location of possible hazards; (3) the location of emergency and decontamination equipment; (4) evacuation plans and routes; (5) agreements with local emergency personnel; and, (6) an up-to-date list of names, addresses, and telephone numbers of Facility personnel qualified to act as EC.

6.1 GENERAL RESPONSIBILITIES OF THE EMERGENCY COORDINATOR

The Facility will train a minimum of five employees to serve as the EC for the Facility. Only one individual at a time will be designated as the primary (on-duty or on-call) EC. Others will be specified as alternate ECs. A list of personnel qualified as ECs will be provided in Appendix K in Volume II prior to waste receipt. Individuals will be listed by name, address, and telephone number. The list will also indicate the order in which each will assume responsibility as ECs. In accordance with 40 CFR 264.52(d), which states, "For new facilities, this information must be supplied to the Regional Administrator at the time of certification, rather than at the time of permit application", the list will be provided to the director of the NMED or designee (NMED Director) prior to receipt of waste and will be kept current both at the Facility and with emergency response organizations.

An acting EC will be either physically at the Facility or on call 24 hours a day, 365 days a year. Each EC will have authority to commit resources needed to carry out the provisions of the Contingency Plan.

The EC will be responsible for implementing the Contingency Plan, coordinating all emergency response efforts, determining the extent of the emergency, assessing hazards to human health and the environment, and completing necessary reports associated with the incident. Each EC will be thoroughly familiar with (1) the Facility layout and operations; (2) all aspects of the Facility's Contingency Plan; (3) the location and characteristics of hazardous materials, hazardous waste, and waste handling activities at the Facility; (4) the location and operation of emergency response equipment; (5) evacuation plans and routes; and (6) the location of all Facility records.

After an emergency has been brought under control, the EC will assume responsibility for treating, storing, or disposing of recovered waste, contaminated soil or surface water, or any other material that is generated as a result of the release, fire, or explosion at the Facility.

If the EC becomes injured or is otherwise unable to serve as EC during an emergency, a designated operations manager will assume the role of EC until an alternate EC is notified and arrives on the scene.

6.2 CIRCUMSTANCES DICTATING IMPLEMENTATION OF THE PLAN

The Contingency Plan must be immediately implemented under any of the following circumstances:

- a fire or explosion occurs resulting in the release of a hazardous waste or involving an active hazardous waste management unit;
- a spill, leak, or other release of hazardous waste or hazardous waste constituents to the air, soil, or surface water occurs that could threaten human health or the environment;
- an indoor spill, leak, or other release of hazardous waste occurs to a secondary containment area that is not removed within 24 hours; and/or,
- a hazardous waste incident occurs resulting in an injury requiring more than basic first aid.

The plan will be implemented any time the EC believes that an event occurring at the Facility has the potential to adversely affect human health or the environment. The plan may also be implemented for other reasons at the discretion of the EC.

During the initial discovery and assessment phase of an incident, the EC will obtain information, including the type and quantity of released material and/or injuries that have occurred. At this time, the EC may consult with environmental specialists and other appropriate personnel to determine whether the incident warrants implementation of the RCRA Contingency Plan.

6.3 IMPLEMENTATION PROCEDURES

Response procedures for emergencies often vary significantly, depending on the specific details of the incident. However, several response procedures are common to all incidents and include the following elements, which are further detailed in this section:

- discovery of incident and request for assistance from emergency response personnel;
- identification and characterization of released or suspected released material;
- assessment of hazard;
- off site notification and evacuation criteria;
- response and control procedures;
- measures to prevent recurrence or spread; and,

- storage and treatment of released hazardous waste.

6.3.1 Discovery of Incident and Request for Assistance from Emergency Response Personnel

The individual who first discovers an incident or emergency will quickly determine whether the situation is immediately life threatening or non-life threatening. The steps taken in each of these scenarios are briefly described below, although they are likely to vary based on occurrence.

6.3.1.1 Life-Threatening Situations

All Facility employees will be instructed and trained on response to a life-threatening situation or life-threatening release of materials. Employees will first relocate to a safe area, if necessary, then immediately notify the EC and/or emergency response personnel as the situation warrants, using the methods described below.

Verbal—In some cases, verbal communication within a building or between buildings will be the fastest way to disseminate emergency information and/or evacuate the area of an emergency.

Telephone—Employees will be instructed to immediately relocate to a safe area, if necessary; appropriate emergency response personnel can be notified by dialing 911 (without first notifying the EC if a particular situation appears to be immediately life-threatening or serious); the EC must be immediately notified of the actions taken.

Fire-Pull Station—The fire-pull station may also be used to alert the fire department and Facility personnel of an emergency. Although this type of alarm does not allow verbal communication with the fire department, it does activate a local fire alarm bell at the Facility and a remote alarm signal at the fire department.

Facility personnel will be trained for initial response to onsite fires. When the alarm is activated, onsite personnel may use fire extinguishers or the application of soil and/or water to suppress fires, when appropriate. The Roswell Fire Department will respond to fires beyond the control of site personnel. Response time for the Roswell Fire Department is approximately 30-45 minutes.

Fire-pull stations will be located at the administration building, the entrance to the landfill, the drum handling unit, and the stabilization unit. Other possible locations of fire-pull stations may be established.

Automatic Fire Detection/Sprinkler System—All permanent Facility buildings will be equipped with automatic fire detection/sprinkler systems, which, when activated, will transmit an alarm directly to the security gate guard shack and the Roswell Fire Department. The fire department will immediately respond to any alarms.

Public Address (PA) Or Paging System—Each of the main buildings will be equipped with a PA or paging system, which will be used to inform employees of adverse conditions at the site and emergency response instructions.

Hand-Held Radios—Hand-held radios will be used to communicate with personnel who are out of range of voice communications, PA, or are working in areas with noise levels such that render the PA system inaudible in emergency situations.

During non-operational hours, the EC will be notified by pager, radio, cellular telephone, or regular telephone. The EC will be at the scene as soon as possible to direct and coordinate emergency response activities.

If the EC determines that additional assistance from an off site agency or emergency response organization is needed or if immediate action is required to protect a local community population or to protect any visitors using the Mescalero Sands recreation complex and travelers at the rest stop on Highway 380 north of the Facility, the EC will contact the appropriate agencies or organizations. A list of these organizations is provided in Appendix J in Volume II. During response activities, two-way radios will be used for communication between responding groups and the EC.

6.3.1.2 Non-Life Threatening Situations

Upon discovery of a non-life-threatening release of materials or other non-life-threatening but potentially serious emergency situation, all Facility employees will be instructed and trained to immediately notify the EC or their supervisor. The EC will evaluate the situation, notify appropriate personnel, and if necessary implement the Contingency Plan.

6.3.2 Identification and Characterization of Released or Suspected Released Material

After the emergency situation has been discovered and appropriate response personnel have been contacted for assistance, the EC will immediately obtain the following information by process knowledge (his own or that of another employee): (1) observation; (2) review of Facility records, including material safety data sheets (MSDSs) and manifests; and/or, (3) chemical analysis of the material, if this becomes necessary. This information will determine the following:

- the character and amount of released waste;

- the exact source and extent of any released material;

- whether the release could move off site; if it is determined that the release could move off site, the EC must determine if any containment procedures have been implemented or whether such procedures should be implemented; and,

- any injuries or potential injuries resulting from the incident.

All containers of waste and material at the Facility will be labeled. Therefore, the identification and characterization work generally will be accomplished through visual inspection and process knowledge. Manifests and lists of the waste and locations of waste being stored at the Facility prior to disposal or treatment will be maintained at the Facility. This information will be used in lieu of the visual inspection noted above in cases where the danger of entering the incident area is high or the container labels have been obscured as a result of the incident.

Copies of the MSDSs for raw materials used at the site will be located in the administration building, in the EC's office, and at appropriate operations locations throughout the site. The information in these documents will be used to prepare a course of action.

6.3.3 Assessment of Hazard

Concurrent with the waste identification and characterization phase of the emergency response, the EC will assess possible hazards to human health or the environment that may result from the emergency situation. Indirect and direct effects of the release, fire, or explosion will be considered during this assessment. Examples of direct and indirect effects include the impacts of any toxic, irritating, or asphyxiating gases that are generated or the effects of any hazardous surface water run-off from water or chemical agents used to control a fire.

During this phase of the emergency response, the EC will consider the following information to determine potential risk to human health or the environment:

- the location from which the material or waste is emanating;
- the weather patterns and wind direction at the time of the release; and,
- the characteristics of the released material, including physical, reactive, and human or animal toxicity.

The EC may choose to obtain emergency response guidance by contacting one or more of the emergency response organizations listed in Appendix J (Volume II) or by utilizing various spill control reference textbooks and MSDSs located in the EC's office.

6.3.4 Off Site Notification and Evacuation Criteria

If the EC determines that a release, fire, or explosion has occurred at the Facility that poses an immediate threat to onsite or off site human health and/or the environment, the findings will be reported to appropriate response personnel as follows:

- local authorities will be immediately notified if an emergency incident at the Facility could affect local areas and if evacuation of these areas is necessary. The EC will be available to assist appropriate officials in deciding whether local areas should be evacuated (evacuation plans are provided in Appendix L, Volume II); and,
- the local authorities will be notified with the following information:
  - ◊ the name and telephone number of the reporter;
  - ◊ the name and address of the Facility;
  - ◊ the time and type of incident that occurred;
  - ◊ the name and quantity of material(s) involved, to the extent that this is known;
  - ◊ the extent of injuries, if any; and,
  - ◊ the possible hazards to human health or the environment ~~outside the Facility~~.

Coordinating agreements will be signed with federal, state, and local emergency response organizations. The agencies with which the Facility will enter these agreements are listed in

Appendix J presented in Volume II. The agreements outline the conditions under which the agencies will be contacted and the roles they will assume during various emergency scenarios at the Facility. The agreements establish the EC as the lead coordinator of all emergency response activities at the Facility. The details of these agreements will be located in the EC's office and with each of the participating organizations. The agreements will be considered controlled documents and will be kept current by updating all copies each time a change is made. This ensures a coordinated response to all emergency situations.

The EC may contact one or more of the agencies, such as police, fire departments, or hospitals, as listed in Appendix J (Volume II), if additional assistance is needed at the site to protect community populations.

6.3.5 Response and Control Procedures

Following proper notification of agencies and/or evacuation of the Facility, the EC will initiate response and control procedures. This effort will involve the use of emergency equipment, which is listed in Appendix M in Volume II. This list also includes equipment descriptions and locations.

Potential incidents for which response and control procedures are necessary will be grouped into three broad categories: (1) fires and/or explosions; (2) spills, leaks, or other releases; and (3) power failures. A brief discussion of emergency training requirements and the general procedures for handling each of these situations are described in the following sections.

Facility personnel and supervisors will receive safety training to enable them to respond to and handle various emergency situations that are not of a serious nature. In addition to this training, employees will participate in emergency response drills on a periodic basis. These drills will involve both internal responses and those response actions taken in conjunction with external emergency response personnel. Key personnel will be familiar with the use of emergency equipment and fire control structures available to prevent the spread of fires in their areas. To prevent recurrence of an incident, any faulty or defective monitoring equipment, valves, pumps, alarms, or other equipment will be repaired. If repair is not possible, the equipment will be replaced. The unit will not receive hazardous waste until the minimum required equipment for safe operation is fully functional.

Procedures for ensuring that incompatible wastes are not treated, stored, or located in areas where a spill has occurred are addressed in Section 6.3.7.

6.3.5.1 Fire and/or Explosion Control Procedure

If a fire or explosion occurs at the Facility that may impact an active hazardous waste management unit or hazardous material storage area, the Contingency Plan will be immediately implemented, as outlined in Section 6.3. The EC will assess the situation and direct the emergency response effort. The EC will also be responsible for advising emergency response personnel of the hazards associated with released materials and other areas that should be protected from the effects of the incident.

In the event that a fire cannot be brought immediately under control and hazardous waste or material are located in the path of the fire or in an otherwise dangerous place, the waste or materials will be relocated to a safer area, if possible. If this is not possible, the material may be sprayed with an appropriate fire suppressant, at the direction of the EC or under the advisement of fire department personnel.

If an explosion is likely to occur, for example because a fire threatens to envelop ignitable waste, the EC may choose to evacuate the area, as described in Appendix L presented in Volume II.

Facility employees will be trained and advised to stay in their work areas during emergency situations, unless they are in immediate danger, until they receive further direction via the PA system or other method of communication. If evacuation is necessary, the EC will communicate this via the PA system and by other means, as necessary, and all employees will assemble at the administration building. If anyone is unaccounted for, emergency response personnel will conduct searches.

After the ~~e~~affected areas have been evacuated, re-entry will be authorized by the EC only after the fire has been extinguished and when the emergency has been resolved.

Any equipment used during the incident will be checked for contamination and cleaned and/or replaced prior to resumption of plant operations in the affected area. Any solutions or materials used to decontaminate the equipment will be managed as RCRA-regulated waste.

6.3.5.2 Spills, Leaks, or Other Releases Control Procedure

All areas in which liquids are stored, managed, or potentially encountered (including tanks, containers, or secondary containment areas) will be inspected regularly for leaks, spills, deterioration, or damage in order to reduce the likelihood of an incident. However, on occasion, such incidents may still occur. This section describes the procedures for responding to spills, leaks, or other releases to containment areas or to the environment.

If Facility employees observe a spill, leak, or other release, whether during a formal inspection or during routine work, they will be instructed to contact the EC immediately and describe the situation in as much detail as possible, giving the following information, at a minimum:

- the location;
- material composition;
- approximate quantity; and,
- estimated extent of the release.

Based on this information (and additional investigation by the EC as necessary), the EC will determine whether to evacuate the area and/or implement the Contingency Plan.

As previously stated, if the EC is not available and if the situation is serious or life threatening, employees will be instructed to dial 911 for emergency assistance. In a life threatening situation personnel may call 911 without first notifying the EC. The EC will then be notified of the employee's actions. Upon notification, the EC will conduct a visual inspection of the release and will then implement immediate containment measures.

Releases Within Containment

The EC will implement the following procedures for responding to leaks or spills from tank systems or containers into secondary containment areas that are not likely to reach the environment:

- the tank system or secondary containment area will be removed from service and the flow of waste stopped;

- the unit will be inspected to determine the apparent cause of the leak or spill;

- all waste released to a secondary containment area will be removed from the secondary containment systems within 24 hours after detection of the leak, or as timely as possible, to prevent harm to human health and the environment;

- leaking containers will be placed in an overpack drum or will have the contents transferred to another container; and,

- affected tank systems will be repaired or replaced (if replaced, the old systems will be closed) prior to returning them to service. All released materials will be removed prior to returning the unit(s) to service. Extrusion repairs to geomembrane liners or metal welds to steel containers will be certified by a qualified registered professional engineer. This certification will be submitted to the ~~regional administrator~~ NMED Secretary.

Releases to the Environment

The EC will implement the following procedures for responding to leaks or spills from units that are likely to reach the environment:

- as previously stated, if uncontrolled releases of ignitable, corrosive, reactive, or toxic materials are involved in the incident, the affected area will be evacuated;

- response personnel will be directed to the incident location to aid in preventing further migration of the leak or spill to soils or surface water, provided that this can be accomplished safely. This effort will involve the use of industrial absorbents, sorbent dams, or other similar materials. If the release is determined to be beyond the capabilities of Facility personnel, the EC will contact one of the emergency response organizations listed in Appendix J (Volume II) for assistance;

- the EC will monitor the status of the incident and direct emergency response personnel until the emergency condition no longer exists;

- when the incident has been brought under control, the EC will coordinate and instruct response personnel to begin cleanup and decontamination operations. These will involve containing and collecting any released material, including liquid releases, contaminated sorbent materials, visibly contaminated soils, and any other waste materials generated during cleanup or decontamination. These items will be removed and properly disposed of, generally by placing the wastes into DOT-approved containers (such as 55-gallon drums), sampling the waste or otherwise determining its constituents, and handling the waste accordingly. All liquids, including the originally released material and any liquids generated during cleanup (unless other circumstances or knowledge preclude this effort) will be pumped into drums and samples taken and analyzed to determine an appropriate course of action;

- if soils or surface water are visibly affected, they will be removed until the contaminant concentration in the remaining soil or water is at or below appropriate levels for the contaminants of concern;

- the EC will then use whatever means are necessary to determine if the released material is a hazardous substance as defined in 40 CFR 302. The EC will then determine whether the amount of released material is a reportable quantity. If the amount is a reportable quantity, the following steps will be taken:

  ◊ waste that could be released to the environment because of a leak in a tank system will be removed from the tank within 24 hours of the detection of the leak, or, if this is not possible (impracticability must be demonstrated to the NMED), it will be removed at the earliest practicable time. In such a case, as much waste as is necessary to prevent further releases to the environment will be removed from the tank system, enabling inspection and repair of the system;

  ◊ the EC will report the release to the NMED Director within 24 hours of detection;

  ◊ the National Response Center will be advised of the situation within 24 hours of the incident;

  ◊ an internal report describing the situation and corrective measures necessary to prevent a recurrence will be prepared; and,

  ◊ a written report will be filed with the NMED Director within 30 days of detection, as described in Section 6.4.2 and

- if the quantity of the spill or leak is less than or equal to 1 pound and is immediately contained and cleaned up or is less than a reportable quantity of material, a Facility employee will be assigned to report on the situation and determine what, if any, follow-up actions are necessary after cleanup.

6.3.5.3 Evaporation Pond Failure Control Procedure

The evaporation pond will be removed from service if the level of liquids in the pond suddenly drops and the drop cannot be attributed to known flowrate changes into or out of the pond or if they are exceeded. The major source of volume reduction from the pond is anticipated to result from evaporation. Liquid may also be pumped out of the pond, for example if a heavy rainfall event causes the water level to rise above the required freeboard elevation. Liquid levels in the evaporation pond will be monitored using a measuring staff gauged either in inches or in tenths of a foot. Daily evaporation losses will be compared to daily evaporation rates obtained from the nearest NOAA weather station. Currently this is the Bitter Lakes Wildlife Refuge station, as evaporation rates are not measured at the Roswell and Tatum stations. If liquid losses exceed daily evaporation losses and no other reasonable explanation is found, then the evaporation pond will be shut down and the authorities at NMED will be notified immediately.

When a pond must be removed from service, the following steps will be taken:

- the flow of waste into the pond will be immediately shut off;

- any surface leakage that has occurred will be contained;
- the leak will be stopped as soon as possible;
- any other necessary steps will be taken to stop or prevent a catastrophic failure of the unit; and,
- in the event that the leak cannot be stopped by any other means, the pond will be emptied.

Several options are available to empty an evaporation pond. Due to the two-sided nature of the single evaporation pond, if a leak occurs in one side, liquid can be transferred to the other side while repairs are being made. Other options, if the leak is on both sides of the pond, include setting up temporary double-lined ponds, temporary double-lined bladders, temporary portable double-lined tanks, or using tanker trucks. These short-term storage measures are intended only to allow storage capacity during a major pond repair effort. The wastes would be transferred into and out of the tanks using existing or temporary pumps.

- Notification will be made to the Chief of the Hazardous and Radioactive Materials Bureau. An oral report will be made within 24 hours. A written report will be submitted within 7 days. An unexplained drop in the level of the evaporation pond would qualify as a noncompliance that may endanger human health or the environment, and 40 CFR 270.30 (l)(6) requires 24-hour notification for such events.

A written procedure for complying with use of temporary double-lined ponds, double-lined bladders, portable double-lined tanks or tanker trucks will be included in the final contingency plan that will be prepared prior to the acceptance of waste at the Facility. This procedure will be written to ensure that all repairs will be made in accordance with approved designs, specifications, and CQA Plan for the pond. All repairs will be done under the supervision of a New Mexico registered professional engineer.

If the evaporation pond is removed from service, it will not be put back into service until it is repaired. If the unit was removed from service as a result of a sudden drop in the liquid level, and the drop in the liquid level was caused by failure of the liner, then either a new liner (in compliance with 264.221[a]) must be installed, or the old liner must be repaired and certified by a qualified engineer that it meets the design specifications approved in the permit. If the pond is not to be repaired, or is not repairable, it will be closed in accordance with the provisions of 264.228 and the approved closure plan.

In the event that the evaporation pond is removed from service due to actual or imminent failure of any portion of the pond dike system, the evaporation pond will not be placed back in service until necessary repairs are completed and inspected, and the structural integrity of the dike is recertified by a New Mexico registered professional engineer. This recertification process will be done in accordance with 40 CFR 264 .226(c) and 40 CFR 264 .227(d)(1).

6.3.5.4 Power or Equipment Failure Control Procedure

The Facility will be equipped with at least one backup generator for emergency power generation to critical equipment only, which may include laboratory and administrative equipment. The generators may also be used to power safety equipment, such as smoke detectors and tank emergency cut-off or bypass mechanisms. The details of this system will be made available as the Facility design is completed. This emergency system will be started within 30 minutes of a power failure.

In the event of a power failure, all waste processing equipment will be shut down and all waste transfer and management activities will cease until power is restored.

Equipment that fails but does not result in an emergency incident, such as a fire or explosion, will be promptly repaired or replaced. If emergencies arise as a result of the equipment failure, they will be handled as described in previous sections.

6.3.6 Measures to Prevent Recurrence or Spread

During an emergency, the EC will take all reasonable measures necessary to ensure that fires, explosions, and releases do not occur, recur, or spread to other hazardous waste areas at the Facility. These measures will include the following, where applicable:

- stopping processes and operations in specific areas of the plant or the entire plant itself; shut-down procedures for processing operations will be maintained in the administration building as well as at specific operating locations;

- collecting and containing released waste as described in Section 6.3.5.2; and,

- removing or isolating containers from the emergency at hand, as described in Section 6.3.5.1; if a material cannot be moved because of danger associated with a fire, the material may be sprayed with an appropriate fire suppressant, as directed by the EC or authorized fire official.

If the Facility ceases operations because of an emergency, the EC or a designated individual will monitor for leaks, pressure buildup, gas generation, or ruptures in valves, pipes, or other equipment, wherever this is appropriate.

A preventive maintenance order schedule will be prepared to ensure that monitoring equipment, valves, pumps, alarms, and other equipment will be maintained in good working order. If any of the equipment is found to be faulty or defective, it will be repaired or replaced.

6.3.7 Storage and Treatment of Released Hazardous Waste

Concurrently or immediately after the emergency has been addressed and cleanup procedures have been completed, the EC will make arrangements for the containerization and storage, treatment, or disposal of any waste generated during the incident. The waste will be assumed to be RCRA-regulated until process knowledge or sampling and analysis can be used to determine the actual nature of the waste. Sampling and analysis will be accomplished in accordance with the Waste Analysis Plan in Section 4.0. The material will be placed in DOT-approved containers and stored as RCRA-regulated waste in the drum-handling unit or roll-off container area until a determination is made. If the waste is determined to be RCRA-regulated, it will be labeled and stored accordingly until it is treated or disposed of in accordance with applicable RCRA regulations and permit conditions.

If the waste generated during the cleanup is determined to be incompatible with other wastes stored or treated at the Facility, the incompatible waste will be labeled as such and physically separated from other incompatible waste. In addition, existing waste at the Facility that may be incompatible with the waste generated during cleanup will not be treated, stored, or disposed of until cleanup activities are completed and the cleanup waste is safely containerized and segregated from the existing waste.

6.4 POST-IMPLEMENTATION PROCEDURES

Following implementation of the Contingency Plan and resolution of the incident, all emergency equipment used during the effort will be made ready for future use. Necessary reports will be prepared and filed at the Facility and with regulatory agencies. These post-implementation procedures are detailed in the following sections.

6.4.1 Post-Emergency Equipment Maintenance

All emergency equipment listed in Appendix M (Volume II) of this Contingency Plan will be cleaned, repaired, or replaced so that it is fit to use before plant operations in the affected area are resumed. If the equipment cannot be adequately cleaned, it will be disposed of as hazardous waste. If it cannot be repaired and is not contaminated, it will be disposed of as non-hazardous waste.

Documentation of post-emergency equipment maintenance will be provided to NMED prior to resumption of operations in the affected area of the plant.

6.4.2 Required Reports and Notification

During and after certain emergency situations, as described in previous sections of this plan, specific types of reports or notification will be required. The EC will determine when, or if, off site notification and reporting are required for certain scenarios. The various reporting and notification requirements are mentioned in the appropriate sections of the Contingency Plan but are detailed here for purposes of clarity.

After the plan has been implemented, if the EC determines that the Facility has had a release, fire, or explosion that could threaten human health or the environment outside the Facility, the EC must immediately notify either the government official designated as the on-scene coordinator for the geographical area or the National Response Center. The report must include the following information: (1) the name and telephone number of the reporter; (2) the time and type of incident; (3) the name and quantity of material(s) involved, to the extent that this information is known; (4) the extent of injuries, if any; and (5) the possible hazards to human health, or the environment, outside the Facility.

If the EC determines that evacuation of local areas may be advisable, appropriate local authorities will be immediately notified. The EC must be available to help appropriate officials decide whether local areas should be evacuated.

Any release to the environment which threatens human health or the environment must be reported to the NMED Director within 24 hours of detection. If the release is reported pursuant to 40 CFR Part 302, that report will satisfy this requirement. Any release involving a reportable quantity of a hazardous waste as defined in 40 CFR 302.4 will be reported to the National Response Center within 24 hours.

Within 24 hours of implementing the Contingency Plan, the EC must notify NMED. The owner or operator must note in the operating record the time, date, and details of any incident that requires implementation of the Contingency Plan.

As required by 40 CFR 264.56(j), within 15 days of the incident, the EC must submit to the NMED Director a written report on the incident. The report must include the following information: (1)

the name, address, and telephone number of the owner or operator; (2) the name, address, and telephone number of the Facility; (3) the date, time, and type of incident; (4) the source and cause of any release to the environment; (5) the name and quantity of material(s) involved; (6) actions taken to mitigate damage due to the release; (7) the extent of injuries, if any; (8) an assessment of actual or potential hazards to human health or the environment, where this is applicable; and (9) the estimated quantity and disposition of recovered material that resulted from the incident.

Within 30 days of detection of a release to the environment, a report containing the following information will be submitted to the NMED Director: (1) the likely route of migration of the release; (2) the characteristics of the surrounding soil (soil composition, geology, hydrogeology, climate); (3) the results of any monitoring or sampling conducted in connection with the release, if available (if sampling or monitoring data relating to the release are not available within 30 days, these data must be submitted to the NMED Director as soon as they become available); (4) the proximity of the incident to downgradient drinking water, surface water, and populated areas; and (5) a description of response actions that were taken or are planned.

The NMED Director and state and local authorities will be notified when the Facility is in compliance with 40 CFR 264.56(h), which states that no waste that is incompatible with the released material can be treated, stored, or disposed until cleanup procedures are completed, and all equipment must be fit for its intended use prior to resuming operations.

6.5 DOCUMENTS TO BE MAINTAINED ONSITE AS PART OF THE PERMIT

Following the resolution of emergencies, various documents must be prepared and maintained onsite as part of the operating record. These documents are discussed in previous sections of this plan and are summarized below.

Copies of the Facility- and building-specific evacuation plans will be maintained in the administration building and at each location for which evacuation plans will be prepared. These documents will be submitted to the NMED within 30 days of the effective date of this permit.

An up-to-date list of all satellite and 90-day accumulation areas, if any are utilized at the Facility, will be maintained at the Facility and provided to the NMED inspectors upon request. Prior to accepting waste at a satellite or 90-day accumulation area for the first time, NMED will be provided with a description and location map.

A list of authorized ECs and their home telephone numbers will be maintained in the administration building, in all other buildings and emergency stations at the site, and in all controlled copies of the Contingency Plan.

A list of coordinating agreements that outline the situations and criteria under which outside help is needed will be maintained in the administration building and in all controlled copies of the Contingency Plan. This list will include the role of each emergency response authority in an emergency.

Coordinating Agreements will be put in place with local, state, and federal agencies for responding to emergency incidents that may occur at the Facility. The Facility will formalize Coordinating Agreements with those organizations listed in Appendix J (see Volume II) no later than 60 days prior to receipt of first waste.

A current evacuation plan will be maintained in the EC's office. Appendix L presented in Volume II provides a general Evacuation Plan for the Facility. The Facility will finalize this Evacuation Plan with details of building-specific evacuations after the Facility design has received final approval from NMED. It is proposed that the Facility will submit the criteria for determining when site evacuations are necessary within 30 days of the effective date of the permit and that final evacuation plans and procedures be submitted following final NMED approval of the Facility design.

A current version of the emergency and spill response equipment list presented in Appendix M (Volume II) will be maintained in the EC's office and in each of the controlled copies of the Contingency Plan.

The operating record for the facility will be updated with the time, date and details of any incidents that require implementation of the Contingency Plan.

6.6 AMENDMENT OF CONTINGENCY PLAN

If the Contingency Plan is implemented, the circumstances under which it was implemented will be thoroughly reviewed to investigate the following:

- why the incident occurred and the cause for the occurrence;
- what measures were taken to prevent a recurrence; and,
- what measures will be taken to reduce the risk of having a similar occurrence in the future.

The Contingency Plan itself will be reviewed by the EC and/or the Facility owner and immediately amended, if necessary, whenever any of the following events occur:

- the Facility permit is revised;
- the plan fails in an emergency;
- changes occur to the Facility design, construction, operation, maintenance, or other circumstance that materially increase the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or that change the response necessary in an emergency;
- the list of ECs changes; or,
- the list of emergency equipment changes.

Because the Contingency Plan is a controlled document, any changes will be made in the following manner: (1) inaccurate or out-of-date pages will be directly replaced with new pages containing the modified or additional information; (2) the corrected pages will be issued to all agencies and organizations that have controlled copies of the plan; and, (3) old pages will be removed from copies of the plan and discarded. These steps will ensure that each organization has a current version of the plan.

4.0 WASTE ANALYSIS PLAN

The Triassic Park Hazardous Waste Disposal Facility (the facility) is a commercial facility that receives hazardous waste generated off-site for treatment, storage, and disposal. This waste analysis plan establishes facility requirements for accepting and characterizing hazardous waste generated both off-site and on-site. The waste analysis plan requirements are established in the New Mexico Hazardous Waste Management Regulations at 20 NMAC 4.1.500 incorporating 40 CFR 264.13, 20 NMAC 4.1.800 incorporating 40 CFR 268.7, and 20 NMAC 4.1.900 incorporating 40 CFR 270.14(b)(3). The most recent revision of this waste analysis plan will be maintained at the facility as part of the facility Operating Record. The facility will continually upgrade the waste analysis plan with regard to the Land Disposal Restrictions (LDR) regulations contained in 40 CFR 268.

Section 4.1 identifies wastes which will be accepted at the facility and wastes which are prohibited. Section 4.2 lists criteria for waste acceptance and management. Sections 4.3 and 4.4 contain pre-acceptance procedures for initial acceptance of hazardous waste received from off-site generators and management procedures for incoming shipments of waste. The various waste analysis protocols that will be required at the facility are contained in Section 4.5. Sampling and analytical methods and protocols for quality assurance/quality control (QA/QC) are discussed in Sections 4.6 and 4.7. Section 4.8 explains the facility's waste tracking system. Section 4.9 summarizes notification, certification, and recordkeeping requirements related to waste analysis.

4.1 PERMITTED AND PROHIBITED WASTE

Section 4.1.1 identifies hazardous waste permitted for acceptance at the facility. Hazardous waste prohibited at the facility is identified in Section 4.1.2.

4.1.1 Permitted Waste

The facility will treat, store, and/or dispose only those hazardous wastes listed in Part A of the facility permit application. Only hazardous waste which meets the Land Disposal Restrictions (LDR) treatment standards identified in 40 CFR 268, Subpart D, or can be treated at the facility to meet these standards, will be accepted. These treatment standards are applicable to both primary contaminants and underlying constituents.

4.1.2 Prohibited Waste

The Facility will not accept the following wastes from off-site generators:

- **dioxin-contaminated wastes. -** Wastes listed in 40 CFR 268.31;
- **certain PCB-contaminated liquids. -** Ignitable PCB-contaminated liquids or liquids with PCB concentrations greater than or equal to 50 ppm;
- **certain PCB-contaminated soils**. – Soils with PCB concentrations greater than or equal to 500 ppm will not be accepted at the facility, ~~except~~except for those soils (or other wastes) which are defined as ~~for~~ bulk PCB-contaminated remediation waste. Before the facility accepts other wastes containing PCB concentrations greater than 500 ppm, the facility will obtain a permit from EPA for management of Toxic Substances

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Control Act **(TSCA)** wastes. A copy of this permit will be transmitted to the New Mexico Environment Department (NMED) before such waste is accepted

;

- **organic liquids/sludges.** - Liquids/sludges ~~with an organic concentration of 10 percent or greater by weight or liquids/sludges~~ that have not been treated ~~(prior to receipt at the facility)~~ to applicable LDR treatment standards;

- **explosives.** - Any substance or article, including a device, which is designed to function by explosion (i.e., an extremely rapid release of gas and heat) or which, by chemical reaction within itself, is able to function in a similar manner even if not designed to function by explosion. This includes materials defined as explosives in 40 CFR 143;

- **radioactive/nuclear materials.** - Materials regulated by the NMED or the New Mexico Oil Conservation Division and defined in 20 NMAC 3.1 Subpart 14, or materials regulated under the Atomic Energy Act of 1954, as amended (including source, special nuclear materials and byproduct materials as defined in 10 CFR 20.1003);

- **medical waste. -** Waste including infectious/biologic/pathogenic solid waste generated in the diagnosis, treatment, or immunization of human beings or animals, in research pertaining thereto, or in the production or testing of biologicals. This also includes infectious waste as defined in NMAC 9.1.105.L.;

- **municipal solid waste.** - Wastes including garbage, refuse, sludges, wastes, and other discarded materials as defined in 40 CFR 761.3 and residential and commercial solid wastes generated within a community as identified in 40 CFR 240.101 and 40 CFR 241.101;

- **construction and demolition debris.** - Waste identified in 40 CFR 243.101 and 40 CFR 246.101 as building materials, packaging, and rubble resulting from construction, remodeling, repair, and demolition operations on pavements, houses, commercial buildings and other structures;

- **certain hazardous debris.** - Hazardous debris which does not meet the LDR treatment standards;

- **special waste.** - Waste identified in NMAC 9.1.105.ZZZ. as nonhazardous solid wastes requiring unique handling, transportation, or disposal requirements other than that normally used for municipal solid waste to ensure protection of the environment and the public health, welfare, and safety (e.g., asbestos waste);

- **certain lab packs.** - Lab packs which contain wastes (identified in 40 CFR 268, Appendix IV) excluded from lab packs under the alternative treatment standards of 40 CFR 268.42(c);

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- **compressed gases.** - Gases stored at pressures higher than atmospheric; and

- **unknown or unidentified waste. -** These wastes cannot be accepted at the Facility except by special provision and direction from the NMED Secretary (e.g., emergency clean-up operations) or until full characterization has been performed.

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4.2. CRITERIA FOR WASTE MANAGEMENT AT THE FACILITY

Waste managed at the facility must meet the facility's criteria for acceptance and management. Waste analysis (or, in some cases, acceptable process knowledge) will be used to ensure determination of:

- complete characterization of the waste;
- compliance with LDR treatment standards, including, where applicable, underlying constituents. If the waste stream does not meet the LDR treatment standards, the waste will be rejected if the facility does not have the appropriate treatment capability to bring it into compliance;
- compliance with the facility's regulatory and operational limits (e.g., the waste is not included in the permitted wastes listed in Part A of this application~~,~~, or the waste does not meet other operational boundaries established by this WAP). ~~or it exceeds the 40 CFR, Subparts BB allowable concentrations for air emissions, or exceeds the allowable concentration of PCBs, or contains biodegradable sorbents, or is incompatible with other wastes or containers).~~

4.3 PRE-ACCEPTANCE PROCEDURES FOR OFF-SITE WASTE

Before a waste stream is accepted, all off-site generators will be required to provide a complete waste characterization (Section 4.3.1). After evaluating the paperwork supplied by the generator (Section 4.3.2), the facility will send a representative sample of the waste to an independent laboratory for analysis and will evaluate the analytical results (Section 4.3.3). Finally, the facility will notify the generator that the facility will accept the waste stream (Section 4.3.4).

4.3.1 Waste Characterization Information Provided by the Generator

The activities associated with pre-acceptance of off-site waste streams are shown in Figure 4-1.

The generator must provide the following waste characterization information for each waste stream:

- a completed Waste Profile Form signed by an authorized agent of the generator. An example of a Waste Profile Form is contained in Vol. II, Appendix H, of this application. This form may be changed if the facility believes that more information is warranted or if there are changes in regulations governing the facility;
- other documentation that supports the information presented on the Waste Profile Form (e.g., Material Safety Data Sheets);
- waste analysis data used to characterize the waste and/or process knowledge documentation;

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- a description of the process that generated the waste;
- a completed Land Disposal Restriction Notification;
- all other supporting data required by 40 CFR 268.7;
- all required certifications; and
- a representative sample of the waste, of adequate volume for analysis.

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Insert Figure 4-1, Pre-Acceptance Procedure for First Time Waste

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In certain cases, generators may meet waste analysis requirements by supplying "acceptable knowledge". Acceptable knowledge includes process knowledge and waste analysis. Process knowledge includes detailed information of a waste obtained from existing published or documented waste analysis data or studies on hazardous wastes generated by processes similar to that which generated the waste, or industry or trade association hazardous waste profile studies, or EPA documents. Examples of waste streams where process knowledge may be adequate for characterization are K-listed wastes (hazardous wastes from specific sources), which are identified by comparing the specific process that generated the waste to those processes listed in 40 CFR 261.32. The application of process knowledge is appropriate where the physical/chemical make-up of the waste is ~~well-known~~well known and consistent. Process knowledge is often used in conjunction with physical and analytical analysis.

If waste analysis is used to characterize the waste, the generator must, at a minimum, supply the following waste analysis data for each sample:

- identification of the sample medium (e.g., aqueous, sludge, soil);
- brief description of the sampling strategy, including
  - a description of the sampling technique (i.e., biased or random);
  - rationale for selection of the number and location of samples;
  - a description of the statistical approach, if any; and
  - the sample type (i.e., grab or composite);
- identification of the analytical methods that were used and the rationale for the selection of these parameters;
- final laboratory reports including case narratives, waste analyses, and quality assurance/quality control analyses; and
- identification of the laboratory which performed the waste analyses.

4.3.2 Paperwork Evaluation

The facility will evaluate all of the waste characterization paperwork to determine if it adequately represents the physical and chemical characteristics of the waste stream and whether the waste stream is appropriate for management at the facility. As part of the pre-shipment process, the facility will work with the off-site waste generator to ensure that all necessary waste analyses and waste characterization information are provided to meet the applicable requirements for acceptance.

If waste analysis was used to characterize the waste, the facility will evaluate the data to determine that:

- appropriate extraction and preservation techniques were used;

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- appropriate sampling strategies were used;
- appropriate sample types were collected (e.g., to demonstrate compliance with the LDR treatment standards, hazardous waste regulations require that grab samples be collected for nonwastewaters and composite samples be collected for wastewaters);
- appropriate parameters were selected for analysis;
- appropriate analytical methods were used;
- recommended holding times were met; ~~and~~
- detection limits were below applicable standards (e.g., the LDR standards); and
- the quality of the analytical data is adequate for making a waste determination based on an evaluation of the final laboratory reports.

If the data supplied are not adequate to provide a complete characterization of the waste stream, the facility will either require additional information from the generator or will not agree to accept the waste.

All of the waste characterization information supplied by the generator will be maintained in the facility's Operating Record. In addition, the facility's evaluation of this information and the results of the independent analysis will be maintained in the Operating Record.

4.3.3 Representative Sample Analysis and Evaluation

After evaluation and approval of the waste characterization data paperwork (see Section 4.3.2), the representative sample submitted by the generator will be analyzed by an ~~off-site~~ independent qualified laboratory other than the one used by the generator. Based upon the facility evaluation of the information supplied by the generator, the facility will inform the laboratory of the medium type (e.g., liquid, aqueous, solid) and appropriate parameters for analysis. The rationale for selection will be maintained in the facility Operating Record.

The facility will select parameters for analysis to ensure that the criteria for acceptance identified in Section 4.2 are met. The analysis will include testing for each hazardous waste contained in the waste stream, as identified by EPA waste code, and for each underlying hazardous constituent, as identified in 40 CFR 268.48, Table 4-1 (see Section 4.5.~~4~~2).

The generator's Waste Profile Form will be compared with the results of the independent analysis of the representative sample and with the facility's permit to ensure that the waste is acceptable for storage, treatment, and/or disposal at the facility. Should there be a discrepancy between the analytical results and the generator information, the facility will contact the generator to resolve the

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discrepancy. The generator will not be authorized to ship the waste until all discrepancies are resolved. If the discrepancies cannot be resolved with the information provided by the generator, the facility will request a new Waste Profile Form and any additional information that may be required to characterize the waste adequately. In addition, the facility may require the generator to submit additional samples of the waste for analysis. If the generator cannot supply adequate information to provide a complete characterization of the waste stream the facility will not accept the waste.

4.3.3.1 Major Ddiscrepancies

Major discrepancies include the following:

- analytical results indicating that the generator applied an incomplete or wrong waste code to the waste stream;
- analytical results indicating that the generator submitted incomplete or wrong information on the LDR Notification Form;
- analytical results including constituents or underlying hazardous characteristics that are not explained by a description of the process; and
- other information indicating that the waste stream is not characterized properly.

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In the event of a major discrepancy, the facility will reject the paperwork and require the generator to analyze the waste in accordance with a sampling plan that is consistent with the guidance in EPA document SW-846, *Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods*, Chapter 9. The facility will require the generator to resubmit the waste characterization information listed in Section 4.3.1 and one or more additional representative samples for analysis.

4.3.3.2 Minor Ddiscrepancies

Minor discrepancies include any other waste characterization discrepancy. In the event of a minor discrepancy, the facility will work with the generator to resolve the discrepancy. For example, uncertainties regarding sorbents will be handled as minor discrepancies. The facility will contact the generator if the Waste Profile Form does not indicate whether a sorbent was added to the waste, or it indicates that a sorbent was added but does not specify the name and type of sorbent and whether it is biodegradable.

If the generator cannot provide this documentation, the waste must be tested to determine if it contains a biodegradable sorbent. If the waste is determined to contain a biodegradable sorbent, it will be rejected.

4.3.3.3 Additional Wwaste Aacceptance Cconditions

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In addition to complete characterization of the waste, the facility will also evaluate the waste to ensure that it can be managed at the facility. Waste analysis will be conducted where necessary to ensure:

- the waste is not prohibited (e.g., the waste is included in Part A of this application, is not listed in Section 4.1 as a prohibited waste, or does not exceed allowable PCB concentrations or include dioxins);
- the LDR treatment standards contained in 40 CFR~~,~~ 268, ~~P~~Subpart D, including the standards for underlying hazardous constituents, are met;
- the general requirements contained in 40 CFR 264.17 for ignitable, reactive, and/or incompatible waste are met;
- the special requirements for bulk and containerized liquids contained in 40 CFR 264.314 are met; and
- ~~the waste does not exceed Subpart BB air emission standards for equipment leaks ; and~~
- the waste does not contain biodegradable sorbents, as required in 40 CFR 264.314(e).

All major and minor discrepancies, discrepancy resolutions, and compliance with the additional waste acceptance conditions listed above will be documented in writing and maintained in the facility Operating Record.

4.3.4 Notification and Approval of Waste Shipment

After the facility determines that the waste stream meets the pre-acceptance requirements, the facility will send a written notification to the generator. This notification will include:

- a statement that the waste is acceptable for shipment;
- a unique identifier number for the waste stream, assigned by the facility (see Section 4.10);
- instructions to put the unique identifier number on all shipment paperwork and all future waste characterization data that are submitted for the waste stream;
- a requirement to notify the facility at least 24 hours before shipping, so that the facility can ensure that there are sufficient resources and capacity to manage the shipment when it arrives;
- a statement that the facility reserves the right to delay shipments beyond the 24-hour time-frame;
- instructions to ensure safe management of the waste (e.g., packaging or labeling requirements not otherwise required by regulations);

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- if the generator has treated the waste prior to shipment to meet applicable LDR treatment standards, a requirement that the generator develop and follow a written waste analysis plan which describes the procedures used; and

- a requirement that the generator retain on-site a copy of all notices, certifications, demonstrations, waste analysis data, and other documentation produced pursuant to characterization of the waste stream for five years from the date that the waste was last sent to the facility.

Once the facility has completed pre-acceptance requirements and has determined that a waste stream is acceptable for shipment, the on-site laboratory will be notified in writing. The notification will include the waste type, waste stream identifier, physical form, packaging, and how the waste is to be managed. This information will be used by the laboratory as follows:

- the waste stream identifier will be used to track the samples in relation to the waste stream;

- the waste type and management methods (storage, solidification, evaporation, and/or disposal) will be used to help determine the analytical methods that will be employed for fingerprint analysis; and

- the physical form and packaging will determine the most applicable sampling methods.

Using this information, the on-site laboratory will designate a sampling and analytical protocol specific to each waste stream. The unique identifier number for the waste stream will be used to track all activities for the waste stream. Individual shipments from within the waste stream will receive an additional identifier to enable the facility to tie information back to the specific shipment as well as to the waste stream.

4.4 PROCEDURES FOR INCOMING WASTE ACCEPTANCE

The activities associated with incoming waste shipments (typically, in drums, roll-off boxes, vacuum trucks, and tanker trucks) are shown in Figure 4-2. These procedures will be used for both initial shipment of a waste stream as well as for waste streams that have previously been accepted by the facility from the same generator and process. The facility will review the waste shipment paperwork and resolve paperwork discrepancies (Section 4.4.1), and visually inspect the waste inside the containers and roll-off boxes (Section 4.4.2). Waste analyses for incoming shipments consist of fingerprint analysis and an annual analysis to update characterization of the waste stream (Section 4.4.3). Based on the facility's evaluation of the waste stream, a determination to accept or reject the waste will be made (Section 4.4.4).

4.4.1 Paperwork Review

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Upon receipt of a waste shipment, the truck will be routed to a parking area outside the facility gate while documents are reviewed. The facility will:

- review all paperwork for completeness to verify that all required documentation is present and signed as necessary;
- compare the information in the manifest, the Waste Profile Form, the LDR Notification Form, and pre-acceptance waste characterization information for consistency;
- compare the number of containers, the volume or weight of the waste, and the waste labels on each container with the manifest for consistency; and
- review all paperwork to verify that the unique identifier number for the waste stream is on all the waste shipment paperwork and all accompanying waste characterization data.

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If the facility determines that the paperwork is complete and consistent, the waste shipment will be routed to the truck sampling station, a staging area inside the facility gate.

If the facility determines that the paperwork is incomplete or inconsistent, the waste shipment will be routed to a segregated, secure area inside the facility gate pending resolution of the discrepancies. An attempt will be made to resolve discrepancies with the waste generator or transporter within 24 hours. In those instances where a discrepancy with the manifest cannot be resolved within 15 days of receiving the waste, a letter will be submitted to NMED describing the discrepancy and the attempts made to reconcile it. A copy of the manifest or shipping paper at issue also will be provided to NMED, as specified in 40 CFR 264.72(b). If the facility is unable to resolve the manifest discrepancies, the waste will not be accepted.

The facility will resolve significant manifest discrepancies in accordance with 40 CFR 264.72. Manifest discrepancies are differences between the quantity or type of hazardous waste designated on the manifest and the quantity or type of hazardous waste contained in the shipment received at the facility.

Significant discrepancies in quantity are:

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Insert Figure 4-2, Incoming Waste Shipment Procedures

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- **bulk waste.** - Variations greater than 10 percent in weight; and
- **batch waste.** - Any variation in piece count, such as a discrepancy of one drum in a truckload.

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Significant discrepancies in type are obvious differences which can be discovered by inspection or waste analysis, such as waste solvent substituted for waste acid, or toxic constituents not reported on the manifest or shipping paper.

All discrepancy resolutions will be documented in writing and maintained in the facility Operating Record.

4.4.2 Visual Inspection

After all paperwork discrepancies have been resolved, the facility will physically open and inspect the waste inside ~~all~~ drums and roll-off boxes for color, similar physical appearance (e.g., single phase, bi-layer, multi-layer), and physical state (e.g., solid, semi-solid, or liquid). This information will be compared with the waste characterization information provided by the generator and the physical appearance of the representative sample. If the color and/or viscosity of bulk wastes (solids and sludges) appear inconsistent, the facility may elect to perform additional chemical tests, i.e., composite samples would be taken from within the different areas of coloration or viscosity.

The facility will inspect a minimum of 10 percent of all drums of each waste stream per shipment (but not less than one drum per waste stream), and each roll-off container or tanker truck.

The ~~F~~facility will physically open all containers of hazardous debris and inspect the contents to ensure that the waste shipment matches the waste that is expected. Prior to acceptance of hazardous debris the facility will require the generator to provide a certification that the waste has been treated in accordance with the requirements defined for the treatment of hazardous debris in 40 CFR 268. Hazardous debris is visually inspected because it is exempted from the representative sample waste analysis requirements discussed in Section 4.7.2. This visual inspection will ensure that the waste stream matches the description provided by the generator.

Certain loads may not be sampled, at the discretion of the facility manager or laboratory supervisor, for environmental and safety reasons (e.g., severe weather which causes unsafe working conditions). In these cases, the generator or his agent will be required to provide a signed certification that the load conforms to the Waste Profile Form. This variance from established procedure will be documented in the facility Operating Record.

If a discrepancy is found, the facility will contact the waste generator for resolution (see Section 4.4.1). The results of visual inspections and all discrepancy resolutions will be documented in writing and maintained in the facility Operation Record.

4.4.3 Waste Analysis for Incoming Shipments

Waste analysis for incoming shipments consists of fingerprint tests (Section 4.5.4) and an annual analysis to ensure correct characterization of each waste stream (Section 4.5.3).

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4.4.3.1 Fingerprint ~~T~~tests

Fingerprint analysis (see Section 4.5.4) will be conducted on each waste stream in each shipment prior to shipment acceptance. Fingerprint analysis will be conducted generally for parameters that will give information that can be used to help verify that a waste stream received from off-site matches the expected characteristics of the waste.

Because the facility already knows the detailed chemical and physical properties of a waste, the appropriate fingerprint or spot check parameters can be chosen easily, since the purpose of the fingerprint is only to verify that the waste received is the waste expected.

Appropriate fingerprint parameters will be selected based on the pre-acceptance waste characterization data, shipment paperwork, physical form of the waste, and the visual inspection of the contents of containers and bulk waste.

Fingerprint analysis will also include parameters as necessary to ensure that the waste is within the facility's regulatory and operational acceptance limits. To select additional sample parameters, the facility will consider:

- compliance with applicable regulatory and permit requirements. (This may require selection of parameters not reported by the generator);
- identification of incompatible and inappropriate wastes; and
- process and design considerations.

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While the incoming shipment is staged at the sampling station, laboratory personnel, or other trained personnel, will review the laboratory requirements for the specific waste stream. After completion of this review, sampling personnel will obtain the necessary samples in the manner prescribed by laboratory requirements. Sampling will be conducted in accordance with approved site operating procedures. These procedures will detail the sampling requirements, sample labeling, chain-of-custody requirements, any necessary sample preservation requirements, and other sampling components (see Section 4.6).

As noted, fingerprint analysis helps the facility minimize the potential to receive waste that is unacceptable. Therefore, the level of analysis required for a waste shipment is a function of the facility's knowledge about the waste generation process and the waste generator. Fingerprint analysis will be conducted for at least one qualitative and one quantitative parameter (see Section 4.5.5). The facility may elect to perform additional fingerprint tests to achieve a higher level of confidence that a full waste characterization is achieved. If discrepancies are noted between the received waste and the Waste Profile Form, the waste will be further analyzed using additional fingerprint parameters. Discrepancies that can result in the facility requiring additional analysis include non-conformance with the results of required testing or a change in color, texture, liquid content, or other characteristics that can be observed upon receipt.

The facility will follow the parameter selection process described in Section 2.2 of the EPA guidance document, *Waste Analysis at Facilities That Generate, Treat, Store, and Dispose of Hazardous Wastes*, April 1994.

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Each waste stream in each shipment will be sampled in accordance with the following sampling rate, at a minimum:

- **bulk waste.** - One sample will be collected from each shipment of bulk waste (one shipment of bulk waste is considered to be one truck load or one roll-off box). If, upon visual inspection, the color and viscosity of solids or sludges appear inconsistent, the Facility may elect to obtain additional samples. These samples would be composites from within the different areas of color or viscosity; and

- **batch waste.** - One sample will be collected from each ten waste drums in each waste stream in each shipment. If there are less than ten waste drums in the waste stream, one drum will be sampled. One sample will be collected from each drum if the waste appears to be inconsistent with the pre-acceptance waste characterization data.

The facility can increase this sampling rate for any reason. For example, the facility may decide to collect additional samples if the waste appears to be inconsistent with the pre-acceptance characterization data. In some instances, the facility may elect to waive one or more analyses under the following conditions:

- the transported waste is a portion of a continuously shipped, well documented waste stream, such as waste produced from a consistent, non-variable process or contaminated soils from a specific remedial action;

- the waste has been approved for receipt by NMED on an emergency basis; or

- facility personnel at the point of generation sampled, or oversaw the sampling of, the waste, and the fingerprint test/supplemental analyses have been conducted. (In cases where a generator is sending very large or continual shipments, the facility may elect to station personnel at the point of generation to obtain samples prior to or during loading of the waste).

Prior to waiving sampling and analysis requirements, however, the facility will request a variance from NMED and will not dispose of the waste until NMED approval is received.

4.4.3.2 Annual ~~a~~Analysis

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As part of the facility's QA/QC procedures (see Section 4.7), the representative sample analysis for each waste stream from each generator will be repeated annually. Repeating this pre-acceptance procedure will ensure that the analysis is accurate and up-to-date and that the waste stream has remained within the operational bounds of the facility. This annual analysis will be performed by an independent laboratory. This analysis will be repeated more frequently if the facility believes, or has been informed by the generator, that the process generating the waste stream has changed. ~~The generator will be required to provide the facility with a revised Waste Profile Form and a representative sample of the changed waste prior to the first shipment of the waste after a process change~~In the case of a change in the waste generation process the waste stream will be managed as a new waste stream in accordance with the requirements of this waste analysis plan.

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4.4.4 Acceptance/Rejection Determination

4.4.4.1 Discrepancy R~~r~~esolution

~~.~~ Upon completion of the fingerprint analysis, a determination will be made as to whether or not the wastes are consistent with the pre-acceptance waste characterization information and within acceptance limits of the facility and specific management units. If any of the analyses determine the waste is not within a specific management unit's operational acceptance limits, the waste will not be accepted by the facility for that unit. If the results of the analysis conflict with the waste profile information, the facility may take any or all of the following actions:

- resample the waste, if necessary, and perform a second fingerprint test. The facility manager has discretion to accept the waste if the second fingerprint results match those on the waste profile sheet. The discrepancy between results will be explained and included in the facility Operating Record for that waste stream or shipment;
- perform further characterization as necessary to verify the composition of the waste by sending a sample to a qualified independent analytical laboratory; and/or
- reject the entire waste shipment or the nonconforming portion of the shipment.

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4.4.4.2 Shipment A~~a~~cceptance P~~p~~rocedures

~~.~~ Once the decision has been made to accept a waste shipment, the appropriate papers will be signed for the generator, and the waste stream will be transported by truck to an appropriate management unit.

4.5 WASTE ANALYSIS

Tables 4-~~2~~1 through 4-~~4~~3 specify parameters which will be analyzed to ensure that all criteria for waste acceptance and management are met. ~~If analytical methods other than those contained in this section are found to be necessary, the facility will refer to the most current version of EPA document SW-846 to select appropriate methods. All analytical methods contained in this section will be updated to conform with updates recommended in SW-846 or by the Americal Society for Testing and Materials (ASTM)~~The facility will use approved analytical methods from SW-846, the American Society for Testing and Materials (ASTM), or other approved method.~~.~~

Sections 4.5.1 identifies the parameters and analytical methods which will be used to test hazardous waste managed at the facility. Requirements for the pre-acceptance analysis of a representative sample of waste generated off-site and for the annual analysis are discussed in Sections 4.5.2 and 4.5.3, respectively. Section 4.5.4 contains requirements for fingerprint testing. Section 4.5.5 contains waste analysis requirements specific to storage, treatment, and disposal units. Section 4.5.6 contains requirements for waste analysis of waste generated on-site.

4.5.1 Analytical Parameters

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Typical parameters which will be tested to characterize a waste stream are specified in Section 4.5.1.1. Additional parameters to ensure compliance with the LDR standards are specified in Section 4.5.1.2. Parameters to ensure compliance with other facility regulatory and operational limits are contained in Section 4.5.1.3. For each waste stream accepted at the facility, appropriate parameters will be selected from each table to ensure that each of the facility criteria are met.

The tables overlap because analysis of some parameters will meet more than one criterion. For instance, analysis of volatile organic compounds (VOCs) is contained in Table 4-1 as a general analytical parameter because it may be an integral component of the waste stream. It is also included in Table 4-2 because analysis of each hazardous VOC is necessary to ensure that the LDR standards are met. Table 4-3 includes analysis of ~~A different analysis for determination of VOCs is included VOC in Table 4-43 to determine whether a waste stream is exempt from requirements under 40 CFR 268, Subpart CC~~VOCs to determine whether a waste stream is exempt from the requirements defined in 40 CFR 268 Subpart CC.

TABLE 4-1
EXAMPLE PARAMETERS AND METHODS FOR PRE-ACCEPTANCE REPRESENTATIVE SAMPLE ANALYSIS*

Waste Parameters	Extraction/Sample Preparation	Method1
Volatile Organic Compounds	5021 5031 5032 5035	8260
Semivolatile Organic Compounds	3510 3520	8270
Organochlorine Pesticides	3510 3520	8081/8270
PCBs	3520	8082/8080
TCLP: Organics	1311	8260/8270/8080/8150
Chlorinated Herbicides	81512	8151
Reactive Cyanide		9014
Reactive Sulfide		9034
Water		ASTM C566
Ignitability		1010/1030
Flashpoint		1010/1020A
Corrosivity to metals		1110 pH paper pH electrometer 9040A/9041A/9045A
pH		9040A/9041A9045A
Dioxins		8280
Total Metals	3000 1311	6000 series 7000 series
Liner Compatibility Tests		9090A
Extractable volatiles	3500	8260
Extractable semivolatiles	3500	8270

Notes: [1]Most current revision of SW-846 will be used.
[2]Method 8151 contains the extraction, cleanup, and determinative procedures for these analytes.
*This table represents examples only. Final determination of methods will be made dependent upon the waste form, expected constituents, and available information regarding the waste.

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TABLE 4-2 ANALYTICAL METHODS FOR FINGERPRINT SAMPLES*		
Test	**Method and Description**	**Qualitative or Quantitative**
Flammability Potential Screen	ASTM D4982	Qualitative
Free Liquids	Paint filter test, penetrometer, or visual/9095	Qualitative
Ignitability	Match test, Pansky-Martens closed cup or Set-a-flash 1010/1020A	Qualitative
Miscibility	50/50 mixture with water	Qualitative
Water Mix	ASTM D5058 Test Method C	Qualitative
Chlorinated Solvents	Colorimetric test or Beilsten test	Quantitative
Cyanide	Electrode or colorimetric test (ASTM D5049 Test Method B)	Quantitative
PCBs	Colorimetric test/8080	Quantitative
Specific Gravity	Hydrometer/Method dependent on material composition and physical state	Quantitative
Sulfide screen	ASTM 4978	Quantitative
*This table represents examples only. Final determination of methods will be made dependent upon the waste form, expected constituents, and available information regarding the waste.		

TABLE 4-3 ADDITIONAL ANALYTICAL METHODS*		
Method	**Reference**	**Description**
Paint Filter Test	EPA 9095	This test will determine the free liquids that are contained within the waste matrix and will be used as a control parameter for wastes that are to be landfilled.
Heavy Metals	6010A/7470	This test determines the concentration of heavy metals.
Free Cyanides	APHA 412G, H	This test determines if cyanides could potentially be reactive under acidic conditions.
Toxicity Characteristic Leaching Procedure[1]	Extraction Method 1311/3010A	Determines if waste, or stabilized waste, contains level of restricted constituents above BDAT treatment standards.
Total Organic Halogens	EPA 9020	Determines if the waste potentially contains LDR constituents above BDAT standards for "California List" wastes.
PCBs	EPA 8080	Determines if PCBs are contained in the waste matrix and determines the concentration.
IR Scan	ASTM D2621, D4053	Determines the presence of organics and provides a rough estimate of their concentration.
[1]Analytical method chosen is dependent upon constituent being determined (i.e., Organics 8260, 8270, 8080). *This table represents examples only. Final determination of methods will be made dependent upon the waste form, expected constituents, and available information regarding the waste.		

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4.5.1.1 Parameters for Waste Characterization

~~.~~ Table 4-1 specifies ~~basic~~ typical parameters to confirm that a waste stream agrees with the information provided by the generator. ~~Table 4.2-1 includes several screening tests to provide a very generalized indentification of the waste.~~

The rationale for the selection of these parameters is as follows:

- **total volatile organic compounds (VOCs).** - This test will determine the presence and concentration of individual VOCs;

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- **total semi-volatile organic compounds (SVOCs).** - This test will determine the presence and concentration of individual SVOCs;

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- **metals and inorganic constituents.** - These tests will determine the presence and concentrations of individual metals and other inorganic constituents;

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- **physical appearance.** - This test determines the general identity of the waste and establishes baseline characteristics that can then be subjectively compared with the waste shipment when it arrives at the facility. The waste is visually inspected and the physical appearance of the waste is recorded, including, at a minimum, the following properties: Color, physical state (solid, semi-solid, or liquid), texture, viscosity, layering (single phase, bi-layer, multi-layer) and presence of free liquids;

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- **pH.** - This test indicates the corrosive nature of the waste. It also determines compatibility with other wastes and with containers or liners, and treatment requirements. The tolerance range for pH is plus or minus 2.5 pH units; and

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- **radioactivity screen.** - This test screens each load using a gamma ray scintillation detector or other appropriate equipment. This test will be used to ensure that the level of radioactivity observed in NORM waste or equipment from oil, gas, and water production containing hazardous constituents is not above regulated limits as defined in 20 NMAC 3.1, Subpart 14 (i.e., the maximum radiation exposure reading at any accessible point does not exceed 50 microroentgens per hour (ΦR/hr), and the maximum radiation reading for sludges and scales contained in oil, gas, and water production equipment does not exceed 50 ΦR/hr, or, if the radiation readings for removable sludges and scales exceed 50 ΦR/hr, the concentration of radium 226, in a representative sample, does not exceed 30 picocuries (30pCi/g)) or is not a material regulated under the Atomic Energy Act of 1954, as amended.

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4.5.1.2 ~~4.5.1.2~~ Additional ~~A~~analysis to ~~E~~ensure ~~C~~compliance with the LDR ~~T~~treatment ~~S~~standards~~.~~

~~**4.5.1.2** The LDR treatment standards require that wastes be treated either to meet designated concentration-based limits for contained hazardous constituents, or by using specified treatment technologies. Table 4-32 specifies parameters to ensure that a waste stream, including underlying constituents, meets the LDR treatment standards identified in 40 CFR~~

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~~268.40 and 268. 48. Table 4-3~~2 ~~also specifies the corresponding analytical methods and applicable sample matrices for each parameter.~~

~~Identification of parameters to demonstrate compliance with LDR standards will be conducted as follows:~~The facility will ensure that LDR treatment standards are met by identifying the appropriate treatment standard requirements as follows:

- **Total waste standards.** All hazardous constituents in the waste or in the treatment residue must be at or below the values for these constituents contained in the Table in 40 CFR 268.40

- **Waste extract standards.** The hazardous constituents in the extract of the waste or in the extract of treatment residue must be at or below the values found in the Table in 40 CFR 268.40, and

- **Technology standards.** The waste must be treated using the technology specified in the Table in 40 CFR 268.40.

Table 4-2 specifies parameters to ensure that a waste stream, including underlying constituents, meets the LDR designated concentration-based limits for contained hazardous waste identified in 40 CFR 268.40. Table 4-2 also specifies the corresponding analytical methods and applicable sample matrices for each parameter.

Identification of parameters to demonstrate compliance with LDR standards will be conducted as follows:

- identification of all hazardous applicable characteristic and listed EPA Hazardous Waste Numbers;

- identification of the appropriate subcategory for each applicable EPA Hazardous Waste Number (from the most current version of the Table in 40 CFR 268.40);

- determination of wastewater/nonwastewater status for the waste stream;

- identification of all underlying hazardous constituents for each applicable EPA Hazardous Waste Number (from the most current version of the Tables in 40 CFR 268.40 and 268.48; and
- selection of the most current versions of the analytical methods associated with all identified hazardous wastes, underlying hazardous constituents, subcategories, and wastewater/nonwastewater status (from Table 4-~~3~~2, SW-846, or equivalent).

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The rationale for the selection of additional parameters to ensure compliance with the LDR standards is as follows:

- **total organic carbon (TOC).** - This test determines the total organic carbon concentration of the waste and is needed to determine whether the waste is a wastewater or nonwastewater;
- **total suspended solids (TSS).** - This test determines the total suspended solids concentration of the waste and is needed to determine whether the waste is a wastewater or nonwastewater;
- **ignitability.** - This is a qualitative test to determine the ignitable nature of the waste, indicate if the waste is prohibited, and determine treatment requirements. It also helps to determine whether the waste is compatible with containers, tanks, liners, piping, structures, equipment, and other waste streams;
- **explosive meter vapor test (TLV sniff test).** - This test determines the fire-producing potential of the waste and whether it is regulated as flammable or combustible by the US Department of Transportation. If liquid waste exceeds 200 ppm, the waste will also be tested for ignitability using the flash point test. The tolerance range for the TLV sniff test is plus or minus 200 ppm;
- **flash point test.** - This test determines the flash point of the waste and determines whether the waste is ignitable**;**
- **pH. -** This test indicates the corrosive nature of the waste. It also determines compatibility with other wastes and with containers or liners, and treatment requirements. The tolerance range for pH is plus or minus 2.5 pH units;
- **reactive sulfide.** - This test determines the reactive nature of the waste, indicates if the waste is prohibited, and determines treatment requirements. It is also used to determine whether the waste is compatible with containers, tanks, liners, piping, structures, equipment, and other waste streams. Wastes containing total releasable sulfide with concentrations less than 500 ppm are considered non-reactive.
- **reactive cyanide.** - This test determines if cyanide could potentially be reactive under acidic conditions, indicates if the waste is prohibited, and determines treatment requirements. It also determines whether the waste is compatible with containers, tanks, liners, piping, structures, equipment, and other waste streams. Wastes containing total releaseable cyanide with concentrations less than 250 ppm are considered non-reactive;

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- **reactivity (compatibility).** - This test determines the compatibility between the waste and the liner, tank, container, or equipment which the waste may contact.

The facility will ensure that potentially incompatible wastes will not be stored, treated, or disposed of in the same location. The facility will perform a compatibility determination based on the pre-acceptance waste characterization information. Acceptable knowledge or assessment information provided on the Waste Profile Form may be used to assign compatibility codes to each waste type form based on 40 CFR 264, Appendix V. For wastes that will be mixed with other waste streams for the purpose of treatment, chemical analysis will be required to ensure the compatibility of the waste streams.

Chemical analysis will be accomplished in three steps, as appropriate for the waste being analyzed:

  - an analysis of the waste for reactive cyanide and sulfide. This analysis will be used to determine the waste's potential to release dangerous levels of hydrogen cyanide or hydrogen sulfide gases in acidic conditions (i.e., pH less than 2);

  - an evaluation of the reactivity characteristics of the waste through process knowledge and a series of analytical procedures that will test for the presence of reactive chemical groups. The procedures in the EPA document, *Design and Development of a Hazardous Waste Reactivity Testing Protocol,* EPA-600/2-84-057, February 1984, will be followed and the results used to assign the waste a reactivity group designation. Figure 4-3, Sequence of Procedure Sets for Determining Reactivity Group, summarizes the reactivity testing protocol; and

  - use of the reactivity group designation contained in Figure 4-3 to evaluate compatibility of the waste with other wastes by comparing it to the compatibility matrix shown in Figure 4-4, Reactivity Group Designation. (Refer to EPA document, *A Method for Determining the Compatibility of Hazardous Wastes*, EPA-600/2-80-076, April 1980, and 40 CFR Part 264, Appendix V, for additional information on waste compatibility);

- **total volatile organic compounds (VOCs).** - This test will determine the presence and concentration of individual VOCs;

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Figure 4-3, Sequence of Procedure Sets for Determining Reactivity Group

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Figure 4-4, Reactivity Group Designation and Compatibility Matrix

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- **total semi-volatile organic compounds (SVOCs).** - This test will determine the presence and concentration of individual SVOCs;

- **metals.** - These tests will determine the presence and concentrations of individual metals and other inorganic constituents;

- **organichlorine pesticides.** - This test determines the pesticide concentration of the waste;

- **chlorinated herbicides.** - This test determines the herbicide concentration of the waste;

- **PCBs.** – This is a quantitative test to determine whether PCBs are contained in oil-bearing and other types of waste and to determine the concentration; and

- **leachate.** - Leachate must be tested for all leachate constituents listed in the Table in 40 CFR 268.40.

4.5.1.3 Additional ~~a~~Analysis to ~~e~~Ensure ~~c~~Compliance with ~~r~~Regulatory and ~~o~~Operational ~~l~~Limits

~~.~~ Table 4-~~4~~3 specifies additional parameters for analysis to ensure that the waste stream is within the facility's operational and regulatory limits. Table 4-~~4~~3 also specifies the corresponding analytical methods and applicable sample matrices for each parameter.

The rationale for the selection of additional parameters to ensure compliance with the facility's regulatory and operational limits is as follows:

- **radioactivity screen.** - See Section 4.5.1.1. This test will determine if the waste is prohibited from acceptance at the facility (see Section 4.1.2 for a list of prohibited wastes);

- **PCBs.** - See Section 4.5.1.2. This test will determine if the waste contains a prohibited concentration of PCBs;

- **VOCs (Subpart BB).** - ~~This test is~~ These tests are conducted as required by 40 CFR 264.1063(d) to determine, for each piece of equipment subject to the requirements of 40 CFR~~,~~ 264, Subpart BB, whether the equipment contains or exceeds 10 percent VOCs by weight. Applicable process knowledge may be used to make this determination~~. A hazardous waste with an organic concentration that equals or exceeds 10 percent by weight will not be accepted by the facility~~;

- **VOCs (Subpart CC).** - ~~This test is~~ These tests are conducted as required by 40 CFR 264.1084(a)(3)(iii) to determine, ~~for~~ if wastes placed in ~~containers,~~ tanks, ~~and~~ the evaporation pond, and the stabilization bins~~, whether the container, tank, or evaporation pond, or stabilization bin i~~ ares subject to the requirements of Subpart CC~~ (i.e., holds a hazardous waste with a volatile organic concentration equal to or greater than 500 parts per million by weight)~~. A

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hazardous waste with a volatile organic concentration equal to or greater than 500 ppmw will be accepted only for storage in approved containers and direct disposal in the landfill;

- **dioxins and dibenzofurans.** - This test is conducted to ensure that the waste stream does not contain dioxins and/or dibenzofurans;

- **nonbiodegradable sorbent test.** - This test is performed as required by 40 CFR 264.314 (prohibition of liquids in landfills). This test is required if the facility determines that the generator did not indicate whether a sorbent was added to the waste or indicates that a sorbent was added but did not specify the name and type of sorbent and whether it is nonbiodegradable. If any of this information is not present, the generator will be contacted for clarification. If uncertainty remains, 40 CFR 264.314(e)(1)(i-iii) will be reviewed. If the sorbent's biodegradability cannot be determined from the list or if the name of the sorbent is unknown, the material will be analyzed following one of the tests referenced in 40 CFR 264.314(e)(2). The facility will select one of the following tests:

  - ASTM Method G21-70 (1984a) - Standard Practice for Determining Resistance of Synthetic Polymer Materials to Fungi;
  - ASTM Method G22-76 (1984b) - Standard Practice for Determining Resistance of Plastics to Bacteria; ~~or~~
  - OECD Test 301B - CO_2 Evolution (Modified Sturm Test) ASTM Method G21-70 (1984a) - Standard Practice for Determining Resistance of Synthetic Polymer Materials to Fungi; or
  - Other approved test method

- **total organic halogens (TOX).** - This test determines if concentrations of halogens in the waste are in compliance with the LDR treatment standards. It also determines if the waste contains constituents that could degrade a liner. Wastes containing TOX greater than 1,000 mg/l (based on TCLP extract) will not be placed in the evaporation pond or the landfill;

- **free liquid content test (paint filter liquids test).** - This test is a qualitative test to determine the free liquids concentration contained within the waste matrix and will be used as a control parameter for wastes that are to be landfilled; ~~and~~

- **toxicity characteristic leaching procedure (TCLP).** - This test must be used to obtain an extract of the waste where treatment standards ~~ARD~~ are based on concentrations in the waste extract;

- major ions and metals in non-leachate (sulfides and sulfates, radionuclides, VOCs, SVOCs, pesticides, PCBs, perchlorate, and TPH).

4.5.2 Representative Sample Analysis

The facility will select appropriate parameters from Tables 4-~~2~~1, 4-~~3~~2, and 4-~~4~~3 for representative sample analysis (see Section 4.3.3) to ensure ~~that that~~that the representative sample of the waste matches the paperwork submitted by the off-site generator and that all three facility criteria are met.

Hazardous debris, as defined in 40 CFR 268.2(g), that has already been treated to meet the LDR treatment standards as described in 40 CFR 268.45 does not have to meet the representative sample analysis requirements if the facility determines that the generator provided waste characterization information that demonstrates that the proper EPA Hazardous Waste Numbers were applied and indicates whether or not the LDR treatment standards have been met.

4.5.3 Annual Analysis

The representative sample analysis for each waste stream from each generator will be repeated annually at an ~~off-site~~independent laboratory not used by the generator (see Section 4.4.3.2).

4.5.4 Fingerprint Analysis

Fingerprint testing (see Section 4.4.3.1) is an abbreviated analysis and is used to confirm that an incoming shipment of waste received at the facility is the actual waste expected and that it matches the expected chemical content for that waste. Parameters for analysis will be selected specifically for each waste stream based on the information supplied by the generator, the physical form of the waste, and the facility's evaluation of the waste. These parameters will be analyzed at the on-site laboratory. Analyses which are not within the on-site laboratory's capability will be sent to an independent ~~off-site~~ laboratory for analysis.

All samples taken for fingerprint analysis will be subject to the tests for physical appearance, pH, and radioactivity (see Table 4-~~2~~1). In addition, all samples will be subject to a minimum of one additional qualitative and one additional quantitative analysis, based on a consideration of the facility's waste acceptance criteria. Supplemental analyses may be conducted to further characterize the waste; this determination will be made by the facility.

4.5.5 Additional Analysis for Specific Management Units

4.5.5.1 Overview of waste management procedures in permitted hazardous waste management units

~~.~~ Upon completion of the fingerprint analysis, and supplemental analyses if conducted, waste will be transferred to the appropriate staging area. Prior to interim or final disposition of the waste, however, additional analyses may be required to ensure that requirements for permitted hazardous waste management units are met.

Analysis necessary for specific management units is generally conducted as part of the pre-acceptance procedure (see Section 4.7.2). Appropriate parameters will be selected from Tables 4-32 and 4-43. The facility will use a combination of process knowledge and analytical results to obtain the information needed prior to placing waste in one of the management units. The facility may elect to

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use other EPA approved analytical methods if it is felt that information other than that obtainable by these methods is needed to manage the waste safely.

All hazardous waste management units will have specific ignitability, reactivity, and compatibility requirements which must be met. Acceptable knowledge or waste analysis will be used to determine whether a waste stream is ignitable, reactive, or incompatible with other wastes when stored or mingled. In addition, acceptable knowledge or waste analysis will be used to determine whether the waste stream is compatible with the container or tank in which it is placed, or with the liner of the evaporation pond or landfill. Specific ignitability, reactivity, and compatibility tests will be conducted as part of the representative sample analysis, and may be repeated in the fingerprint test, for wastes assigned to specific management units. Management of these wastes is discussed in Vol. I, Section 5.5 of this application. Ignitability, reactivity, and compatibility determination is discussed in Section 4.5.1.2.

The facility will conduct compatibility tests as part of the representative sample analysis procedure on an incoming waste stream specific to each management unit and specific to other waste streams with which it may be combined. Special requirements for specific management units are discussed in Sections 4.5.5.12 through 4.5.5.35.

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~~Wastes will be treated in the evaporation pond and in the stabilization tanks. Dilution of restricted wastes will not be used as a substitute for adequate treatment for non-toxic hazardous characteristic waste. If toxic characteristic wastes and listed wastes are amenable to the same type of treatment and aggregation is a part of treatment, then the aggregation step does not constitute impermissible dilution.~~

4.5.5.2 Waste A~~a~~nalysis R~~r~~equirements S~~s~~pecific to S~~s~~torage U~~u~~nits.

Wastes will be stored in the drum storage building, the roll-off container storage area, and the liquid waste storage tanks. ~~Containerized wastes that are not compatible with other wastes may be accepted but will be segregated within the storage area. Waste analysis or acceptable knowledge will be used to ensure that stored waste is compatible with other wastes and with the container or tank in which it is placed~~Waste characterization is accomplished through the representative sample analysis, the yearly update of the representative sample analysis, and on-going fingerprint analysis. The ignitability, reactivity, and incompatibility of each waste stream will be determined using procedures listed in Table 4-2 to ensure that stored waste is compatible with other wastes and with the container or tank in which it is placed. Spills or releases of hazardous waste and/or fluids removed from the leak detection systems will be tested to determine if the recovered material is hazardous.

Procedures from Table 4-3 will be used to determine whether a hazardous~~Hazardous~~ waste stored in containers ~~will be analyzed to determine whether it~~ must comply with the requirements of 40 CFR 264, Subpart CC. If it must comply, the container will be managed to meet Container Level 1~~,~~ and Level 2~~, or Level 3~~ standards as appropriate. Waste which must comply with the requirements of 40 CFR 264, Subpart CC, will not be placed in storage tanks.

The facility will ensure that containers are either at least 90 percent full when placed in the landfill, or are crushed, shredded, or similarly reduced in volume to the maximum practical extent.

4.5.5.~~2~~3 Waste A~~a~~nalysis ~~requirements~~ Requirements S~~s~~pecific to the E~~e~~vaporation P~~p~~ond

Liquid waste streams may be placed in the evaporation pond for drying before they are sent to the stabilization tanks for solidification. ~~Waste placed in the evaporation pond will be tested to ensure that it meets all applicable LDR standards.~~ Following evaporation of the pond liquids, sludge will be removed from the bottom with trash pumps or hand excavation equipment. ~~Waste will be tested after removal from the evaporation pond and prior to treatment in the stabilization tanks to characterize the waste and to determine the proper reagent admixture.~~

Waste will be characterized, using Tables 4-1 through 4-3, before it is placed in the evaporation pond. -A determination of ignitability, reactivity, and incompatibility with other wastes with which the waste may be combined and with the pond liner will be made. It will also be tested to ensure that the LDR standards are met and that the waste placed in the pond does not contain volatile organic concentrations equal to or greater than 500 ppmw.

Because evaporation in the pond may change the chemical composition of the waste, or different waste streams may be combined in the pond, analysis to ensure that the LDR standards are met will be conducted on a waste stream after it leaves the pond. Applicable knowledge will be used to determine appropriate parameters for analysis. If, after treatment, a waste displays a characteristic for

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the first time, the characteristic waste code will be added to the LDR Notification Form and facility records. The waste will be retreated, if necessary, to meet the characteristic treatment standard before land disposal.

Dilution of restricted wastes will not be used as a substitute for adequate treatment for non-toxic hazardous characteristic waste. If toxic characteristic wastes and listed wastes are amenable to the same type of treatment and aggregation is a part of treatment, then the aggregation step does not constitute impermissible dilution.

4.5.5.~~3~~4 Waste A~~a~~nalysis R~~r~~equirements S~~s~~pecific to the S~~s~~tabilization T~~t~~anks.

Waste treated in the stabilization tanks is characterized to determine the hazardous constituents contained in the waste and to ensure that waste placed in the stabilization tank is compatible with the tank liner and with the previous waste type treated. Acidic or caustic material may be neutralized by the stabilization process.
In addition to the representative sample provided by the generator during the pre-acceptance period, a second representative sample of any waste requiring stabilization prior to placement in the landfill (or a sample of waste coming from the evaporation pond for stabilization) must be supplied. This sample will be used for bench-scale testing to determine regulated constituent leaching based on varying admixtures and ratios (i.e., to determine treatability of wastes). The stabilization process will result in a dry and structurally stable material that is suitable for compaction and landfilling.

Bench-scale tests will be conducted as part of the representative ~~samply~~sample analysis for incoming waste streams which will go directly to the stabilization tanks, or for a waste stream from the evaporation pond. Selection of treatment reagents and quantities will be established according to the waste profile and the post-treatment LDR requirements. Stabilization agents that will be tested include, but are not limited to, lime, fly ash, and Portland cement.

The waste will also be treated to ensure that it does not contain volatile organic concentrations equal to or greater than 500 ppmw.

~~Acceptable knowledge or waste analysis will be used to ensure that waste placed in the stabilization tank is compatible with the tank liner and with the previous waste type treated. Acidic or caustic macrial may be neutralized by the stabilization process.~~

The EPA universal treatment standard (see 40 CFR 268.48) will be met for wastes treated on-site. Waste streams that carry more than one characteristic or listed EPA Hazardous Waste Number will be treated to the most stringent treatment requirements for each hazardous waste constituent, including underlying hazardous constituents. When wastes with different treatment standards are combined solely for the purpose of treatment, the most stringent treatment specified will be met for each hazardous constituent in the combined waste.

After stabilization, wastes will be retested prior to placement in the landfill to determine whether they meet LDR requirements. If LDR requirements are not met, the waste will be retreated. After testing, stabilized waste will be placed in roll-off containers and placed on the roll-off pad until cured.

4.5.5.~~4~~5 Waste A~~a~~nalysis R~~r~~equirements S~~s~~pecific to the L~~l~~andfill.

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The stabilized waste will be retested prior to placement in the landfill to determine whether it meets LDR standards as set forth in 40 CFR 268, Subpart D. 40 CFR 268.40 states that a waste identified in the table "Treatment Standards for Hazardous Wastes" may be land disposed only if it meets the requirements found in the table. For each waste, the table identifies one of three types of treatment standard requirements:

- All hazardous constituents in the waste or in the treatment residue must be at or below the values found in the table for that waste ("total waste standards"); or
- The hazardous constituents in the extract of the waste or in the extract of the treatment residue must be at or below the values found in the table ("waste extract standards"; or
- The waste must be treated using the technology specified in the table ("technology standard") which are described in detail in 40 CFR 268.42, Table 4-1.

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In cases where treatment standards are based on concentrations in the waste extract, the facility will use toxicity characteristic leaching procedures (TCLP, see 40 CFR 261, Appendix II) to determine if the waste meets the standards. The sampling and analysis protocols outlined in Sections 4.5 through 4. 7 of this permit application will apply to all wastes to ensure compliance with LDR standards. Parameters for analysis will be determined by the characterization of the waste before analysis. All information obtained to document LDR compliance will be maintained in the facility Operating Record.

In addition to other required procedures and analyses, on an annual basis the facility will randomly sample and analyze a minimum of 10 percent of incoming waste streams that are to be directly landfilled to verify conformance with the LDR requirements. These additional samples will be analyzed for the specific regulated hazardous constituents contained in the hazardous waste stream. The data generated from these samples, in conjunction with the generator-supplied data, will be used to verify conformance with the LDR requirements.

Facility personnel, either at the facility or at the point of generation, will collect these samples. The samples will be split into a minimum of two aliquots. One will be retained and the other analyzed for conformance with the applicable LDR requirements. If the results of the analysis indicate that the waste does not conform with the applicable LDR requirements, the retained sample will be analyzed, generator-supplied information re-evaluated, and an evaluation made of the potential for the waste's variability based on the process that generates the waste stream.

The retained sample will subsequently be analyzed, the generator-supplied information re-evaluated, and an evaluation made of the potential for the waste's variability based on the process that generated the waste stream. These factors, along with an evaluation of the QA/QC data from the laboratory (both the generator's and the facility's), will be used to determine if the subject waste stream is eligible for continued disposal at the facility or if additional treatment is necessary prior to disposal. Disposal of the waste stream will be discontinued until the discrepancy regarding compliance with the LDR requirements has been resolved and the generator has demonstrated that its on-going program for compliance with LDR requirements is adequate.

Procedures to meet LDR standards for specific wastes include the following:

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- **lab packs.** - Prior to disposal, hazardous wastes contained in lab packs will be treated to meet applicable treatment standards for each waste type identified. Procedures to determine applicable treatment requirements, and the subsequent treatment of lab wastes to applicable standards, will be consistent with procedures implemented for other waste types. Lab packs will also be analyzed to ensure that they do not contain hazardous wastes listed in 40 CFR 264, Appendix IV. In cases where hazardous lab pack wastes are combined with non-hazardous lab pack wastes prior to or during treatment, the entire mixture will be treated to meet the most stringent treatment standard for each hazardous constituent before being disposed of in the landfill;

- **ignitable or reactive wastes.** - Ignitable or reactive hazardous waste will be tested to ensure that it will not be placed in the landfill until the waste has been rendered non-ignitable or non-reactive by treatment;

- **characteristic wastes.** - Generator process knowledge and/or analytical data will be used to determine whether characteristic ~~wstes~~wastes meet the applicable treatment standards or to demonstrate that the waste has been treated b~~v~~y the appropriate specified treatment technology. In accordance with 40 CFR 268.41, where treatment standards are based on concentrations in the waste extract, generators shipping waste to the facility will determine if their wastes meet treatment standards; ~~and~~

- **bulk liquids.** All hazardous wastes will be tested for the presence of free liquids (paint filter test) to ensure that no free liquids are placed in the landfill. No containers holding free liquids will be placed in the landfill unless the container is in a lab pack, or the container was designed to hold liquid for use other than storage, such as a battery or capicitor, or the container is very small, such as an ampule;

- **Reactive wastes.** - Reactive wastes will not be placed in the landfill until they have been rendered nonreactive by treatment;

- **Incompatible wastes.** - Incompatible wastes will be sufficiently separated when placed in the landfill to ensure that they do not combine to cause adverse reactions. These wastes will be managed to ensure that they meet the requirements specified in 40 CFR 264.313 and 274.17. This management includes placing incompatible wastes in non-adjacent landfill grids and treatment of potentially noncomp~~atilbie~~atible wastes prior to landfilling~~placed in different cells in the landfill~~; and

- **hazardous debris.** - Hazardous debris will not be treated at the facility. Therefore, the facility will only accept hazardous debris that has been treated and certified to meet the LDR treatment standards specified in 40 CFR 268.45(b) or (c) by the generator prior to shipment to the facility.

- **listed waste.**-Listed waste will not be placed in the landfill until it has been shown to meet the requirements of 40 CFR 268.40.

4.5.6 Waste Analysis Requirements for Waste Generated On-Site

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4.5.6.1 Overview of ~~W~~waste ~~G~~generated on-~~S~~site

The facility is expected to generate some waste on-site through waste treatment, day-to-day facility operations, leachate, or releases of hazardous waste to the environment.

Waste generated on-site will be assumed to be RCRA-regulated until process knowledge and/or sampling and analysis can be used to determine the actual nature of the waste. Sampling and analysis will be accomplished in accordance with the requirements this waste analysis plan.

The facility will select waste analysis parameters to confirm the identity of waste streams generated at the facility. The selection of waste analysis parameters will typically be based on knowledge of the physical and chemical processes that produced the waste stream. If there is doubt as to the specific source, the facility will use the waste tracking system to identify all possible sources and to develop a list of specific parameters for laboratory analysis. Acceptable knowledge and analytical testing as necessary will be used to ensure compliance with LDR requirements and provide waste compatibility and other information to determine appropriate waste management activities.

After analysis, the waste will be returned to the unit from which it came or sent to another appropriate unit. The facility will ensure that all on-site generated waste sent to the landfill meets all LDR treatment standards.

Treated waste is considered newly generated waste because hazardous waste treatment at the facility will result in a change in the physical and/or chemical character or composition of the waste. ~~Waste analysis requirements for managing waste after treatment and before disposal in the landfill are discussed in Sections 4.5.2, 4.5.3, and 4.6.3.5.4.~~Treated waste will be recharacterized, using waste analysis or acceptable knowledge as appropriate and it will be tested to ensure that LDR treatment standards are met before disposal in the landfill. Waste analysis requirements are discussed in Section 4.5.5.5.

Day-to-day operations at the facility will produce some waste on-site from day-to-day operations (e.g., paint and paint strippers, laboratory chemicals and equipment, vehicle maintenance). This waste will be characterized using acceptable knowledge, or waste analysis if the source cannot be definitively determined. If it is hazardous waste, it may be sent to the evaporation pond or stabilization tanks for treatment as appropriate, and disposed in the landfill. If it is not hazardous waste, it will be sent off-site for disposal.

~~Landfill and evaporation pond fluids that pass through the primary liners are leachates in accordance with the definition in 40 CFR 260.10, which identifies these leachates as multi-source leachates. These leachates are managed as wastes when they enter and are ultimately removed from either the Leachate Collection and Removal System, the Leak Detection and Removal System, and the Vadose Zone Monitoring System.~~

~~Leak detection and removal/vadose zone monitoring for evaporation pond leacdhate is discussed in Vol. I, Sections 2.6.1.2 and 2.6.4.3 of this application. Procedures for the removal of evaporation pond sludge are discussed in Section 2.5.4.3. Sludge will be removed by vacuum truck on a regular basis, analyzed, and sent to the stabilization tanks for solidification. Evaporation pond leachate that does not meet applicable LDR requirements~~

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~~will then be treated in the stabilization unit before landfilling. Procedures to control failure of the evaporation pond are contained in Section 6.3.5.3 of this application.~~

~~Leachate generated from the landfill will be pumped out of the unit sumps into tanks or tanker trucks. It will then be tested to assure compliance with LDR requirements defined in 40 CFR Part 268 for F039 listed wastes. Parameters and methods for analysis of the leachate are provided in the *Vadose Zone Monitoring System Work Plan* (submitted separately)~~

A **release** is defined as "any spilling, leaking, pouring, emitting, emptying, discharging, injecting, pumping, escaping, leaching, dumping, or disposing of hazardous waste (including hazardous constituents) into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing hazardous wastes or hazardous constituents)". The various types of releases and management procedures for each release are discussed below. ~~Section 4.5.6.3 briefly discusses further disposition of this waste.~~

The facility has a number of ~~A~~areas/activities with the potential to generate releases of hazardous waste. ~~are identified in Table 4-14. The areas identified are shown in Volume III, Drawing 4, of this application. Table 4-14 also identifies release types and associated media.~~ Management protocols for releases generated on-site are discussed below:

- **spills and leaks.** - Spills and leaks may occur during ordinary facility operations (e.g., release of fluid from a leaking drum to the cell trench and sump in the drum handling unit, a spill at any loading or unloading area, or overtopping at the evaporation pond).

  Provisions for the detection, characterization, and management of spills and leaks are discussed in Vol. I, Sections 2.0, 5.4.2 , 6.3.5.2, and 6.3.7 of this application. ~~If spills~~If spills and/or leaks are identified during inspections, the materials will typically be removed from the system, characterized, and managed appropriately. If necessary, the contaminated area will be sampled to ensure that all contaminated materials are removed.

- **decontamination rinse water.** - Personal protection equipment (PPE), as well as other equipment (e.g., trucks, sampling equipment, industrial absorbents used during spill or leak clean-up, emergency equipment), may become contaminated during the course of site operations such as the handling of wastes, the transfer of waste to another unit, or emergency operations. The water used to rinse this equipment will be analyzed to determine if it is a hazardous waste and if the equipment has been adequately decontaminated. Provisions for the detection, characterization, and management of decontamination rinse water are discussed in Vol. I, Sections 5.2.5 and 5.2.10, and Vol III, Section 9.1.2, of this application. Rinse water will be removed to the

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truck wash area. Rinse water and residues will be chemically analyzed and handled in an appropriate manner;

- **run-on/run-off.** - Facility stormwater control is provided by a network of surface run-on and run-off diversion channels and collection and detention basins (see Vol III, Drawing 25 of this application). To control the run-off from the facility, several collection channels and culverts will be built to divert discharges from storm events to a stormwater retention basin (see Section 2.7 of the Operations and Maintenance Plan, submitted separately). Procedures for management of run-on/run-off are discussed in Volume I, Sections 2.5.1.6, 2.6.1.4, and 5.4.2. Contaminated water will be characterized, treated in the evaporation pond and/or stabilization bins, and disposed of in the landfill in compliance with appropriate regulations. Sampling will be conducted upstream of the stormwater retention basin to determine the point where hazardous constituents were introduced into the stormwater. Appropriate corrective actions will be implemented to prevent further contamination during future stormwater events.

~~Section xx of Vol. I of this application specifies the sampling procedures that will be followed to properly characterize any contaminated run-on/run-off water.~~

- **investigation derived wastes.** - IDW may include drill muds, cuttings, and well installation purge waters associated with the investigation of spills and releases; purge waters, soils and other materials from regularly scheduled sampling activities associated with waste management units and the vadose zone monitoring system; and contaminated PPE. All IDW will be assumed to be hazardous waste until site or material specific information becomes available. IDW will be stored near the point of generation in appropriately labeled containers for no greater than 90 days and ~~shall~~ will be appropriately analyzed to determine whether it is either a characteristic or listed hazardous waste. Analysis of materials associated with the IDW may be used also to characterize the IDW. An example of associated analysis for urge waters from the vadose zone monitoring system would be the final analytical results for the samples collected to satisfy regularly scheduled monitoring requirements.

- **contaminated soil.** - Soil means unconsolidated ~~earthern~~earthen material consisting of clay, silt, sand or gravel size particles as classified by the US Natural Resource Conservation Service, or a mixture of such materials with liquids, sludges or solids which is inseparable by simple mechanical removal processes and is made primarily of soil by volume based on visual inspection. Contaminated soil is soil impacted by a hazardous constituent release. Soil may become impacted by a release either at the surface or subsurface. If the contaminated soil exists at the surface, the appropriate response is described in the Contingency Plan in the Permit Application. If the contaminated soil exists subsurface, the appropriate response will be developed by NMED as permit conditions. Contaminated soils that are managed as hazardous wastes will be analyzed and managed in accordance with the ~~Phase IV, Part 2 LDR rule~~alternative LDR treatment standards for contaminated soil contained in 40 CFR 268.49.

- **air emissions.** - Procedures for detection of hazardous gases and volatile ~~organics~~organic at the landfill are discussed in Vol. I, Sections 2.5.1.8 and 6.2.2 of this application. Procedures to minimize wind dispersal of dust throughout the facility are identified in Section 5.4.8. This section also discusses pollution control systems in the stabilization unit to minimize the release of ~~particulates~~particulate to the atmosphere. The

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facility will apply to NMED for a new source air emissions permit before start-up of operations.

- **Leachate.-**Leachate collected from the storage units or the stabilization building is treated as a spill or release. ~~Leachates~~Leaches as used here refer to landfill and evaporation pond fluids. The definition of leachate in 40 CFR 260.10, collected from the Leachate Collection and Removal System, the Leak Detection system, or the Vadose Zone Monitoring System sumps.

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Leak detection and removal/vadose zone monitoring for evaporation pond leachate is discussed in Vol. 1, Sections 2.6.1.2 and 2.6.4.3 of this application. Procedures for the removal of evaporation pond leachate are discussed in Section 2.5.4.3. Leachate will be removed by vacuum truck on a regular basis, combined with leachate from the landfill and treated in the stabilization tanks to remove free liquids and to ensure that LDR treatment standards are met.

Leak detection an removal/vadose zone monitoring for landfill leachate is discussed in Vol 1, Sections 2.5.1.3, 2.5.1.4, and 2.5.1.5. Leachate generated from the landfill will be pumped out of the unit sumps into the temporary leachate storage tank. It will then be tested to assure compliance with LDR requirements defined in 40 CFR 268 for F039 listed wastes.

Leachate will be transferred daily from both the landfill and the surface impoundment sumps and combined in temporary storage tanks for management purposes. The combined leachate will be analyzed monthly for the F039 underlying ~~hazardsous~~hazardous constituents to determine whether it meets LDR treatment standards and can undergo evaporation in the surface impoundment prior to stabilization.

Leachate may also be collected from the Vadose Zone Monitoring Wells. These wells will be monitored monthly; if any fluids are present they will be sampled and analyzed for all F039 constituents. Biennially, the wells will be analyzed for all the Ground Waste Monitoring List identified in 40 CFR 264, Appendix IX.

Leachate sampling and analysis will follow the sampling and analytical procedures and recordkeeping requirements contained in the Vadose Zone Monitoring System Work Plan and this section.

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~~**THE FACILITY WILL APPLY TO NMED FOR A NEW SOURCE AIR EMISSIONS PERMIT BEFORE START-UP OF OPERATIONS.**~~

~~4.5.6.2 SELECTION OF WASTE ANALYSIS PARAMETERS.~~ ~~**WASTE GENERATED ON-SITE WILL BE ASSUMED TO BE RCRA-REGULATED UNTIL PROCESS KNOWLEDGE AND/OR SAMPLING AND ANALYSIS CAN BE USED TO DETERMINE THE ACTUAL NATURE OF THE WASTE. SAMPLING AND ANALYSIS WILL BE ACCOMPLISHED IN ACCORDANCE WITH THE REQUIREMENTS OF SECTIONS 4.7 THROUGH 4.9.**~~

~~**THE FACILITY WILL SELECT WASTE ANALYSIS PARAMETERS TO CONFIRM THE IDENTITY OF WASTE STREAMS GENERATED AT THE FACILITY. THE SELECTION OF WASTE ANALYSIS PARAMETERS WILL TYPICALLY BE**~~

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~~BASED ON KNOWLEDGE OF THE PHYSICAL AND CHEMICAL PROCESSES THAT PRODUCED THE WASTE STREAM. IF THERE IS DOUBT AS TO THE SPECIFIC SOURCE, THE FACILITY WILL USE THE WASTE TRACKING SYSTEM TO IDENTIFY ALL POSSIBLE SOURCES AND TO DEVELOP A LIST OF SPECIFIC PARAMETERS FOR LABORATORY ANALYSIS. ACCEPTABLE KNOWLEDGE AND ANALYTICAL TESTING AS NECESSARY WILL BE USED TO ENSURE COMPLIANCE WITH LDR REQUIREMENTS AND PROVIDE WASTE COMPATIBILITY AND OTHER INFORMATION TO DETERMINE APPROPRIATE WASTE MANAGEMENT ACTIVITIES.~~

~~AFTER ANALYSIS, THE WASTE WILL BE RETURNED TO THE UNIT FROM WHICH IT CAME OR SENT TO ANOTHER APPROPRIATE UNIT. THE FACILITY WILL ENSURE THAT ALL ON-SITE GENERATED WASTE SENT TO THE LANDFILL MEETS ALL LDR TREATMENT STANDARDS.~~

~~BOTH THE LANDFILL AND SURFACE IMPOUNDMENT F039 LEACHATES WILL BE ANALYZED SEPARATELY AT LEAST ONCE A MONTH AT THE POINT OF GENERATION. THESE LEACHATES WILL BE ANALYZED FOR ALL CONSTITUENTS SPECIFIED IN 40 CFR PART 264, APPENDIX IX USING APPROPRIATE METHODS SPECIFIED IN SW-846. THE PURPOSE OF ANALYZING THESE LEACHATES IS TO IDENTIFY THOSE CONSTITUENTS THAT WILL BE MONITORED IN THE VADOSE ZONE MONITORING SYSTEM.~~

~~LEACHATES WILL BE TRANSFERRED DAILY FROM BOTH THE LANDFILL AND THE SURFACE IMPOUNDMENT AND COMBINED IN TEMPORARY STORAGE TANKS FOR MANAGEMENT PURPOSES. THE COMBINED LEACHATE WILL BE ANALYZED FOR THE F039 UNDERLYING HAZARDOUS CONSTITUENTS TO ASSURE COMPLIANCE WITH THE LDR UST PRIOR TO STABILIZATION TO DETERMINE WHETHER THEY CAN UNDERGO EVAPORATION IN THE SURFACE IMPOUNDMENT. LEACHATES THAT DO NOT MEET THE UST WILL UNDERGO STABILIZATION WITHOUT EVAPORATION. ESCAPED LEACHATES THAT HAVE BEEN RELEASED (SEE DISCUSSION ABOVE) ARE HAZARDOUS WASTES VIA THE CONTAINED-IN RULE.~~

~~ANALYSIS OF THE F039 LEACHATE WILL FOLLOW THE SAMPLE COLLECTION AND QA/QC PROCEDURES OF SECTION 4.6 (SAMPLING PLAN), THE LABORATORY QA/QC PROCEDURES OF SECTION 4.8 (ANALYTICAL METHODS), AND THE RECORDING AND REPORTING PROCEDURES OF SECTION 4.9 (NOTIFICATION, CERTIFICATION, AND RECORDKEEPING).~~

4.6 SAMPLING PLAN

Prior to beginning operations, the facility will submit the facility sampling plan. The plan will be developed based upon the guidance provided in Chapter 9 of SW-846. The overall plan will take into account the regulatory and scientific objectives identified in this waste analysis plan. Based upon these objectives, the sampling strategy will ensure that the data collected will minimize the potential for accepting waste that is unsuitable for management at the facility.

The sampling program will take into account the different types of waste constituents and the various waste matrices that may be encountered. By taking these variables into account, the facility will

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identify the protocols by which sample locations will be selected and the methods most appropriate for collecting samples from the different waste streams.

The current revision of SW-846, ASTM methods, or other approved methods will be used, and site procedures will be revised as necessary to incorporate new requirements.

Sampling methods and collection techniques which will be included in the sampling plan are discussed in Section 4.6.1. Section 4.6.2 discusses the plan's quality assurance/quality control (QA/QC) procedures.

4.6.1 Sampling Methods

Sampling methods will follow Appendix I of 40 CFR, Part 261. Table 4-5, Sampling Methods, lists waste matrices and appropriate sampling methods that will be used at the facility. The methods and equipment used for sampling wastes will vary with the form and consistency of the material to be sampled.

4.6.2. Collection Techniques

This section discusses decision-making for selection of sample locations (Section 4.6.2.1) and sample types (Section 4.6.2.2).

4.6.2.1 Selection of S~~s~~ample L~~l~~ocations

~~.~~ The facility will collect samples from containers and roll-off boxes using either random (i.e., probability) or biased (i.e., authoritative) sampling methods.

With random sampling, every unit in a population (e.g., every drum from a given waste stream in a shipment) has a theoretically equal chance of being selected for sampling. Consequently, data generated by these samples are unbiased estimators of the range of concentrations in a population. If a sufficient number of samples are taken, they would be representative of the average concentrations within the entire population.

There are a number of ways that samples can be randomly selected from a population of drums or from a particular location in a roll-off of non-liquid waste. In the case of drums, drum numbers could be randomly drawn, while for a roll-off of non-liquid waste, the container could have numbers assigned to an imaginary grid and the numbers selected using a random-numbers table.

With biased sampling, a preference is given to selecting only certain units in a population. This technique requires the sampler to use discretion and to have knowledge of the waste. The sampler selects the sample locations from areas where contamination is known or suspected (e.g., the sampler could collect a biased sample from areas where there is layering or differences in color or consistency). Also, the facility may use a field screening instrument to bias the sample location, (e.g., a photoionization detector could be used to select locations having higher volatile organic concentrations). EPA-approved ASTM method D140-70 identifies the procedure for estimating the number of containers that should be sampled.

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The facility will collect random samples from containers and roll-off boxes if the wastes are expected to be fairly ~~homogeneous waste~~homogeneous waste streams. Biased samples will be collected if the wastes are expected to be or are found to be during the visual inspection fairly heterogeneous. For some waste streams, the facility may use both sampling techniques.

The facility will document the sampling technique that is used to locate each waste sample collected pursuant to this waste analysis plan. The facility will maintain this information in the facility Operating Record.

4.6.2.2 Sample T~~t~~ypes

~~.~~ Samples of the waste will be collected as either composite or grab samples. The facility will develop procedures for the collection of composite and grab samples before the facility becomes operational; these procedures will be included in the facility sampling plan.

In composite sampling, a number of samples are initially collected from a waste and combined into a single sample which is then analyzed for the constituents of concern. Composite sampling is a valid method for homogeneous samples and tends to minimize the between-sample variation, much like the maximization of the physical size of a sample. This has the effect of reducing the number of samples that must be analyzed to verify the contents of a waste shipment. Composite samples can also be obtained from a waste that has stratified; however, a composite would only be made from samples obtained from the same strata within the waste. Composite samples will be taken with clean sampling equipment and samples will be blended before analysis. Composite sampling will be used to obtain samples of wastewaters.

Grab sampling will be used to obtain samples of nonwastewaters and heterogeneous wastes.

4.6.3 Sampling QA/QC

QA procedures developed for the sampling program at the facility will be included in the facility sampling plan. These procedures will be conducted in accordance with the guidance provided in the EPA document SW-846 and EPA's guidance manual, *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste*. The QA requirements will be applicable to on-site sampling (e.g., leachate collection system samples, truck rinsate, waste removed from the evaporation pond) as well as to the sampling of incoming waste shipments. This program is required for ensuring that decisions regarding the acceptance and disposition of waste are based on sound, statistically valid, and documented data.

The sampling QA program will include the following:

- training requirements for personnel responsible for sample collection;
- chain-of-custody protocols for tracking samples;
- QA review of procedures to ensure proper use of equipment;
- protocols for equipment maintenance;
- identification of required sampling techniques for specific media;
- field sampling QC procedures; and
- documentation of sampling locations.

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Deviations from the approved sampling program, sampling methods, or chemical analytical methods will be documented and reviewed by personnel responsible for site QA. NMED will be notified in writing of the QA exceptions within seven days of the occurrence and measures will be taken to correct the problems as soon as practicable.

4.6.3.1 Training Requirements for Personnel Responsible for Sample Collection

All personnel and supervisory staff responsible for collecting waste samples for screening and chemical analysis will be trained in the use of all sampling methods and equipment used at the site. The sampling methods and equipment include but are not limited to those listed in the EPA Waste Analysis Plan guidance manual.

The facility will submit a Health and Safety Plan approved by a certified industrial hygienist to NMED for review and approval prior to accepting any waste at the facility. The Health and Safety Plan will be reviewed annually and updated as needed. The facility operations will comply with all applicable health and safety regulations in 20 CFR 1910, 20 CFR 1926, and 11 NMAC 5.1-5.4.

4.6.3.2 Chain-of-Custody Protocols for Racking Samples

The integrity of the sampling/analytical scheme will be maintained by following chain-of-custody procedures from the point of sample collection through analytical data reporting to sample disposal. The possession and handling of samples will be traceable from the time of collection through analysis and final disposition.

A sample is considered to be in a person's custody if it is:

- in a person's physical possession;
- in view of the person after taking possession; or
- secured in a container sealed by the responsible person so that it cannot be tampered with during transport to the designated destination or during storage after being secured by that person in an area of restricted access.

The sampler will place a sample label on each sample container. The label will include the following information:

- sample number, a unique identifier that is traceable to the waste stream and shipment;
- name of collector (sampler);
- date and time of collection; and
- place of collection.

Labels will be affixed to sample containers prior to or at the time of sampling and will be filled out at the time of collection.

Sample chain-of-custody seals will be required if the sample is designated to leave the possession of facility personnel for transport to an analytical laboratory. The seal will include the same information as the sample label. The seal will be attached in such a way that it is necessary to break it in order to

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open the sample container. In addition, chain-of-custody seals will be affixed to sample storage containers in a similar manner in order to prevent tampering prior to shipment from the facility to off-site analytical laboratories. Samples and storage containers which require seals must be sealed prior to leaving the possession of facility personnel.

To establish the documentation necessary to trace sample possession from the time of collection, a chain-of-custody record will be filled out and will accompany every sample. A sample chain-of-custody record is provided in Vol. II~~, Appendix ???~~ of this application.

If the sample is to be shipped off-site for analysis, it will be accompanied by a sample analysis request sheet. The sample analysis request sheet will include the information necessary to identify the sample and the analyses requested by the facility. Samples shipped off-site for analysis will be packaged and shipped in accordance with DOT transportation requirements.

Laboratory samples will be maintained in a secure area and retained until holding times expire, as listed in SW-846, or three months, whichever comes earlier. After the holding time or three month holding period has expired, samples will be disposed at the facility with compatible waste batches. Records of the date the samples are removed from storage and the date and method of disposal will be maintained at the facility until completion of post-closure care. In cases where samples are not analyzed within their holding times, the facility will resample.

4.6.3.3 QA Review of Procedures to Ensure Proper Use of Equipment

Standard operating procedures will be developed for the use, decontamination, and storage of sampling equipment used to characterize waste shipped to the facility. The standard operating procedures will include the sampling equipment to be used, instructions for use, and the applications for use of the equipment for collection of samples from specific media and types of shipping containers. The procedures and QA standards for waste sample collection will be included in the standard operating procedures.

4.6.3.4 Protocols For Equipment Maintenance

The protocols for equipment maintenance will be included in the standard operating procedures. Protocols will be developed, as described in the preceding paragraph, for use, decontamination, and storage of equipment.

4.6.3.5 Identification Of Required Techniques For Specific Media

The sampling methods and equipment used for collecting samples from specific media will be selected in accordance with the guidelines included in 40 CFR, Part 261, Appendix I, and in the EPA guidance manual, *Waste Analysis at Facilities That Generate, Treat, Store, and Dispose of Hazardous Waste*, Chapter 2. Alternative sampling methods may be used with prior approval of NMED.

4.6.3.6 Field Sampling ~~Qc~~ QC Procedures

Blank and duplicate samples will be obtained during waste characterization sampling to confirm that sample collection and handling procedures meet the QA/QC standards outlined in the standard operating procedures and data quality objectives included in the facility sampling manual. Duplicate samples will be collected at a minimum frequency of 10 percent (one for every 10 samples). Field

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blanks and equipment blanks will be collected at a minimum frequency of 5 percent (one for every 20 samples). Trip blanks will be included with all sample kits where samples are sent to off-site laboratories for chemical analysis. The field QA samples are described below:

- **field blanks.** - Field blanks are prepared in the field by filling a clean container with pure de-ionized water and appropriate preservative (if required for a specific activity). Contaminants found may indicate airborne contamination, contaminated equipment, or cross-contamination during sampling. A minimum of one field blank will be collected for every 20 waste samples collected;

- **trip blanks.** - Trip blanks are sample containers that are prepared with an inert material such as de-ionized water and carried into and out of the field, but not opened at any time during the sampling event. Contaminants detected in the trip blank may indicate that the source where the sample was prepared or the container that transported the trip blank was contaminated. A trip blank will accompany all sample shipping containers sent from and to off-site laboratories;

- **equipment blanks.** - Equipment blanks are prepared in the field prior to sampling by running de-ionized water over sampling equipment and placing it into a clean sample container. Contamination in this type of sample will indicate that the sampling equipment is contaminated. A minimum of one equipment blank will be collected for every 20 waste samples collected; and

- **field duplicates.** - Field duplicates are independent samples that are taken from the same location at the same time and are used to measure the effectiveness of obtaining representative samples. A minimum of one field duplicate will be collected for every 10 waste samples collected.

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4.6.3.7 Documentation Of Sampling Activities

Sampling activities, including observations and field procedures, will be recorded on appropriate forms and kept on file at the facility. Copies of the completed forms will be maintained in a bound and sequentially numbered file. The record of waste stream sampling activities will include:

- the date;
- the time of arrival and departure;
- weather conditions (including estimated temperature and wind direction);
- the name of the sample collector;
- daily activities and times sampling was conducted;
- observations;
- a record of samples collected, with sample designations and locations specified;
- field monitoring data, including health and safety monitoring;
- a list of equipment used and calibration records, if appropriate;
- a list of additional data sheets completed; and
- the signature of personnel completing the field record.

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Each sample collected during waste stream sampling activities will be identified by a unique sample designation. The sample designation will be included on the sample label. QA samples will be designated with a "Q" (QA/QC samples) at the end of the sample designation, followed by one of the following to indicate the type of QA sample:

- **D.** - "D" will be used for a duplicate sample;
- **E.** - "E" will be used for equipment rinsate blanks;
- **F.** - "F" will be used for field blank samples; or
- **TB.** - "TB" will be used for field trip blanks.

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This coding will be used to assure that duplicates and blanks are submitted "blind" to the laboratory, but can still be easily tracked by the facility for QA purposes.

4.7 ANALYTICAL METHODS

Analytical methods which the facility will use for specific tests are identified in the waste analysis tables (Tables 4-1 through 4-3). All analytical methods used in conjunction with this waste analysis plan must be EPA-approved methods or methods required by hazardous waste regulations. If there is no equivalent EPA-approved method, an ASTM method or other approved method may be used. If the facility or a generator wishes to use ~~another~~ alternate test methods, the facility or generator will first demonstrate to the NMED Secretary that the proposed method is equal or superior to the corresponding methods prescribed in 40 CFR 261 or 264, in accordance with 40 CFR 260.21.

An example of a non-EPA method required by hazardous waste regulations are the ASTM tests specified in 40 CFR 264.314(e)(2) to determine the presence of nonbiodegradable sorbents.

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Section 4.7.1 identifies the duties of the laboratory manager. Section 4.7.2 identifies the contents of the laboratory QA/QC plan. Requirements for off-site laboratories used by the facility are contained in Section 4.7.3.

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4.7.1 Duties of the Laboratory Manager

The on-site laboratory manager will have the following responsibilities to ensure an effective quality assurance program:

- ensuring that laboratory personnel are adequately trained to perform sampling and analytical procedures and in safety procedures;
- ensuring that equipment and instrumentation under his or her control are calibrated and functioning properly;
- coordinating internal and external assurance audits;
- reviewing procedures and QA plans of outside laboratories used. QA/QC practices will be considered during the selection of independent analytical laboratories. QA/QC practices that will be reviewed include written procedures, certification, internal and external audits, personnel training, and chain-of-custody procedures; and
- development, updating, and implementation of the laboratory QA plan.

4.7.2 Facility Laboratory QA/QC Plan

Prior to beginning operations, the facility will develop procedures which will comprise the laboratory QA/QC plan. The facility will develop a QA manual for operation of the on-site laboratory. The manual will be submitted to NMED for review.

The results of chemical analysis of waste samples generated by the on-site laboratory will not be used as part of the waste acceptance evaluation process prior to NMED's review of the QA manual.

The overall QA objective for measurement data is to ensure that data of known and acceptable quality are provided. All measurements will be made to yield accurate and precise results representative of the media and conditions measured. QA objectives for precision, accuracy, and completeness will be established for each measurement variable, where possible, and will be included in the QA manuals of the on-site and off-site laboratories where waste samples will be submitted for chemical analysis. The laboratory procedures, practices, and qualifications will be included in the QA manual for each laboratory.

The laboratory QA plan will also include descriptions of procurement, sample management, bottle preparation, detection and quantification limits, evaluation of QC samples, data verification, reporting, and sample and records management. Other procedures which will be included in this plan are:

- laboratory quality assurance;
- equipment calibration;
- laboratory QA/QC samples;
- laboratory QC;
- analytical procedures; and
- laboratory maintenance.

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4.7.2.1 Laboratory ~~Q~~quality ~~A~~assurance

The facility laboratory and each off-site laboratory will maintain an internal quality assurance program, as documented in its laboratory quality assurance manual. The laboratories will use a combination of blanks, surrogates, duplicates, MS/MSD (matrix spike/matrix spike duplicate) and laboratory control samples, BS/BSD (blank spike/blank spike duplicate), to demonstrate analytical QA/QC. Control limits will be established for individual chemicals or groups of chemicals based on the long-term performance of the test methods. The specific procedures to be completed and the laboratory control limits will be included in the QA manual for each laboratory.

4.7.2.2 Equipment ~~C~~calibration

The laboratory equipment calibration procedures, calibration frequency, and calibration standards will be in accordance with EPA (or equivalent method) specified test methodology requirements and will be documented in the laboratory's QA manual. All instruments and equipment used by the laboratory will be operated, calibrated, and maintained according to manufacturers' guidelines and recommendations. Operation, calibration, and maintenance will be performed by personnel who have been properly trained in these procedures. A routine schedule and record of instrument calibration and maintenance will be kept on file at the laboratory.

4.7.2.3 Laboratory QA/QC samples

Analytical procedures will be evaluated by analyzing reagent or method blanks, surrogates, MS/MSDs, BS/BSDs, and/or laboratory duplicates, as required or appropriate for each method. The laboratory QA/QC samples and frequency of analysis to be completed will be in accordance with EPA or equivalent method protocols and will be included in the QA manual for each laboratory.

The laboratory QA manuals and procedures will incorporate data quality objectives (DQOs) to verify that waste characterization data obtained by the methods established in this waste analysis plan meet regulatory requirements with regard to regulatory compliance and facility waste management requirements. The following DQOs are established for the sampling and analysis of waste managed by this facility;

- Identify and quantify the hazardous constituents in the waste to ensure compliance with 40 CFR 264 and the requirements of the facility permit, and

- Compare the contaminant concentrations in the waste with the specified characteristics of 40 CFR 261 in order that the waste may be managed in accordance with facility requirements.

To ensure that the laboratory data quality objectives are met, the following analyses will be completed in the laboratory to monitor the analytical process:

- **laboratory duplicate samples.** - Laboratory duplicate samples will be analyzed to monitor for intralaboratory precision of data generated. These samples will be analyzed at a rate of no less than five percent (one for every 20 samples) of the total samples with at least one replicate if fewer than 20 samples are analyzed for any particular parameter;

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- **spiked samples (MS/BS).** - Spiked samples will be analyzed to monitor analytical precision. Spiked samples will be tested on no less than a five percent (one for every 20 samples) basis for any particular parameter. At least one spiked sample will be run if fewer than 20 samples are analyzed;

- **control charts.** - Control charts will be utilized to establish laboratory control limits to monitor and review the accuracy of the data generated as a result of spike analyses. Control limits reflect long-term data accuracy trends and will be modified as new data are acquired;

- **method/reagent blanks.** - Method/reagent blanks will be prepared using samples of purified water or reagents which will then subjected to the entire sample analytical procedure to monitor potential contamination of samples due to contamination in the laboratory or laboratory equipment. Method or reagent blanks will be included with each set of samples;

- **laboratory equipment blanks.** - Laboratory equipment blanks will be analyzed to monitor potential contamination of samples due to improper or ineffective cleaning of equipment. These samples will be analyzed at a rate of no less than five percent (one for every 20 samples) of the total samples;

- **quality control samples.** - QC samples will be analyzed to monitor for accuracy of data generated. EPA QC samples or samples purchased from a reputable independent source will be submitted to off-site laboratories as blind samples for chemical analysis of a set of selected analytes approved by NMED at the beginning of the facility operation and also at regular intervals during the facility operating life;

- **surrogates.** - Surrogates will be analyzed in accordance with EPA guidelines for organics analysis. Surrogate recovery is a measure of the effectiveness of the analytical process. Surrogates will be tested on no less than a five percent (one for every 20 samples) basis for any analysis of organic compounds;

- **calibration standards and devices.** - Calibration standards and devices will be used in accordance with the manufacturers' recommended guidelines to calibrate laboratory instrumentation; and

- **internal standards** - Internal standards prepared in the laboratory will be referenced against external standards to measure accuracy.

Laboratory QC procedures will be included in the laboratory QA manuals prepared by each laboratory.

4.7.2.4 Laboratory Quality Control

~~.~~ QC objectives for the analytical data are a means of checking and controlling the sources of error in analytical data results. The criteria for data evaluation include assessing the data accuracy, precision, completeness, representativeness, and comparability. The criteria are described below:

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- **accuracy.** - Accuracy is a measure of the error between chemical analytical results and the true sample concentrations. Accuracy is a measure of the bias in a system and will be expressed as the percent recovery of spiked samples. Accuracy will be presented as percent recovery and will be calculated as follows:

  %R - (S-U) X 100%C_{sa}
  where
  %R = percent recovery
  S = spike sample analytical result
  U = sample analytical result
  C_{sa} = known spike concentration

- The data quality objectives (DQOs) for accuracy for each analytical method will be presented in the laboratory QA manual;

- **precision.** - Precision is a measure of data variability. Variability can be attributed to sampling activities and/or chemical analysis. Relative percent difference (RPD) will be used to assess the precision of the sampling and analytical method and will be calculated as follows:

  RPD = [*C_1 - C_2*/(C_1 + C_2)/2)] x 100
  where
  RPD - relative percent difference
  C_1 = larger of the two concentrations
  C_2 = smaller of the two concentrations

- The DQOs for precision for each analytical method will be presented in the laboratory QA manual;

- **completeness.** - Completeness will be evaluated to assess whether a sufficient amount of valid data is obtained. Completeness is described as the ratio of acceptable measurements. Completeness will be calculated as follows:

  C = (Number of samples having acceptable data)/(total number of samples analyzed) x 100%
  where
  C = completeness

- The DQOs for completeness will be presented in the laboratory QA manual;

- **representativeness.** - Representativeness is a qualitative parameter related to the degree to which the sample data represent the specific characteristics of concern. Procedures in sample collection will be implemented to assure representative samples, such as repeated measurements of the same parameter from the same waste stream in the same shipping container over several distinct sampling events. Any procedures or variations that may affect the collection or analysis of representative samples will be noted and the data qualified as appropriate; and

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- **comparability.** - Comparability is a qualitative parameter related to whether similar sample data can be prepared. To assure comparability, analytical results will be reported in appropriate units for comparison with other data (such as past studies or clean-up standards), and the standard collection and analytical procedures included in this waste analysis plan will be implemented. Any procedures or variations that may affect comparability shall be noted, and the data will be qualified as appropriate.

4.7.2.5 Analytical Procedures

Specific QA/QC procedures to be used for sampling, chain-of-custody, calibration, analytical methods, reporting, internal QC, audits, and preventative maintenance will be included in the laboratory QA manual.

Laboratory procedures and methods to be used will contain all of the information presented in the EPA document, SW-846, for each method. The format for each method will be similar to that used in SW-846. If there is no appropriate SW-846 method ASTM or other approved methods will be employed. The laboratory procedures and methods also will include the following:

- **scope.** - A description of the scope of applicability of the procedure;
- **principal.** - A brief description of the steps to be taken and/or the theory involved in the laboratory analysis;
- **interference.** - A description of known interfering agents that would cause difficulty in the laboratory analysis;
- **apparatus.** - A listing or description of equipment required to perform the laboratory analysis;
- **reagents.** - A listing of the reagents required, a description of the steps involved in preparing the reagents, and instructions on storage requirements and retention times;
- **procedures (instructions).** - An enumeration of the sequence of activities to be followed. The topics include sample preparation or pretreatment, sample storage requirements, instrument set-up, standardization or calibration, sample analysis, calculations, and glassware-cleaning procedures. The procedure includes any precautions, explanation, or clarifications needed to properly perform the analysis. These include safety precautions, the frequency of standardization required, the acceptance criteria or procedures for determining the acceptability of standard curves, clarification or special techniques critical to the analysis, and the procedure the analyst uses to determine the reliability of sample results based on the standard curves;
- **quality control requirements.** - A listing of the QC checks to be performed and the acceptance criteria used to evaluate the QC data; and

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- **reference.** - A listing of the publications from which the information was derived in preparing the laboratory method. All references pertain to these documents. As a rule, laboratory methods are derived from the following publications:

  - *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association;
  - *Annual Book of Standards*, American Society for Testing and Materials;
  - *Methods for Chemical Analysis of Water and Waste*, US Environmental Protection Agency;
  - *Test Methods for Evaluating Solid Waste*, SW-846, US Environmental Protection Agency;
  - *National Functional Guidelines for Organics Data Review*; and
  - *Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses*.

Editions used will be those currently specified in 40 CFR, as updated.

4.7.2.6 Laboratory Maintenance

The analytical laboratory will have in place a procedure that details the steps to be taken to calibrate and standardize instruments to ensure that analytical data produced are accurate. Records of all calibrations, preventative maintenance, and service calls will be readily available from the laboratory files. Calibration procedures will follow the method procedures outlined in the EPA document, SW-846, or the *Annual Book of ~~(~~ASTM~~)~~ Standards*.

A procurement procedure that identifies methods to be used to document and control the purchase of materials, parts, and services will be implemented by the laboratory and will be presented in the laboratory QA manual. The procedure will include identifying the quality of laboratory chemicals and equipment, management approval of procedure items, inspection of shipments for compliance with requirements, and isolation of nonconforming items to be returned to vendors. The quality of all equipment will conform to the requirements specified in the most current edition of the EPA document, *Handbook of Analytical Quality Control in Water and Wastewater Laboratories*, the Federal Register, or other regulatory agency publications. This procurement procedure will serve to ensure that spare parts routinely required will be readily available.

4.7.3 Requirements for Off-Site Laboratories

The facility will document that the following conditions are met for each off-site laboratory performing waste analyses for the facility:

- the laboratory will not be the same laboratory that was used by the generator;
- the laboratory must be approved by the facility;

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- the laboratory must use the analytical methods identified in Section 4.5;

- if there is more than one analytical method for a specific test identified in Section 4.5, the laboratory must follow the guidance in Chapter Two of the current version of EPA document SW-846 to determine the appropriate analytical method; and

- the laboratory must follow the QA/QC requirements described in this waste analysis plan.

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4.8 WASTE TRACKING

To identify and track the waste managed at the facility, a facility-specific number will be assigned to each waste stream and to each shipment within that waste stream. Each waste shipment will be tracked using a unique alphanumeric designation. This designation will identify the generator, a sequential number specific to the shipment, substance and source and the delivery date (or, in the case of site-generated waste, the date the waste entered the system). An example is presented below:

ABC-0001-043099
where
ABC identifies the generator
0001 identifies the waste stream, source, and shipment
043099 is the date the waste was delivered.

The waste numbering system will assist in the tracking of waste as it moves through the facility. The number will be recorded on:

- all incoming paperwork from the generator;
- samples received from the generator;
- samples taken on site; and
- site-generated records.

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The date will not be recorded until the waste actually arrives on site. This numbering system will allow the facility to track a specific waste with regard to analyses conducted, necessary treatment, and the final disposition of the waste. In addition, assigning a unique designation to each generator and a unique number to each waste stream from that generator will make possible determining the amount of waste from a given waste stream that has been received by the facility. Individual shipments from within the waste stream will receive an additional identifier to enable the facility to tie information back to the specific shipment as well as to the waste stream. The system will allow the facility to locate the current position of the waste at the facility, including the location of the waste in the landfill.

Tracking waste in this manner will allow the facility to determine the efficiency and accuracy of a generator's profiling efforts and the rejection rate for incoming waste. This information will be used to assist facility operations in determining the rate of fingerprint analysis required for a given generator.

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The facility number will designate waste generated on site. All other numbering and tracking will be the same for all waste managed at the facility. The tracking system will be maintained in the facility records as either hard copy or electronically (computer database).

4.9 NOTIFICATION, CERTIFICATION, AND RECORDKEEPING

The facility will maintain a facility Operating Record in accordance with 40 CFR 264.73. The Operating Record will include:

- all analytical results;
- all chain-of-custody forms;
- generator notices of restricted wastes not meeting treatment standards or exceeding levels specified in RCRA Section 30049(d), including the information listed in 40 CFR 268.7(a)(1); and
- generator notices of restricted wastes meeting applicable treatment standards and prohibition levels, including the information in 40 CFR 268.7(a)(2).
- all final disposition records;
- all manifest and waste discrepancy resolution documentation; and
- all other information (e.g., notifications, certifications, waste analysis reports, waste movements) which will be maintained in the Operating Record as noted in this waste analysis plan.

As required in 40 CFR 268.7, the following records will be maintained at the facility for wastes generated on-site, and/or documentation of treating restricted wastes:

- where on-site generated wastes are characterized to determine compliance with LDR standards using only process knowledge, all data used to make any such determination. This data will be maintained by site personnel;
- where a representative sample of waste is analyzed to determine compliance with LDR standards, all waste analysis information. This data will be retained on-site in facility files; and
- all notifications and/or certifications submitted by waste generators. These records will be maintained until facility closure as required in 40 CFR 264.73.

In addition, relevant inspection forms and monitoring data will be maintained on file at the facility. Files will be maintained for a minimum of three years (for inspection records and LDR notification), or until approval of facility closure (for inventory records).

~~INSERT FIGURE 4-1.~~
~~PRE-ACCEPTANCE PROCEDURE FOR FIRST-TIME WASTE~~

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~~INSERT FIGURE 4-2.~~
~~INCOMING WASTE SHIPMENT PROCEDURES~~

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~~INSERT FIGURE 4-3.~~
~~SEQUENCE OF PROCEDURE SETS FOR DETERMINING REACTIVITY GROUP~~

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This submittal supersedes all previous information.

~~INSERT FIGURE 4-4.~~
~~REACTIVITY GROUP DESIGNATION~~

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~~Table 4-21~~
~~Basic Analytical Parameters~~

	~~Method~~	~~Matrix[1]~~
~~VOCs~~	~~SW-846 Method 8460B~~	~~L, Sl, S~~
~~SVOCs~~	~~SW-846 Method 8270C~~	~~L, Sl, S~~
~~Metals and Inorganic Constituents: Antimony, arsenic, barium, beryllium, cadmium, chromium (total), lead, mercury, nickel, selenium, silver, thallium, vanadium, zinc~~	~~SW-846 Methods: Applicable 6000 or 7000 series~~	~~L, Sl, S~~
~~Physical appearance~~	~~ASTM Method D4979~~	~~L, Sl, S~~
~~pH~~	~~SW-846 Method 9040B (pH Electronic Measurement, SW-846 Method 1110 (Corrosivity toward Steel), SW-846 Method 9041A (Paper Method), SW-846 Method 9045D (Soil and Waste)~~	~~L, Sl, S~~
~~Radioactivity screen~~	~~Industry standard survey technique (e.g., scintillation detector)~~	~~L. Sl, S~~

~~[1] L - liquids, Sl - sludges, S - solids~~

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~~Table 4-32~~

~~Analytical Parameters to Ensure Compliance with LDR Standards~~

~~Parameter~~	~~Method[1]~~	~~Matrix[2]~~
~~TOC~~		
~~TSS~~		
~~Ignitability~~	~~SW-846 Method 1010 (closed cup test for liquids), SW0-846 Method 1030 (open cup test for solids)~~	~~L,Sl,S~~
~~Explosive meter vapor test (TLV sniff test)~~		
~~Total explosives test~~	~~SW-846 Method 83330 or US Army Corps of Engineers Method 8321 (liquid chromatography and mass spectrometry for total explosives)~~	
~~Flash point test~~		~~L, Sl, S~~
~~pH~~	~~See Table 4-21.~~	~~See Table 4-21.~~
~~Reactive sulfide~~	~~EPA Method 9030~~	~~L, Sl, S~~
~~Reactive cyanide~~	~~EPA Methods 9010 and 9012~~	~~L, Sl, S~~
~~Reactivity~~	~~EPA 600/2-84-057[3]~~	~~L, Sl, S~~
~~VOCs~~	~~See Table 4-21.~~	~~See Table 4-21.~~
~~SVOCs~~	~~See Table 4-21.~~	~~See Table 4-21.~~
~~Metals and inorganic constituents: Antimony, arsenic, barium, beryllium, cadmium, chromium (total), lead, mercury, nickel, selenium, silver, thallium, vanadium zinc~~	~~See Table 4-21.~~	~~See Table 4-21.~~
~~Organochlorine pesticides~~	~~SW-846 Method 8081A~~	~~L, Sl, S~~
~~Chlorinated herbicides~~	~~SW-846 Method 8151A~~	~~L, Sl, S~~
~~PCBs~~	~~SW-846 Method 8082~~	~~L, Sl, S~~
~~Leachate~~		~~L~~

~~[1] The method used must be capable of achieving detection limits below the applicable LDR standards contained in 40 CFR 268.40 and 268.48.~~

~~[2] L - liquids, Sl - sludges, S - solids~~

~~[3] *Design and Development of a Hazardous Waste Reactivity Testing Protocol*, February 1984.~~

~~Table 4-43~~

~~Analysis to Ensure Compliance with Facility Regulatory and Operational Limits~~

~~Parameter~~	~~Method~~	~~Matrix[1]~~
~~Radioactivity screen~~	~~See Table 4-32.~~	~~See Table 4-32.~~
~~PCBs~~	~~See Table 4-32.~~	~~See Table 4-32.~~
~~Total VOCs~~	~~40 CFR 60, Appendix A, Method 25D; 40 CFR 136, Appendix A, EPA Method 624, 625, 1624, 1625; 40 CFR 136, Appendix A, Alternative Test Method; SW-846, Method 8260B~~	
~~Dioxins and dibenzofurans~~	~~SW-846 Method 8280A and 8290~~	

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~~Nonbiodegradable sorbents test~~	~~ASTM Method 21-70; ASTM Method G22-76; OECD Test 301B; or ASTM Method G21-760~~	
~~Total organic halogens (TOX)~~	~~SW-846 Method 9020~~	
~~Free liquid content test (Paint filter liquids test)~~	~~SW-846 9095, penetrometer or visual~~	~~Sl, S~~
~~Toxic Characteristic Leaching Procedure (TCLP)~~	~~SW-846 Method 1311~~	~~S~~

~~[1] The methods must be EPA-approved and must be either the most recent version of either SW-846 or ASTM methods.~~

~~[2] L - liquids, Sl - sludges, S - solids~~

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~~Table 4-1~~

~~Potential Release Types and Areas~~

~~Area~~	~~Type of Release~~	~~Matrix[1]~~
~~Drum Storage Area~~	~~Spills, leaks~~	~~L, S~~
~~Roll-Off Storage Area~~	~~Spills, leaks~~	~~L, S~~
~~Liquid Waste Storage Area~~	~~Spills, decontamination rinse water~~	~~L~~
~~Stabilization Area~~	~~Spills, air emissions, decontamination rinse water~~	~~L, S,A~~
~~Evaporation Pond~~	~~Evaporation pond fluids collected in the collection system Leachate, non-leachate, spills (including overtopping, sludges generated as a result of cleaning and repair of the liner system~~	~~L, Sl, S~~
~~Landfill~~	~~Leachate collected in the leachate collection system, non-leachate, spills, air emissions~~	~~L, Sl, S, A~~
~~Truck Wash~~	~~Decontamination rinse water, spills~~	~~L, Sl~~
~~Stormwater Retention Basin and ditches~~	~~Contaminated rain water, sediments~~	~~L, Sl~~
~~Sitewide Operations~~	~~Sampling (investigation derived waste, purge waters, spills, leaks~~	~~L, Sl, S, A~~

~~[1] L - liquids, SL - sludges, S - solids, A - air~~

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~~Table 4-5~~
~~Sampling Methods~~

~~Waste Matrix~~	~~Sampling Method~~	~~Sampling Equipment~~
~~Extremely viscous liquid or sludge~~	~~ASTM D140-7000~~	~~Composite liquid waste sampler (Coliwasa), dipper, scoop, thief~~
~~Crushed or powdered material~~	~~ASTM D346-75~~	~~Scoop, shovel, tube sampler~~
~~Soil or rock-like material~~	~~ASTM D420-69~~	~~Scoop, shovel, auger~~
~~Soil-like material~~	~~ASTM D1452-65~~	~~Scoop, shovel, tube sampler~~
~~Fly ash-like material~~	~~ASTM D2234-76~~	~~Tube sampler, trier, auger, scoop, shovel~~
~~Containerized liquids~~	~~SW-846~~	~~Coliwasa, tube sampler, weighted bottle, dipper, thief~~

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~~Table 4-???~~
~~WHAT ABOUT THESE?~~

~~Parameter~~	~~Method~~	~~Medium Type~~	~~Qualitative or Quantitative~~
~~Flammability Potential Screen~~	~~ASTM D4982~~	~~Liquid, Sludge, Solids, Stabilized Waste~~	~~Qualitative~~
~~Free Liquids~~	~~SW-846 Method 9095 (Paint Filter Liquids Test), penetrometeror visual~~	~~Sludge, Solids, Stabilized Waste~~	~~Qualitative~~
~~Ignitability~~	~~Match test, Pensky-Martens closed cup or Set-a-flash~~	~~Liquid~~	~~Qualitative~~
~~Miscibility~~	~~50/50 mix with water~~		~~Qualitative~~
~~Water Mix~~	~~ASTM D5058 Test Method C~~		~~Qualitative~~
~~Chlorinated Solvents~~	~~Colorimetric Test or Beilsten test~~		~~Quantitative~~
~~Cyanide~~	~~Electrode or colorimetric test (ASTM D5049 Test Method B)~~		~~Quantitative~~
~~PCBs~~	~~Colorimetric Test~~		~~Quantitative~~
~~Specific Gravity~~	~~Hydrometer~~		~~Quantitative~~
~~Sulfide screen~~	~~ASTM 4979~~		~~Quantitative~~

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~~Table 4 ??? (second table)~~
~~AND WHAT ABOUT THESE?~~

~~Method~~	~~Reference~~	~~Description~~
~~Paint Filter Test~~	~~EPA 9095~~	~~This test will determine the free liquids that are contained within the waste matrix and will be used as a control parameter for wastes that are to be landfilled.~~
~~Reactive Cyanide and Sulfide~~		~~This test determines if cyanides could potentially be reactive under acidic conditions.~~
~~Total Halogens~~	~~SW-846 9020~~	~~L, Sl, S~~
~~PCBs~~	~~EPA 8080~~	~~This test determines if PCBs are contained in the waste matrix and determines the concentration.~~
~~Water reactivity~~		~~Sl, S~~
~~Solids screen~~		
~~Oxidizer Screen~~		~~L, Sl~~
~~Reducer Screen~~		~~L, Sl~~
~~Water Reactivity~~		
~~Solids Screen~~		

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~~total explosives test. - This test determines whether the waste is reactive (i.e., explosive). This test is required if the waste contains explosive contaminated soil or material or if the waste was previously a D003 reactive characteristic waste that was deactivated before shipment to the facility. If the concentration of total explosives is 10 percent or greater, the waste is rejected;~~

~~bench-scale tests. - These tests are undertaken to determine regulated constituent leaching based on varying admixtures and ratios (i.e., to determine treatability of wastes.) These may be required during pre-acceptance testing if the waste is to be treated on-site;~~

~~specific gravity. - This is a quantitative test to determine the sedimentation rate or buoyancy of wastes in suspension, as well as treatability. This test is only applicable to homogeneous wastes. The tolerance range for specific gravity is plus or minus 20%;~~

~~cyanide screen. - This test determines if the waste has the potential to produce hydrogen cyanide gas upon acidification below pH2. This test is not required if the waste exhibits a pH below 2, if the waste is organic, or if the waste is not water-soluble;~~

~~sulfide screen. - This is a quantitative test to determine if the waste has the potential to produce hydrogen sulfide gas upon acidification below pH 2. This test is not required if the shipped waste exhibits a pH below 2, if the waste is organic, or if the waste is not water-soluble; and~~

~~total cyanide. - This test determines the chemical compatibility of wastes that are treated and disposed. This test may be required if the waste will be combined with other wastes during on-site treatment (e.g., placed with other wastes in the evaporation pond or stabilization tank);~~

~~total sulfide. - This test determines the chemical compatibility of wastes that are treated or disposed. This test may be required if the waste will be combined with other wastes during on-site treatment (e.g., placed with other wastes in the evaporation pond or stabilization tank);~~

~~IR scan. - ASTM D2621, D4053This test determines the presence of organics and provides a rough estimate of their concentration;~~

~~solids screen. - This test determines solids management requirements. The tolerance range for a solids screen is plus or minus 20%;~~

~~(Trey, if the Facility wishes to do this test, you need to provide either an EPA-approved method or ASTM reference for the test method or have a facility-specific test developed for this and include it in the WAP. It appears as though Grassy Mountain has developed its own test for this.)~~

~~oxidizer screen. - This test is a rapid qualitative method for determining the presence or absence of oxidizing materials in liquid or semi-solid materials. It is also used to indicate whether a material might be an ignitable waste (i.e., whether it is an oxidizer as defined in 49 CFR 173.151). The tolerance level for this test is positive to negative only;~~

~~(Trey, if the Facility wishes to do this test, you need to provide either an EPA-approved method or ASTM reference for the test method or have a facility-specific test developed for this and include it in the WAP. It appears as though Grassy Mountain has developed its own test for this.)~~

~~reducer screen. - This test is a rapid qualitative method for determining the presence of absence of reducing materials in liquid or semi-solid materials. It is also used to indicate if a material has reducing properties that would affect the safe management of the waste. The tolerance level for this test is positive to negative only;~~

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~~(Trey, if the Facility wishes to do this test, you need to provide either an EPA-approved method or ASTM reference for the test method or have a facility-specific test developed for this and include it in the WAP. It appears as though Grassy Mountain has developed its own test for this.)~~

- ~~water reactivity. - This is a qualitative test to determine whether the waste has a potential to react vigorously with water to form significant gases or solids, or whether it generates significant heat. This test does not apply to wastes that are already in contact with excess water, or for which sufficient data exist that indicate no potential reactivity with water;~~
- ~~flammability potential screen. - This is a qualitative test to indicate the fire-producing or explosive potential of the waste. This test is not necessary if other information clearly indicates the waste is not ignitable;~~
- ~~chlorinated solvents. - This is a quantitative test....Colorimetric test or Beilsen test;~~
- ~~miscibility. - This is a qualitative test....50/50 mix with water;~~
- ~~one additional parameter. - One additional parameter, based on the facility's evaluation of the waste characterization information provided by the generator as described in Section 4.2.1, will be tested. WHAT IS THIS ALL ABOUT?; and~~
- ~~unconfined compressive strength of cohesive soil. - This test will determine the compressive strength of a stabilized waste and may be performed on waste prior to landfilling. A DIFFERENT KIND OF TEST. INCLUDE OR NOT?~~
- ~~cyanide. - This is a quantitative test....Electrode or colorimetric test (ASTM D5049 Test Method B);~~

- ~~free cyanide (sulfide). - APHA 412G, H. This test determines if cyanide could potentially be reactive under acidic conditions. Acceptable limits are: total CN <1 000 mg/l; releasable CN <250 mg/l, if destined for direct landfilling. (Part of a chemical oxidation treatment.)~~
- ~~corrosivity to metals (from Trey's list). - L: 1110.~~

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3.0 GROUNDWATER PROTECTION

Section 3.0 presents historical and ~~1994~~recent field data, which demonstrate that the proposed landfill at the Facility will not impact groundwater resources. The EPA's RCRA Groundwater Monitoring Technical Enforcement Guidance Document was used in the preparation of this material.

The proposed Facility is located in a remote portion of eastern Chaves County, New Mexico, 36 miles from the city of Tatum (see Figure 3-1). Section 3.1, Geographical Setting and Topography, describes the favorable physical attributes of the proposed site location.

Climatic conditions, which are favorable for the efficient and environmentally safe operations of the proposed landfill and the ability to provide long-term isolation of hazardous waste, are described in Section 3.2. Data in this section were obtained from the National Oceanic and Atmospheric Administration's (NOAA's) recording station at Roswell, New Mexico.

Section 3.3, Soils and Land Use, describes soils, ranching, and other land uses in the area surrounding the proposed site. This section shows that the proposed hazardous waste disposal activities should have no impact on the existing occupational or recreational use of the surrounding land.

The regional and local geologic setting of the proposed landfill site is detailed in Section 3.4. Sediments of the Dockum Group of Triassic age are proposed as host rocks for this Facility. These unsaturated and low permeability sediments represent a stable geologic barrier to potential migration of contaminants from the proposed site.

Section 3.5, Surface Water and Water Balance, describes surface waters and meteorological conditions used to estimate groundwater recharge at the proposed site. Results from this section show that the proposed site's low groundwater recharge rate significantly reduces the potential for migration of contaminants to groundwater.

Regional and local aquifers are described in Section 3.6. This section documents the lack of groundwater present in the proposed Triassic host rocks and presents contaminant transport modeling results that demonstrate that the proposed landfill design, in conjunction with the site's geologic setting, will meet or surpass all RCRA minimum technology requirements.

Section 3.7, Groundwater Protection Requirements, presents the design of the groundwater monitoring network for the proposed Facility.

Section 3.8, Summary and Conclusions, summarizes the detailed technical data, which demonstrate that the proposed Facility is situated in a hydrologic setting that will assure long-term isolation of hazardous wastes from the environment. Technical data to support this conclusion are contained in the appendices included with this application in Volume II.

3.1 GEOGRAPHICAL SETTING AND TOPOGRAPHY

The proposed site is located in a remote portion of eastern Chaves County in New Mexico. The proposed Facility area is located in the eastern half of Section 18 and western half of Section 17, T11S, R31E, encompassing 480 acres.

This site is approximately 4 miles south of U.S. Highway 380, which provides the main access to the property. Roswell, New Mexico is approximately 43 miles west of the proposed site, and Tatum, New Mexico is approximately 36 miles to the east. Other New Mexico communities in the region include Lovington (42 miles to the southeast) and Artesia (50 miles to the southwest).

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3.1.1 Physiographic Setting

The proposed site lies within a region of transition between the northern extension of the Chihuahuan Desert and the Southern High Plains. The Caprock escarpment, located approximately 2 miles east of the proposed site, delineates the western boundary of the Southern High Plains province, which, in west Texas and eastern New Mexico, is known as the Llano Estacado. The Llano Estacado is a flat-lying elevated plain, whose grass-covered surface is remarkably different from the wind-blown, sandy desert environment to the west.

3.1.2 Topography

The proposed site is located on the far eastern flank of the Pecos River Basin. The land surface gently slopes to the west at approximately 40 to 50 feet per mile toward the river. This sloping plain is characterized by low-relief hummocky wind-blown deposits, sand ridges, and dunes. The average elevation above sea level of the proposed site is 4,150 feet.

The Caprock escarpment (or Mescalero Rim) is one of the most prominent topographic features in southeastern New Mexico. East of the proposed site, the escarpment has approximately 200 feet of relief. On top of the Caprock, the land surface consists of low-relief undulating plains.

Figure 3-2 contains a portion of the USGS topographic map coverage of the proposed site. The Caprock escarpment is well illustrated in the southeastern corner of the mapped area. The proposed site and surrounding area are covered by two USGS 7½° quadrangle maps: Mescalero Point and Mescalero Point NE.

3.2 CLIMATE

The information used to evaluate the climate of the project area was obtained from climatological data summaries from the Class A recording station in Roswell, New Mexico. This recording station is part of the National Climatic Center of NOAA. The local climatological data summaries provided extreme and normal values of the meteorological parameters (for the period of record at the Roswell Municipal Airport and more recent data from the Roswell Industrial Air Center) that were used to characterize the area's climate.

The climate of the region is semiarid, with generally mild temperatures, low precipitation and humidity, and a high evaporation rate. Winds are most commonly from the south and moderate. During the winter, the weather is dominated by a high-pressure system often situated in the central portion of the western United States and a low-pressure system commonly located in north-central Mexico. During the summer, the region is affected by a low-pressure system normally situated over Arizona.

3.2.1 Temperatures

Moderate temperatures are typical throughout the year, although seasonal changes are distinct. Mean annual temperatures in southeastern New Mexico are near 60°F (Eagleman, 1976). Temperatures in December through February show a large diurnal variation, averaging 36°F at Roswell. On approximately 75 percent of winter mornings, temperatures are below freezing, and afternoon maximum temperatures average in the high fifties. Afternoon winter temperatures of 70°F or more are not uncommon. Nighttime lows average near 23°F, occasionally dipping as low as 14°F. Generally, there are only two or three winter days when the temperature fails to rise above freezing.

Table 3-1 shows the average monthly and average daily maximum/minimum temperatures recorded for Roswell for a typical year.

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3.2.2 Precipitation

Precipitation is light and unevenly distributed throughout the year and averages 10 to 13 inches. Winter is the season of least precipitation, averaging less than 0.6 inch of rainfall per month. Snow averages about 5 inches per year at the site and seldom remains on the ground for more than a day because of the typically above-freezing temperatures in the afternoon. Approximately half the annual precipitation comes from frequent thunderstorms in June through September. Rains are usually brief but occasionally intense when moisture from the Gulf of Mexico spreads over the region.

Precipitation for the project area varies greatly from year to year. For example, Roswell's record low annual precipitation is 4.35 inches. The maximum 24-hour rainfall was 5.65 inches in October 1901. The record annual high is 32.92 inches. Most years are either "wet" or "dry"; few are "average." An average precipitation rate for Roswell, for a 107-year period from 1878 to 1982, is 10.61 inches per year. Table 3-2 shows monthly precipitation rates for the Roswell area for a five-year period and compares annual rates to the average precipitation.

3.2.3 Wind

Prevailing winds are from the south, with a normal mean wind speed at Roswell of 9.6 mph. An annual wind rose for a four-year period is shown in Figure 3-3. This wind rose shows the predominant southerly winds occurring 14 percent of the time.

3.3 SOILS AND LAND USE

The proposed site is located in a rural portion of Chaves County, New Mexico. This section describes soil profiles of the land surface in this area, existing vegetation, and the current land usage.

3.3.1 Soil Profiles

Information on soil profiles at the proposed site has been obtained from the National Cooperative Soil Survey. This survey covers Chaves County and was made cooperatively by the Soil Conservation Service, the BLM, and the New Mexico Agricultural Experiment Station.

There are two types of soils present on the proposed site. The Roswell-Faskin-Jalmar Association is present on the sandy slopes throughout the property. The Alama Series is restricted to topographically lower drainage areas and is associated with flood plain deposits.

3.3.1.1 Roswell-Faskin-Jalmar Association

This association consists of excessively drained and well-drained soils with slopes of 0 to 15%. The association is about 40% Roswell soils, 25% Faskin soils, 15% Jalmar soils, and the remainder being a mixture of various soil types. The soils of this association are used for grazing and wildlife habitat. Vegetation is mainly sand dropseed, little bluestem, sand bluestem, sandbur, three-awn, shinnery oak, yucca, and sand sagebrush. Elevation ranges from 3,500 to 4,100 feet. The frost-free season ranges from 190-205 days per year.

Roswell soils are deep, gently undulating to rolling, and rapidly permeable. They are found in hummocky or billowy areas of deep sands. They consist of a surface layer of light brown fine sand. The underlying material is pink fine sand.

Faskin soils are deep, level to nearly level, and moderately permeable. They are intermingled with Roswell soils in depressions. They have a surface layer of brown and strong brown fine sand and loamy fine sand. The subsoil is yellowish red sandy clay loam and reddish brown clay loam.

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Jalmar soils are deep, evenly deposited, and moderately permeable. They are intermingled with Roswell soils in depressions. They consist of a surface layer of brown, reddish yellow, and yellowish red fine sand and loamy fine sand. The subsoil is light reddish brown, heavy loamy fine sand, and sandy clay loam.

3.3.1.2 Alama Series

The Alama Series consists of deep, well-drained soils formed in alluvium on flood plains. Slopes are 1% to 3%. Elevation is 3,400 to 3,600 feet. These soils are used for grazing, watershed, and wildlife habitat. Vegetation is mainly tobosa, buffalo grass, vine-mesquite, mesquite, and cactus. The frost-free season ranges from 200-215 days per year.

In a representative profile, the surface layer of these soils is brown loam about 3 inches thick. The subsoil is reddish brown clay loam and silty clay loam about 16 inches thick. The substratum is stratified reddish brown and light reddish brown sandy clay loam, silty clay loam, and loam to a depth of 69 inches or more. The soil profile is strongly calcareous and moderately alkaline throughout.

Permeability is moderately slow, and available water capacity is 11 to 12 inches. Effective rooting depth is 69 inches or more.

3.3.2 Land Ownership and Use

The property for the proposed site is owned by Marley Ranches, Ltd. Adjacent lands are both federally and privately owned. Generally, lands to the west are owned by the BLM, and lands to the east are privately owned.

The predominant land use in this area is grazing. With existing vegetation, approximately one section of land is required to sustain five animal units year-long. Intermittently, the land is the site of exploratory drilling for gas and oil wells, but there are no abandoned well sites within the proposed Facility boundary, and the nearest production well is approximately 3 miles from the proposed site.

The BLM has developed a recreation area known as Mescalero Sands approximately 2 miles northwest of the proposed site. The recreation area allows hikers and recreational vehicles in the sand dunes.

3.4 GEOLOGY

This section describes the regional and geologic setting of the proposed landfill.

3.4.1Regional Geology

The geologic formations present within the region range in age from Quaternary through Triassic. Those include Quaternary alluvium, Tertiary Ogallala Formation, and the Triassic Dockum Group. Permian sediments do not outcrop in this region but, because they underlie the proposed host sediments, they are also discussed in this section.

3.4.1.1 Regional Stratigraphy

The stratigraphic relationship of the formations discussed in this section is illustrated in Figure 3-4. Information concerning formation tops and thicknesses was obtained from well logs from the New Mexico OCD office in Hobbs, New Mexico. Appendix B presented in Volume II contains a representative oil well log.

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Quaternary

The surface throughout the project area is covered by alluvial deposits of Quaternary age. These deposits are comprised of fine-grained, red-brown sands, interbedded with red-brown silts and clays. A major source of these sediments was the topographically higher Ogallala Formation, as evidenced by the abundant granitic cobbles, chert pebbles, and fragments of petrified wood found throughout this unit. The thickness of these alluvial deposits along the eastern flank of the Pecos River Basin in Chaves County varies from a few feet to as much as 50 feet.

Tertiary

The "Caprock," which is the surface expression of the Tertiary Ogallala Formation, unconformably overlies Triassic sediments in southeastern New Mexico. This flat-lying sandstone and conglomeritic unit is approximately 300 to 400 feet thick. It consists of fluviatile sand, silt, clay, and gravel capped by caliche. The sand deposits of the Ogallala Formation consist of fine- to medium-grained quartz grains, which are silty and calcareous. Bedding features range from indistinctly bedded to massive to crossbedded. The formation varies from unconsolidated to weakly cohesive and contains local quartzite lenses. The sand intervals of the Ogallala Formation occur in various shades of gray and red.

Ogallala Formation silt and clay deposits are reddish brown, dusky red, and pink and contain caliche nodules. Gravels occur as basal conglomerates in intra-formational channel deposits and consist primarily of quartz, quartzite, sandstone, limestone, chert, igneous rock, and metamorphic rock. There are abundant petrified wood fragments throughout this unit.

Triassic

Triassic sediments are the potential host rocks for the proposed Facility and, as such, are described in more detail than the other formations. The Depositional Framework of the Lower Dockum Group (Triassic), Texas Bureau of Economic Geology, No. 97, 1979, by McGowen was used as a major reference for gathering information on the characteristics of Triassic sediments.

Triassic sediments unconformably overlie Permian sequences in Texas and New Mexico and have been classified as the Triassic Dockum Group. The Dockum Group is comprised of a complexly interrelated series of fluvial and lacustrine mudstone, siltstone, sandstone, and silty dolomite deposits that can be as much as 2,000 feet thick in this part of the Permian Basin. These sediments accumulated in a variety of continental depositional settings, including braided and meandering streams, alluvial fan deltas, lacustrine deltas, lacustrine systems, and mud flats.

The Triassic Dockum Group is divided into an Upper and Lower Unit. The Upper Dockum Unit is very near the surface within the project boundary, covered only by a thin veneer of Quaternary sediments. The character of this unit, also know as the Chinle Formation, is a series of fluvial sediments. These sediments conformably overlie the Lower Dockum Unit and consist of red-green micaceous mudstones, interbedded with thin, discontinuous lenses of siltstone and silty sandstones. A continental fluvial depositional environment predominated during Upper Dockum time, when the Triassic basin was filled with lacustrine sediments. The Chinle Formation is widespread in the southwestern United States.

The Lower Dockum accumulated in a fluvial lacustrine basin defined by the Amarillo Uplift on the north and the Glass Mountains on the south ~~(Figure 3-5)~~. As presented in th~~is~~e basin map shown on Figure 3-5, the Lower Dockum represents sediments from a large, regional depositional system. For any given portion of this basin, these sediments tend to be very homogeneous and not subject to abrupt local changes. This basin was peripherally filled, receiving sediment from the east, south, and west. Chief sediment sources were Paleozoic sedimentary rocks. Lowlands to the east and west were

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traversed chiefly by meandering streams. Higher gradient streams with flashy discharge existed at northern and southern ends of the basin. The large shallow lake (or lakes) was the last portion of the basin to be filled. The lacustrine sediments that accumulated here consist primarily of low-energy mudstone.

The proposed site, situated on the western flank of the Triassic paleobasin, is underlain by thick sequences of Lower Dockum mudstones. In Triassic times this area was dominated by meandering streams. The former tectonic belts were more than 200 miles away, and the regional slopes were relatively low. Surface exposures today in these areas consist of thick sequences of maroon-red-purple variegated mudstones with thin discontinuous layers of siltstones and silty sandstones.

The stratigraphy of Lower Dockum sediments in east-central New Mexico is significantly different from that of the proposed site. Figure 3-6, a subsurface sand percent map of this unit, was compiled from drill hole data from more than 1,500 oil wells throughout the basin. Thick sequences of sandstones at the northern and southern portions of the basin are shown projecting inward toward the center of the basin. In the New Mexico portion of this basin, these sand accumulations are related to the occurrence of the Santa Rosa Sandstones. This medium-to-coarse grained, white to buff sandstone represents the lowermost Triassic depositional unit and is a major aquifer in this portion of New Mexico.

Figure 3-6 illustrates that the great accumulation of Santa Rosa Sands that fills the northern portion of the Triassic paleobasin pinches out before reaching the Facility site. During the Lower Dockum time, the Facility site was part of a low-relief area with little fluvial deposition. The McGowen report specifies sand percentages of the Lower Dockum group in the Facility site area to be in the 10-20% range. This is consistent with data gathered from the two deeper drill holes completed north and south of the site boundary. There is a basal sand unit in the Lower Dockum below the site, but it appears not to be depositionally related to the Santa Rosa Sandstone.

Permian

Permian sediments are important to the geologic setting because they are immediately below the proposed Triassic host rocks. The deeper formations of Permian age were deposited in a restricted-marine environment and thus contain salt deposits, which make the groundwater produced from them too brackish for use.

Permian sediments underlying the Triassic units in the project area are assigned to the Artesia Group. Oil well logs from the New Mexico OCD in Hobbs, New Mexico, have provided sufficient data to identify the Dewey Lake Formation, Rustler Formation, and Yates Formation from the upper portion of this group. Geologic literature describes these Permian sediments to be gently dipping to the east. This fact was confirmed by using oil well log data to construct a graphic 3-point solution, as shown in Figure 3-7. Using the top of the anhydrite (Rustler) as a marker bed, the following simple calculations were made:

Known Point Elevations of Marker Bed

A = Lowest elevation - 2,975 feet
C = Highest elevation - 3,148 feet
B = Middle elevation - 3,091 feet

Strike Determination

Strike is defined as the direction of a horizontal line along the bedding plane and is calculated as follows:

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D = point along AC with the same elevation as B (BD is strike)

$$AD = AC \times \frac{\text{difference in elevation between A and B}}{\text{difference in elevation between A and C}}$$

$$AD = 18{,}500 \text{ ft} \times \frac{3091 - 2975}{3148 - 2975} = 12{,}405 \text{ ft}$$

CD = 18,500 ft – 12,405 ft = 6,095 ft

BD = direction of strike = N6°E

Dip Determination

Dip is defined as the angle of the bedding plane measured from a horizontal line perpendicular to the strike and is calculated as follows:

E = point along strike, therefore, E(elevation) = B(elevation)

$$\text{Tangent of dip angle} = \frac{E(\text{elevation}) - A(\text{elevation})}{AE}$$

$$\text{Tangent of dip angle} = \frac{3091 \text{ ft} - 2975 \text{ ft}}{7520 \text{ ft}} = \frac{116 \text{ ft}}{7520 \text{ ft}} = .015$$

Dip angle = $\text{Tangent}^{-1}(.015)$

Dip angle = 0°52'

These calculations indicate a north-south strike and a dip of less than 1° to the east. These results are consistent with the reported regional dip for Permian (and Triassic) sediments along the western flank of the Permian Basin.

Dewey Lake Formation—The uppermost Permian sediments underlying the Triassic sequence in the project area correlate to the Dewey Lake Formation. These sediments are predominately red to red-brown mudstones and siltstones and are virtually indistinguishable from the overlying Triassic sediments. Geologic literature reports a conformable relationship between these sediments and the overlying Triassic sediments. There are approximately 240 feet of Permian redbeds in this section.

Rustler Formation—The top of the Rustler Formation was identified on OCD well logs and corresponds to the top of a 40-foot bed of anhydrite. These anhydrites are visible in outcrop on the hills immediately east of the Pecos River drainage east of Roswell, New Mexico. Underlying the anhydrite are approximately 500 feet of halite (salt). The Rustler Formation represents the youngest anhydrite sequence in the Permian Basin.

Yates Formation—Unconformably underlying the Rustler, the Yates Formation is composed primarily of interbedded sandstone with minor dolostone and limestone. The sands are light gray and fine to very fine grained. Limestone is white to very light gray microcrystalline lime mudstone with a chalky texture. Dolostone is pink to light gray and microcrystalline.

3.4.1.2 Regional Structure

The tectonic setting and seismic activity are discussed in this section.

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Tectonic Setting

The proposed Facility site is located on the western flank of the Permian Basin of west Texas. Because of the distance from tectonic centers and the minimal seismic activity, this is considered one of the more geologically stable regions within the United States.

The region underwent intense deformation, however, during late Paleozoic times. ~~As shown in Figure 3-5, m~~Major uplifting occurred along the Ouachita Tectonic Belt and the Wichita System of Texas and Oklahoma (shown in Figure 3-5). The Sacramento and Sangre de Cristo uplifts in northeastern New Mexico were also active during late Paleozoic time. The overall structural configuration of the Permian Basin was established at this time.

This period of intense deformation was followed by a long period of gradual subsidence. The sea covered the region, and throughout the remainder of Permian era, the Permian Basin was slowly filled with several thousand feet of evaporites, carbonates, and shales. As discussed in Section 3.4.1.1, non-marine deposition began in Triassic time with the accumulation of lacustrine/fluvial sediments into a large shallow lake.

During the late Cretaceous to early Tertiary Laramide Orogeny, there was renewed uplifting along the Sacramento, Sangre de Cristo, and other ranges within the Rocky Mountains. This orogeny uplifted the region to its present position and supplied sediments for the Tertiary Ogallala Formation.

Seismic Activity

The Permian Basin is an area of moderate to low seismic activity. Data obtained from the National Geophysical Data Center of NOAA indicate a total of 102 observed earthquakes within a 250-km (155-mile) radius of the proposed site. These data reflect observations made from 1930 to 1993.

As shown in Figure 3-8, there were no recorded earthquakes with a magnitude greater than 3.9 within 70 miles of the proposed site and no recorded seismic activity within a radius of 45 miles. The distance from any tectonic centers and the low recorded seismic activity suggest that the proposed site is located in an extremely stable environment where activity is not expected. Consequently, little damage from earthquake activity is anticipated.

3.4.2 Site Geology

Figure 3-9 illustrates the surficial geology on and adjacent to the proposed site. This section will provide detailed descriptions of the proposed Triassic host sediments and the Quaternary alluvium that overlies these sediments only.

3.4.2.1 Site Stratigraphy

Specific data for this section was obtained through drilling activities described in Section 3.4.3. Figure 3-10 is a stratigraphic cross-section based on this drilling, illustrating relationships between the proposed Triassic host sediments and adjacent formations. Other site-specific cross-sections are located in Volume II, Appendix G.

Quaternary

The thickness of Quaternary alluvial deposits at the site varies from less than 10 feet to 35 feet. The upper portion of these sediments consists of fine to very fine, wind-blown yellow-brown sands. Below this sand are varying thicknesses of red-brown to yellow-brown siltstones and silty mudstones. Scattered throughout these sediments are small chert pebbles and granitic cobbles derived from the Tertiary Ogallala Formation.

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A caliche zone (Mescalero Caliche) is present in most of this unit. The caliche is found immediately under the top wind-blown sands and coats and fills fractures within the more consolidated siltstones. Where the Quaternary alluvium is quite thin, this caliche is found coating Triassic sediments.

Triassic

Drilling at the site has delineated 1,175 feet of Dockum sediments. Two distinct units can be identified in these sediments: the Upper Dockum (475 feet thick) and the Lower Dockum (700 feet thick). Within the proposed Facility boundary the thickness of the Upper Dockum unit never exceeds 100 feet. Upper Dockum sediments are in contact with the overlying Quaternary alluvium throughout the project area.

Upper Dockum—This unit consists of variegated (red-brown-green) mudstones interbedded with reddish gray siltstones and reddish-gray-green sandy siltstones. The siltstones are micaceous (predominantly muscovite), indicating they were part of a relatively active fluvial system capable of transporting material into the basin from distant source rocks.

From examination of lithology and down-hole electric logs, it is estimated that 30 percent of the unit is comprised of mudstones. Lithologies of the remainder of the unit are evenly divided between siltstones and sandy siltstones. However, as the geotechnical properties of these two lithologies are very similar, this geologic discussion will simply refer to them both as siltstone. Mudstones were found to have an average permeability of 2.45 x 10^{-7} cm/s, and the siltstones average 1.22 x 10^{-5} cm/s.

These sediments were deposited in a fluvial environment. Mudstone and siltstone bodies are very lenticular and are found to pinch out abruptly. Accordingly, individual lithologies are not correlatable over significant distances (thousands of feet).

Cross-sections prepared from the close-spaced drilling within the proposed Facility boundary establish an understanding of the fluvial nature of this unit (see Appendix G in Volume II). Figure 3-11 shows the locations of drill holes for the close-spaced drilling pattern and provides an index of cross-sections that illustrate the character of the Upper Dockum Unit. Also shown on Figure 3-11 is the location of the "most favorable" area for the construction of the proposed landfill. Figure 3-12 shows the lithology of the site. ~~Figure 3-12 shows the location of the proposed disposal site.~~ As shown in the cross-sections on Figures 3-10 and 3-12, the lithology of this area ~~(centered on drill hole PB-4)~~ is predominantly mudstone, with thin beds of siltstones. The lenticular nature of the mudstone and siltstone bodies is also shown in these cross-sections. Cross-sections 3-1 and 3-2, in Appendix G (Volume II), show the facies relationships of the "most favorable" area.

The fluvial nature of the Upper Dockum Unit has led to the scouring of channels into the underlying Lower Dockum Unit. This scouring and the pinching-out of fluvial sediments have resulted in the local development of an undulatory surface on top of the Lower Dockum Unit. This phenomenon is well illustrated in Cross-sections 3-3, 3-4, and 3-5, in Appendix G (Volume II).

Lower Dockum —The Lower Dockum Unit, described in Section 3.4.1.1, has a completely different character from the upper unit. The lower unit represents a time of relatively quiet lacustrine deposition, which resulted in the accumulation of thick sequences of predominantly mudstones interbedded with thin siltstones. These sediments are very homogeneous, in contrast with the abrupt facies changes present in the more active Upper Dockum depositional system.

Most of the close-spaced drilling within the proposed Facility boundary "bottomed" in Lower Dockum mudstones. These mudstones were consistently a moderate reddish brown color, which according to McGowen (1979), is associated with low stand lacustrine and mud flat deposition.

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The 1995 confirmation drilling provided some important data on this unit. As illustrated in Figure 3-13, all three holes penetrated the clays of the Lower Dockum unit. PB-36 encountered 64 feet of this unit, PB-37 encountered 55 feet, and PB-38 encountered 18 feet. Ten feet of core of Lower Dockum were collected from PB-36 at a depth of 138 to 148 feet and 7 feet of Lower Dockum were collected from PB-37 at a depth of 148 to 155 feet. Four representative samples of this core were sent to AGRA Earth & Environmental laboratories for permeability analyses. The results of these analyses confirm the Lower Dockum to be a very impermeable unit (average permeability of 5.7×10^{-8} cm/s), capable of performing as a geologic barrier to downward migration from the proposed landfill. Following are the results of the core analyses:

Core Interval	Permeability (cm/sec)
PB-36 (144'-145')	5.2×10^{-8}
PB-36 (147'-148')	6.8×10^{-8}
PB-37 (150'-151')	5.8×10^{-8}
PB-37 (154'-155')	4.9×10^{-8}

3.4.2.2 Site Structure

There are no identified faults within the project area. As previously discussed, the proposed site is located in a geologically stable area. There are no mapped faults on or adjacent to the project area. Color air photos of the area were examined for surface lineations, which can reflect faulting in the subsurface. All surface lineations observed on these photos were attributed to man-made features (i.e., fences, roads, etc.).

Subsurface drilling did not encounter displacement or repeating of geologic sequences that would be indicative of faulting. In the Upper Dockum Unit, there are abrupt changes in lithologies, but these are attributed to depositional processes associated with an active fluvial system. The fluvial nature of the Upper Dockum Unit has led to the scouring of channels into the underlying Lower Dockum Unit. This scouring and the pinching-out of fluvial sediments have resulted in the local development of an undulatory surface on top of the Lower Dockum Unit (Figure 3-14~~, Structure Contour - Top of Lower Dockum~~). Figure 3-14 also shows the northeast dip of the Lower Dockum.

3.4.3 Site Investigation Activities

Triassic sediments in eastern Chaves County were initially identified as excellent host rocks for proposed hazardous waste disposal because they (1) contain thick sequences of low permeability clays; (2) occur in remote, unpopulated areas; and (3) produce virtually no groundwater. This section describes the series of exploration activities undertaken to verify and document the suitability of the site for hazardous waste disposal.

As part of this permit application, a total of 41 drill holes were completed. The lithologies of these holes were recorded and a geophysical log was run on each drill hole. Thirty-one of these drill holes were completed within the project boundary (Figure 3-15).

3.4.3.1 Preliminary Evaluation Activities

The first phase in determining an appropriate disposal site was to identify potential sites with exposed or near-surface Triassic sediments. To identify such sites, color aerial photos were obtained of areas underlain by Triassic sediments in eastern Chaves County (Figure 3-16). The areas exhibiting the characteristic coloration associated with the Triassic sediments on the photos were then plotted on topographic maps. The locations with desirable geology were screened for additional factors,

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including accessibility and land ownership. From this process, a prioritization of sites was developed and a shallow drilling program designed.

In July and September 1993, two shallow drilling programs were conducted to examine Triassic sediments underlying the Quaternary alluvium. Average depth of these holes was 40 to 60 feet, and the drilling was conducted on a spacing of approximately 1,000 feet between holes. As shown in Figure 3-17, three areas encompassing seven sections were examined. The objective of this drilling was to identify an area where the Triassic sediments were unsaturated, were situated close to the surface, and contained low permeability clays. An Ingersol Rand 1500 air rotary drill was used to perform this work. This air rotary technique was used because of the high quality of drill cuttings it produces and because the presence of any subsurface water can be easily detected.

Of all areas investigated, the surface and near-surface geology in the vicinity of Red Tank (the proposed site) was found to be the most favorable. Over most of this area, the thickness of Quaternary alluvium averaged approximately 10 feet, and the shallow drilling indicated the presence of unsaturated mudstones underlying the alluvium. Five shallow core holes were completed, adjacent to rotary air holes, to obtain preliminary geotechnical data on the near-surface Triassic sediments. As a result of the shallow depth of these sediments, many of the clays were very dry and brittle. This presented some difficulty in obtaining "undisturbed" core samples. Despite these difficulties, materials testing results showed low permeabilities for Triassic clays, ranging from $1x10^{-7}$ to $3x10^{-8}$ cm/s. These values, along with the local geologic setting, established the Red Tank area as an area conducive to more detailed site characterization.

Two deep holes (WW-1 and WW-2) were drilled to the base of the Dockum Group in November 1993. These holes encountered an unsaturated thickness of 600 to 650 feet of Lower Dockum mudstones consisting primarily of reddish brown, maroon, and purple mudstones with thin intervals of reddish brown silts.

Lithologic logs developed from cuttings samples and down-hole geophysical logs (gamma and thermal neutron) confirm the homogeneity of this thick mudstone interval. In addition, samples of drill cuttings from one of the deep holes (WW-2) were taken to the University of New Mexico's Diagnoses Laboratory for a grain size analysis. This analysis showed a remarkably constant grain size distribution throughout the sequence, which is consistent with the technical definition of a mudstone. This procedure involved desegregating, centrifuging, drying, wet sieving, and weighing the samples. A complete procedure and the results of this analysis are contained in Volume II, Appendix F.

The 600- to 650-foot mudstone interval rests on a basal sandstone unit that is approximately 50 feet thick. This basal unit is present in oil well logs in the area as a clean to a silty sand. The deep drilling did not retrieve any cuttings from this basal unit. The drilling was performed with air, and the moisture in this unit prevented the return of cuttings to the surface. Casing was placed in these holes, and water levels were taken (Section 3.6.2).

WW-1 and WW-2 were drilled north and south of the project boundary to characterize the nature of the Lower Dockum. Because of the consistent, continuous depositional environment within the lacustrine sediments at the Lower Dockum, it was decided (and approved by the NMED) that is was unnecessary to penetrate the entire Lower Dockum sediments within the site boundary. Such penetration would have certainly violated the integrity of the formation in the area of the planned hazardous waste landfill and in all likelihood would not have provided additional geologic information.

Details for the closure of the two deep wells (WW 1 and WW 2) will be provided for review and approval by NMED prior to plugging. Both wells will be abandoned prior to the start of any facility construction

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3.4.3.2 1994 Site Characterization Activities

In June 1994, a drilling plan for site characterization activities at the proposed site was prepared and submitted to the Hazardous and Radioactive Materials Bureau of the New Mexico Environment Department. The plan identified drilling locations, depths and methods, proposed geotechnical tests and methods, and down-hole geophysical logging methods. The 100-foot depth was sufficient to penetrate the base of the Upper Dockum (with the exception of the easternmost portion of the site). The plan was approved as submitted.

Drilling operations commenced on July 17, 1994 and a total of 36 drill holes were completed. There were three distinct phases of this drilling program: (1) close-spaced pattern drilling in the area of the proposed site (to a depth of 100 feet) to obtain detailed lithologic and hydrologic information for the design of a landfill, (2) stratigraphic drilling across the project area (to a depth of 200 feet) to correlate the site geology with the regional setting, and (3) selected core drilling in the proposed site for geotechnical samples. Samples of drill cuttings were collected and logged for each hole (see Volume II, Appendix C). Southwest Geophysical Services, Inc. conducted down-hole geophysical logging of each drill hole. These electrical surveys consisted of thermal neutron and gamma logs. The electric logs provide lithologic information from ~~unsaturated~~ drill holes to supplement and verify the lithologic interpretations based on drill cuttings. Copies of all geophysical logs can be found in Volume II, Appendix D.

A rotary air rig (Ingersol Rand 1500) was used for this work. Drilling with air provides cleaner drill cuttings than drilling with water, and usually a good indication of water saturation. However, in the case of the Upper Dockum sediments on the Facility site, this drilling technique was not always successful in identifying water saturation. This failure was a result of the low to very low permeabilities of the silty sands and the low amount of water saturation. The pressure of the air from the drilling process prevented water from immediately entering the holes. If groundwater was present, it was not always detected until the hole had stabilized and a geophysical log was taken. Geophysical logs on all 31 drill holes within the site boundary encountered no saturated Upper Dockum sediments.

Three core holes were completed and a total of 85 feet of core recovered. A CME-55 hollow-stem auger rig using a continuous sampler was used to collect these samples. The dry, brittle nature of these shallow, unsaturated sediments made the recovery of undisturbed core samples difficult.

Representative core samples of mudstones, siltstones, and sandy siltstones were sent to materials testing laboratories for measurement of geotechnical parameters to be used in the Facility design and contaminant transport modeling. In addition to core samples, 11 backhoe pits were dug adjacent to drill holes for the collection of bulk samples. Proctor tests were performed on these bulk samples to provide information required for design studies. All geotechnical results are contained in Volume II, Appendix E.

3.4.3.3 1995 Confirmation Drilling Program

In order to confirm the unsaturated nature of the Upper Dockum sediments on the eastern boundary of the proposed Facility, a drilling plan was submitted to Mr. Bob Sweeney of NMED on June 26, 1995. This plan was modified and approved in a letter from Mr. Ronald A. Kern, dated July 12, 1995. A three-hole drilling program was conducted on the GMI site on July 24 & 25, 1995. Mr. Bob Sweeney visited the site and observed the drilling operations on Monday, July 24, 1995.

Holes PB-36, PB-37, and PB-38 were completed as an extension to an existing east-west line of drill holes. The westernmost drill hole was located on the eastern boundary of the proposed landfill. The other two holes were drilled 1,000 feet apart and examined the area immediately east of the proposed landfill. All surface locations for these drill holes were surveyed.

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No groundwater saturation was encountered. All holes were completed with air so that saturated sediments could have easily been detected. Lithology logs describing drill hole cuttings were prepared in the field and down-hole geophysical logs were run on each hole. The geophysical logs included gamma ray, thermal neutron, and caliper profiles.

3.4.3.4 1999 Drilling Program

In order to further clarify the subsurface stratigraphy and groundwater conditions underlying and adjacent to the proposed site within the upper Dockum and its contact with the Lower Dockum, a drilling program was conducted in August 1999 consisting of 10 drill holes. This drilling program was conducted at the request of NMED and in accordance with the Final Work Plan for Stratigraphic and Groundwater Characterization Program, dated July 28, 1999. The results of this program were documented in Final Report for 1999 Stratigraphic and Groundwater Characterization Program, dated September 10, 1999 (Montgomery Watson).

The results of this program 1999 demonstrated that the subsurface stratigraphy underlying the proposed site is both continuous with and predictable from previous drilling results, as shown in Figure 3-14. There were no unexplainable features within the depositional environment. In all cases, the depth of the contact between the Upper Dockum and the Lower Dockum sediments was encountered where it was estimated to be. There was no groundwater within these sediments.

The groundwater characterization drilling demonstrated that there is even less groundwater in the vicinity of the site than originally thought. Pooled surface waters have the potential of migrating through the surface alluvial sediments. Limited saturation encountered one-mile northeast of the site in the Upper Dockum now appears to have been an isolated occurrence of perched groundwater. Upper Dockum sediments underlying the site and extending ¾ mile downgradient have been examined by over 40 drill holes and found to be unsaturated.

3.5 SURFACE WATER AND WATER BALANCE

This section describes surface waters and meteorological conditions used to estimate groundwater recharge at the proposed site.

3.5.1 Surface Water

There are no perennial stream drainages on or near the proposed site. The nearest surface drainage is the Pecos River, approximately 30 miles to the west.

There is one small stock tank (Red Tank) within the proposed Facility boundary and several additional tanks on adjacent lands. These tanks are approximately 200 feet by 200 feet and contain water for livestock. The tanks are clay-lined and retain water from run-off or receive water from an underground pipeline. Water in the underground pipeline is supplied from three water wells on the Marley Ranch located in Section 10, T11S, R31E. These wells are east of the Mescalero Rim and produce water from the Ogallala Formation. In the past, water from the springs along the Caprock excarpment was used in this pipeline, but now water is pumped from the Ogallala Formation. The pipeline is personally owned and maintained by the Marley Ranch to provide water to cattle operations below the Caprock.

Once the site is designated as a disposal area, cattle operations on this property will cease and the Marley Ranch will stop using Red Tank. They will also re-route their personal pipeline, as appropriate, to avoid landfill operations and continue to supply water to their cattle operations below the Caprock.

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3.5.2 Water Balance

The water balance analysis estimated groundwater recharge from direct precipitation, surface water bodies, and irrigation at the proposed landfill site. This information is useful for assessing the potential migration of contaminants released at or near the surface to groundwater. The groundwater recharge rate is directly related to the potential for contaminants spilled or leaked at the surface to reach groundwater. In areas with little or no groundwater recharge, there is less potential for groundwater contamination from releases of hazardous substances than in high recharge areas because the mechanisms to transport potential contamination are limited.

A water balance requires quantification of the hydrologic components, which can result in changes in the amount of water stored in the area of interest. Often, water balances are calculated for an entire watershed to understand the relative importance of the hydrologic components within that area. For this analysis, the water balance was performed to estimate groundwater recharge at the proposed landfill site.

Groundwater recharge at the proposed site can be estimated by summing precipitation, infiltration from surface water bodies, and irrigation at the site and subtracting evapotranspiration and surface run-off. As no natural surface water bodies or irrigation occur at the site, groundwater recharge is estimated as the difference between direct precipitation and evapotranspiration. This assumes no surface run-off at the site.

Precipitation data collected at the Roswell weather station indicate that mean annual precipitation is 10.61 inches (Section 3.2.2). This annual mean is used as the average precipitation at the proposed site.

Evapotranspiration refers to the processes that return water to the atmosphere by a combination of direct evaporation and transpiration by plants and animals. It is the largest item in the water budget because most of the precipitation that falls in the area returns almost immediately to the atmosphere without becoming part of the surface water or groundwater systems. On unirrigated rangeland, much of the precipitation that does not evaporate immediately is taken up fairly rapidly by plants and transpired. In a regional water balance conducted in southeastern New Mexico, it was estimated that approximately 96 percent of total precipitation is lost to evapotranspiration (Hunter, 1985). This number corresponds to data presented for the Rio Grande Basin by Todd (1983), which estimated that 95.4 percent of total precipitation was being lost to evapotranspiration.

Assuming a mean annual precipitation rate of 10.61 inches, of which 96 percent is lost to evapotranspiration, the net recharge to groundwater is estimated as 0.42 inch per year. This low groundwater recharge rate significantly reduces the potential for groundwater contamination from spills or leaks at the proposed Facility.

The purpose of this water balance is to provide a conceptual understanding of the hydrologic components at the site. The amount of groundwater recharge is a reflection of the arid climate of the region. The net recharge estimate of 0.42 inch per year (based on average hydrologic components) represents the expected long term annual conditions at the site. The relatively low recharge rate appears to be reasonable given the unsaturated conditions of the Upper Dockum within the site boundaries. Using the highest recorded annual precipitation value of 32.92 inches yields only a slightly higher recharge rate of 1.32 inches (assuming an evapotranspiration rate of 0.96). This short term (1 year) increase in recharge is unlikely to have a significant impact on the unsaturated flow regime at the proposed site.

3.6 GROUNDWATER

This section describes regional and local aquifers.

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3.6.1 Regional Aquifers

In the region surrounding the proposed site, there are two geologic units that have produced groundwater, the Triassic and the Tertiary Ogallala Formation. Very minor amounts of groundwater have been produced from Triassic sediments; but the Tertiary Ogallala Formation is a major aquifer in southeastern New Mexico, west Texas, and several other western states.

A listing of all water wells within a 4-mile radius and 10-mile radius of the proposed site was obtained from the New Mexico State Engineer's office. Water wells within a 10-mile radius are shown in Figure 3-18, while those within a 4-mile radius, along with oil well locations and the locations for all site investigation drilling activities, are shown in Figure 3-19.

Sixteen water wells were reported, fourteen from the Ogallala Formation and two from the Triassic. Of the two Triassic wells, one is now reported to be dry and the other is actually located more than 6 miles west of the proposed site. Six of these wells are shallow completions (100 feet or less) from the 1910's and 1940's and are used with windmills to supply water to livestock and wildlife. The numbers of these wells are RA-8585 through RA-8589 and RA-8363. These ~~are~~ include~~d~~ ~~as~~ wells that appear to~~s~~ penetrating Triassic sediments because of their surface locations, but ~~. However,~~ due to their shallow depths, the source of water could be from surface alluvial sediments.

F~~The f~~our ~~other~~of the remaining eight wells range in depth from 560 to 640 feet and have been completed within the past seven years. These wells would have penetrated the Lower Dockum sediments (including the Santa Rosa Sandstone equivalent). Following is a description of these wells:

- RA-8577 was drilled to a depth of 614 feet in 1992. It's initial production was 4 gallons per minute.
- RA-9320 was drilled in 1996 to a depth of 560. The estimated yield was 6 gallons per minute, however, the water was determined to be not potable. The well was plugged and abandoned on 11/25/96.
- RA-9568 was drilled to a depth of 640 feet in 1998. It was a dry hole and was plugged and abandoned on 08/14/98.
- RA-9670 was drilled in 1998 to a depth of 587. The estimated initial yield was 2 gallons per minute.

Little information about the remaining four wells was available at the time of the study.

3.6.1.1 Ogallala Aquifer

The Ogallala Aquifer is the primary freshwater aquifer within the regional study area and serves as the principal source of groundwater in the Southern High Plains. The saturated thickness of the Ogallala Aquifer ranges from a few feet to approximately 300 feet in the Southern High Plains. Groundwater within the Ogallala Aquifer is typically under water table conditions, with a regional hydraulic gradient toward the southeast ranging from approximately 10 feet/mile to 15 feet/mile. The average hydraulic conductivity of the Ogallala Aquifer ranges from ~~1 foot/day to 27 feet/day~~ 3.5×10^{-4} cm/s to 9.5×10^{-3} cm/s.

The Ogallala Aquifer is recharged primarily through the infiltration of precipitation. The rate of recharge is believed to be less than 1 inch/year. Groundwater discharge from the Ogallala Aquifer occurs naturally through springs, underflow, evaporation, and transpiration, but groundwater is also

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removed artificially through pumpage and catchment. Currently, the rate of withdrawal exceeds the rate of recharge for much of the Ogallala Aquifer.

3.6.1.2 Triassic

Regionally, the only aquifer within Triassic sediments is the Lower Dockum Aquifer. However, because the Upper Dockum is known to have permeable facies that locally produce low quantities of good to poor quality water, it is included in this section.

Lower Dockum Aquifer

The major aquifer within the Lower Dockum is the Santa Rosa Sandstone. This sandstone is present along the northern and southern flanks of the Permian Basin and is a principal source of groundwater in Roosevelt and Curry Counties, New Mexico. The Santa Rosa Sandstone is not present along the western flank of the Permian Basin, which includes the proposed site.

Where the Santa Rosa Aquifer has been studied, hydrochemical analyses and groundwater oxygen isotopes indicate that it is distinctly different from the Ogallala Aquifer. The thick, impermeable clays within the Triassic section have been sufficiently impermeable to prevent hydraulic communication between these aquifers.

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Upper Dockum Aquifer

There is no regional aquifer developed within Upper Dockum sediments. In local areas, recharge to the Upper Dockum is provided through vertical infiltration from overlying aquifers which are water-bearing units within the Ogallala Formation. This relationship has been illustrated in Figure 3-10.

3.6.2 Site Groundwater

Potential Triassic host sediments within the proposed Facility boundary are unsaturated. Detailed drilling within this boundary has encountered no groundwater. Drilling outside the proposed Facility boundary has identified saturated zones in both the Upper and Lower Dockum Units. The following subsections contain descriptions of these saturated zones.

3.6.2.1 Ogallala Aquifer

The western boundary of the Ogallala Aquifer, represented by the Caprock escarpment, is located topographically/stratigraphically above and 2 miles east of the proposed site. At the base of the escarpment, along the contact of the Ogallala Formation and the underlying Upper Dockum, are numerous springs, which are a result of downward-migrating Ogallala groundwater coming into contact with low permeability zones within the Upper Dockum and being diverted to the surface.

3.6.2.2 Upper Dockum - "Uppermost Aquifer"

For the purpose of this application, the uppermost aquifer is considered to be the Upper Dockum Unit because the Ogallala Aquifer is not present at the site. The EPA has defined the uppermost

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aquifer as the geologic formation, group of formations, or part of a formation that is the aquifer nearest to the ground surface capable of yielding a significant amount of groundwater to wells or springs. The Upper Dockum Unit certainly does not yield a significant amount of groundwater. However, preliminary drilling in the site area has found portions of this unit to be water-bearing and to possess consistent hydrologic characteristics.

The identification of a confining layer on the lower boundary is an essential factor in the identification of the uppermost aquifer. The thick sequence of mudstones of the Lower Dockum Unit (as discussed in Section 3.4.2.1) represents a high-integrity aquitard, effectively confining the aquifer. Although there is a saturated basal sandstone in this unit, the 600 to 650 feet of mudstones separating the Upper Dockum sediments from this sandstone are of sufficiently low permeability to prevent hydraulic communication between the Upper and Lower Dockum Units.

As previously discussed in Section 3.6.2.1, several springs are present where the Ogallala Formation crops out, two miles east of the Facility site, along the 200-foot high Caprock escarpment. These springs are present where the Ogallala sands unconformably overlie impermeable Dockum mudstones and claystones and the groundwater moves laterally to the surface. Where these water-bearing Ogallala sands are in contact with more permeable units of the Upper Dockum, saturation of these underlying sediments occurs. The result, as illustrated in Figure 3-10, is the formation of a groundwater divide east of the proposed site. The majority of the groundwater entering the Upper Dockum flows to the east, conforming to the regional dip of the unit. There is also a minor flow component which slopes away from the unconformable contact, creating a steep hydraulic gradient towards the west. This gradient does not extend beneath the Facility site. As shown in Figure 3-20, this gradient must lie immediately east of PB-38, which is still unsaturated, whereas holes WW-1, and PB-26 are saturated.

Where groundwater has been observed in the Upper Dockum, not all lithologies within the unit are saturated. Air drilling through these sediments found the mudstones to be unsaturated. The more permeable sandy siltstone facies were water-bearing below depths of 135 to 150 feet. These saturated lithologies were encountered approximately 2,500 feet east (downdip) of the proposed landfill site, beyond the proposed Facility boundary (Figure 3-20). It is extremely significant that this saturation does not extend beneath the Facility site. All 31 drill holes within the site boundary, as shown on Figure 3-15~~9~~, were unsaturated. For this reason, there were no groundwater production tests conducted.

Exploratory drilling west of the proposed Facility boundary (updip), near the outcrop of the Upper Dockum Unit, the small sandy hills located along the section line between Section 18, T11S, R31E and Section 13, T11S, R30E, encountered an isolated occurrence of groundwater (Figure 3-19~~8~~). In a single drill hole (PB-14), at a depth of 42 feet, a small accumulation of groundwater was found in a depression developed on the surface of the underlying Lower Dockum mudstones. This depression is consistent with the "scouring" of the Upper Dockum fluvial sediments into the Lower Dockum mudstones (Section 3.4.3.2). Closer spaced drilling in the vicinity of this occurrence encountered no other such accumulations. This isolated "pooling" is most likely a result of surface run-off entering the subsurface from the nearby outcrop and being caught in a small "stratigraphic trap."

Because of the identification of groundwater in borehole 14, an offset (borehole 14o) was completed 400 feet to the east (down-gradient). This borehole location was in addition to those pre-approved by the NMED, but determining the potential extent of groundwater saturation was important. Borehole 14o was drilled to a depth of 100 feet.

There was no saturation observed while drilling this offset, but the geophysical log indicated the presence of fluid at the bottom of this borehole. The top of the fluid was observed to be at a depth of 92.0 feet, indicating a maximum apparent concentration of 3.5 feet. This is an apparent concentration because a 2.25 inch probe will displace approximately one-half of the volume of the

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hole. Regardless of all of these factors, there was approximately one gallon of fluid in the bottom of this borehole introduced by a heavy rainfall that occurred after the hole was drilled and before it could be logged. Due to the impermeable nature of the Lower Dockum mudstones, the water did not infiltrate into the formation and was trapped in the bottom of the hole.

The hole was cased with 3-inch plastic tubing and monitored for several weeks. No additional water entered the hole, and, in fact, the gallon of water eventually dispersed into the Lower Dockum. An examination of the log for PB-14o shows the bottom of the sandy silt unit (Upper Dockum) to be a depth of 36 feet. If the Upper Dockum was the source of the water, the hole would have equilibrated or filled to a depth of at least 36 feet. The fluid did not migrate upward through several hundred feet of Lower Dockum mudstones; therefore, there is no apparent subsurface source for the small quantity of water shown in the log for this hole.

Water Level Measurements—After the stratigraphically trapped water (Cross-section 3-3, Appendix G, Volume II) was encountered, temporary casing was placed in the drill hole (PB-14) so that piezometric water levels could be measured. For the first six weeks after casing the drill hole, the water was pumped from the hole weekly. After each pumping event, the water returned to a static level of 42 feet. Subsequent water level measurements have confirmed a static water level in this drill hole.

In addition to casing drill hole PB-14, nine other drill holes, located downdip, were also cased. Although the Upper Dockum is unstaturated in these other drillholes, the holes were examined weekly for six weeks. No water was observed except for that previously described in PB-14o. The drill holes that were cased with 3-inch plastic casing and the perforated intervals for these holes are as follows:

Hole No.	Perforated Zone	Base of Upper Dockum
PB-14	30-80	42'
PB-14o	20-40	36'
PB-33	20-55	52'
PB-18	60-80	78'
PB-16	60-80	79'
PB-15	30-65	62'
PB-13	30-50	48'
Hole No.	**Perforated Zone**	**Base of Upper Dockum**
PB-9	40-80	72'
PB-7	20-40	38'
PB-17	60-85	80'

The intent of installing casing in these 10 holes was to allow any groundwater in the vicinity of these drill holes to collect for detection purposes. The depths of the cased intervals varied because there is an approximate 1° regional dip to the east. All cased intervals extend down to the bottom of the Upper Dockum sand. Slits were cut in the PVC casing every foot throughout the perforated zones.

Water Quality—Preliminary water quality data were obtained from limited chemical analyses on a sample of the stratigraphically trapped groundwater from drill hole PB-14. These results include the following measurements:

Total Dissolved Solids	4,920 mg/L
Alkalinity	396 mg/L

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Sodium	1,640 mg/L
Magnesium	103 mg/L

These preliminary data indicate that water from the Upper Dockum is of poor quality. The most significant parameter is total dissolved solids (TDS); water with TDS values of greater than 5,000 mg/L is considered to be unfit for human consumption.

3.6.2.3 Lower Dockum Aquifer

The basal sandstone of the Lower Dockum Unit is the water-bearing portion of this unit. As shown in Figure 3-10, this unit is overlain by a thick sequence (600 to 650 feet) of low permeability mudstones that act as an aquitard. The recharge area for the Lower Dockum Aquifer is the Pecos River drainage to the west. Groundwater flow direction is easterly, along the regional dip of this unit.

Most of the shallow drilling in the site area has "bottomed" in the upper portion of the aquitard. Two holes (WW-1 and WW-2) were drilled to approximately the base of the Triassic section and encountered water from the Lower Dockum Aquifer (Figure 3-~~18~~20). Hole WW-1 also penetrated a saturated zone in the Upper Dockum Unit, resulting in a mixing of these groundwaters in this drill hole.

Both holes were drilled with an air rotary rig and drill cutting samples were collected. WW-1 was completed to a depth of 820 feet and, at the time of drilling, no water saturation was apparent in the drill cuttings. WW-2 was completed to a depth of 710 feet; however, circulation was lost at a depth of 645 feet. Loss of circulation commonly occurs when drill cuttings are too wet for the air pressure of the rig to remove the cuttings from the hole. It is likely that the basal sandstone of the Lower Dockum Unit was penetrated at this depth.

Water Level Measurements—Temporary plastic casing was placed in each of the two holes immediately after completion. In July 1994, geophysical logs were run for each hole, and water levels were identified. WW-1 had a water level of 155 feet. This level is 20 feet above the Upper/Lower Dockum contact, and it is likely that groundwaters from both units are present in this drill hole. A water level of 467 feet was observed for WW-2. This finding indicates that there is a hydrostatic head pressure within the Lower Dockum Aquifer of 178 feet.

Both of these cased holes were pumped and allowed to recover. After a sufficient recovery period, a static water level (155 feet for WW-1 and 467 feet for WW-2) was maintained.

Water Quality—Preliminary water quality data are presented only for WW-2. This drill hole encountered groundwater from the Lower Dockum. Because groundwater from the Upper Dockum and Lower Dockum was mixed in drill hole WW-1, preliminary water quality data from WW-1 do not accurately characterize either aquifer and are not presented. The results from WW-2 include the following:

Total Dissolved Solids	18,800 mg/L
Alkalinity	83 mg/L
Sodium	7,030 mg/L
Magnesium	87 mg/L

These preliminary data indicate that the water quality of the Lower Dockum is very low. The extremely high TDS values are indicative of long formation retention times, which reflects low groundwater flow and low permeability conditions within the Lower Dockum aquifer.

3.6.3 Contaminant Transport Modeling

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For the purpose of this application, two types of groundwater modeling were performed to estimate contaminant transport times. One approach is extremely conservative and presents a "worst case" scenario. One of the many conservative assumptions used in these calculations, despite field evidence, is that contaminant transport will take place under saturated conditions. A second, more realistic approach, assumes unsaturated flow conditions.

3.6.3.1 Saturated Flow Modeling

Saturated flow modeling was used to simulate potential leakage or infiltration from the Facility landfill. The objective of contaminant transport modeling was to calculate the time necessary for a hypothetical leak from the landfill to reach the uppermost aquifer. Travel time was calculated using a steady-state groundwater flow model. The model was based on results of the site investigation and geologic characterization, which indicated that perched groundwater exists upgradient and downgradient of the site (Section 3.6.2.2).

Perched groundwater located approximately 2,500 feet downgradient of the proposed landfill is the uppermost aquifer that could be affected by a contaminant. For the purpose of calculating travel time to the uppermost aquifer, contaminants were assumed to travel from the location of the Upper Dockum/Lower Dockum ~~interface~~ contact at borehole PB-3 to the perched groundwater downgradient of the site (Figure 3-~~18~~20). This location was chosen for contaminant transport modeling because it represents the shortest distance from the proposed landfill to downgradient groundwater. The Lower Dockum unit will act as a barrier limiting the vertical migration of contaminants because of its lower permeability and contaminated groundwater will preferentially migrate along the Upper Dockum/Lower Dockum contact until reaching the uppermost aquifer, located 2,500 feet downgradient of the site.

As mentioned in Section 3.4.3.2, representative core samples Upper and Lower Dockum were sent to a materials testing laboratories for measurement of geotechnical parameters, inlcuding hydraulic conductivity (1994 Site Investigation).

The following assumptions were made during modeling groundwater flow and contaminant transport to the uppermost aquifer. All of these assumptions are believed to be conservative in that they result in shorter travel times to the uppermost aquifer:

- It was assumed that contaminants would migrate completely through siltstones, along the Upper Dockum/Lower Dockum contact. A saturated hydraulic conductivity value of the siltstone unit (1.22×10^{-5} cm/s) was used for calculating travel time. In reality, both higher permeability siltstones and lower permeability mudstones (2.45×10^{-7} cm/s) will exist along the migration pathway. As contaminant velocity is directly proportional to the permeability value that is used in the calculation, using a value approximately two orders of magnitude greater than the lower permeability unit results in an extremely conservative estimate of travel time to the uppermost aquifer.

- It is reasonable to assume that any lateral migration of contaminants from the proposed landfill will occur in the most permeable units (siltstones/sandstones) within the Upper Dockum unit. However, the fluvial depositional environment of the Upper Dockum resulted in the formation of discontinuous lenses of various lithologies. This discontinuous deposition pattern (facies changes) is well illustrated in cross-sections shown in Figure 3-13. Using these cross-sections as a specific example, any lateral migration within the siltstones/sandstones at the base of the Upper Dockum unit will encounter a lower permeability mudstones facies approximately 1,000 feet downgradient from the eastern edge of the proposed landfill. This permeability barrier will severely retard continued migration. In the contaminant modeling for this section, these

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lithologic changes were not credited. Instead, it was assumed that there was a continuous siltstone/sandstone migration pathway from the proposed landfill to the uppermost aquifer. This assumption, based on the discontinuous, fluvial deposition environment within the Upper Dockum, is considered to be conservative;

- To provide an additional degree of conservatism for the travel time calculations, a non-reactive contaminant was assumed to be transported in the groundwater at the interstitial water velocity. Most contaminants are reactive, which results in longer travel times. The ratio of the reactive transport time to non-reactive travel time is given by the retardation coefficient. The retardation coefficient can be calculated, for organic contaminants, by using Equation 1:

Equation 1

$$R = 1 + \frac{(\rho_b * F_{oc} * K_{oc})}{\phi}$$

where:

R = retardation coefficient
ρ_b = bulk density
K_{oc} = organic carbon partition coefficient
F_{oc} = fraction of organic carbon
ϕ = porosity

- For a typical reactive compound such as trichloroethylene (TCE), a retardation coefficient of 4.89 is calculated using measured values of 0.0089 for the fraction of organic carbon, 1.96 g/cm^3 for bulk density, and 0.48 for the porosity of the siltstone; and a handbook value of 107.15 cm^3/g for the organic carbon partition coefficient (Knox et al., 1993). This means that TCE would require 489 percent more time to reach the uppermost aquifer than a non-reactive contaminant;

- The Upper Dockum sediments in the area of the proposed landfill and extending approximately 2,500 feet downgradient from the landfill are unsaturated. For the purpose of this contaminant transport modeling, it was assumed that these sediments were saturated and that lateral migration occurred under steady-state conditions. Due to our understanding of the subsurface conditions of the Upper Dockum unit at the proposed site, this assumption is also considered to be conservative. Assuming saturated conditions results in a conservative estimate of travel time to the uppermost aquifer because unsaturated hydraulic conductivities are orders of magnitude less than saturated values, especially at low water contents (Fetter, 1988). Assuming saturated conditions may result in slightly underestimating hydraulic gradients, especially at short distances; however, at longer distances hydraulic gradients will approach saturated values. Most importantly, while hydraulic gradients vary only by a factor of two or three, this variation is more than offset by the use of values for hydraulic conductivity. The hydraulic conductivity values are orders of magnitude greater during saturated conditions.

- Saturated hydraulic conductivity and porosity values for the Upper Dockum siltstone used during modeling were based on laboratory tests of cores collected during the drilling program. Average saturated hydraulic conductivity and porosity values for the siltstone were 1.22 x 10^{-5} cm/s and 0.48, respectively.

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- Travel time was calculated using a steady-state model represented by Darcy's Law as shown in Equation 2 (Fetter, 1988).

Equation 2

$$q = K_{sat} \frac{dh}{dl}$$

where:

q = darcy flux

K_{sat} = saturated hydraulic conductivity
h = hydraulic head
l = length

- The hydraulic gradient used in the model was calculated by dividing the elevation difference between the location of the hypothetical leak and the perched downgradient water (4055-4025) by the distance between these sites (2,500 feet). This calculation results in a hydraulic gradient of 0.012 and a darcy flux of 1.46×10^{-7} cm/s.

- Interstitial water velocity was calculated using Equation 3. Water content was assumed to be 0.48 based on the assumption of saturated flow.

Equation 3

$$v = \frac{q}{\theta}$$

where:

v = interstitial water velocity
q = darcy flux
θ = water content

The results of the modeling indicate that a solute would travel at an interstitial velocity of 3.05×10^{-7} cm/s and would require 7,920 years to reach the uppermost aquifer. This estimate of travel time is extremely conservative for the following reasons: (1) the saturated hydraulic conductivity of the siltstone used in the calculations is two orders of magnitude greater than the hydraulic conductivity of the mudstone; (2) non-reactive chemical transport was assumed; and (3) saturated hydraulic conductivity values used in the model are orders of magnitude greater than unsaturated values.

To confirm this travel time, similar calculations were conducted using the results of the 1995 confirmation drilling program. A hydraulic gradient of 0.0135 was calculated between drill holes PB-36 and PB-38. The same modeling parameters and equations were applied to this gradient. It was estimated that the time required for contaminants to migrate 2500 feet from the eastern boundary of the proposed landfill to the uppermost aquifer will be 7,042 years.

3.6.3.2 Unsaturated Flow Modeling

Unsaturated flow modeling was performed to simulate potential leakage or infiltration from the proposed hazardous waste landfill. Site characterization data indicate unsaturated conditions in the strata surrounding the proposed landfill. The unsaturated flow model developed by Mckee and Bumb (1988) predicts the extent of wetting fronts emanating from leakage sources on the base and side slopes of the landfill. Leakage rates were based on preliminary HELP (Hydrologic Evaluation of

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Landfill Performance) modeling results presented in Tables 3-3 and 3-4. The modeling results help illustrate how the natural hydrological conditions at the site inhibit subsurface fluid flow. [Note: These HELP modeling results should not be confused with those presented in the engineering report in Volumes III and VI, which support the current landfill design.] Three separate simulations were performed to account for the heterogeneities at the site. The first simulation predicts the soil moisture distribution in the Lower Dockum from leakage sources at the base of the landfill. The second simulation predicts the lateral movement of the wetting front into the Upper Dockum from leakage sources on the side slopes of the landfill. The third simulation predicts fluid movement through the clay berm and adjacent Quaternary alluvium along the perimeter of the landfill. The predicted wetting fronts led to the estimation of unsaturated hydraulic conductivities, darcy flux rates, interstitial water velocities and approximate contaminant travel times to the nearest aquifers. The primary modeling objectives include the following:

- prediction of the effective saturation distribution (wetting front) emanating from the landfill source;
- determination of the unsaturated hydraulic conductivity and advective transport rates; and,
- breakthrough time of the wetting front at the edge of the clay berm.

Modeling Methodology

Unsaturated flow modeling was performed using the exact steady state solution developed by Mckee and Bumb (1988) and Bum~~p~~b and Mckee et al. (1988). The steady state solution derived from the Richards equation (1931) of unsaturated flow provides more conservative results in lieu of transient based solutions. The Mckee and Bumb (1988) and Bumb and Mckee et al. (1988) steady state solution for a continuous point source in an infinite isotropic medium is governed by the following equation:

$$\Delta \eta_{\infty} = \frac{Q^{\exp\left[\frac{\alpha}{2}\left(z-z'-\sqrt{r^2+(z-z')^2}\right)\right]}}{4\pi\sqrt{r^2+(z-z')^2}}$$

where

$$r = \sqrt{(x-x') - (y-y')^2}$$

$\Delta \eta$ = hydraulic potential

$$S = S_r + (S_m - S_r)(\alpha\eta / K_o)^{1/n}$$

or

$$S_e = (a\eta / K_o)^{1/n}$$

At the Facility site, the evapotranspiration rate is high with respect to precipitation. According to Mckee and Bumb (1988), the soils in semi-arid regions of the western United States are at or below residual saturation (Sr). Therefore, the observed initial moisture contents are probably at or near the residual moisture content. Generally fluid flow is inhibited at soil moisture contents at or below the residual moisture content. The amount of saturation above the residual moisture content is referred

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to as the effective saturation. Unsaturated hydraulic conductivity is a function of the effective saturation and is expressed in the following equation (Mckee and Bumb, 1988; Bumb and Mckee et al., 1988):

$$K(\theta) = K_0 S_e^n$$

Brooks and Corey (1964) correlated the *n* exponent with the pore size distribution index α. Mckee and Bumb (1988) by confirmation of theoretical derivations by Irmay (1954) suggest an optimal value of 3 for η.

Under steady state conditions flow is driven by the force of gravity as the matric potential approaches unity (Hillel, 1980). Therefore, under steady state conditions the unsaturated hydraulic conductivity ($K(\theta)$) is equal to the darcy flux ($q(\theta)$), which in turn is multiplied by the unit area to obtain a leakage or discharge rate (Q). The following equations express these relationships:

$$q(\theta) = K(\theta);$$

$$Q = \frac{q(\theta)}{A}$$

The average interstitial water velocity (*v*) was used to estimate advective transport rates of non-reactive conservative solutes. Approximate travel times to the nearest aquifers can be estimated from the interstitial water velocity using the following expression:

$$v = q / \theta$$

In summary, modeling assumptions include steady state unsaturated flow in an infinite domain, a continuous leakage source, flow through porous medium, complete saturation of the soil beneath the source, and initial uniform saturation of the medium. The modeling does not account for secondary permeability features such as faults, fractures and macropores.

Input Parameters

Input parameters and initial boundary conditions were based on observed field conditions, landfill design specification, and preliminary HELP modeling results [Note: These preliminary HELP modeling results were based on a landfill liner design which did not incorporate a double liner system on the side slope areas. These results should not be confused with the HELP modeling results presented in the engineering report in Volume III and VI. The results presented in the engineering report support the currently proposed landfill design which incorporates a double liner in all areas and does not indicate any leakage from the landfill.] Average hydraulic parameters for the Lower and Upper Dockum and landfill design specifications are presented in this section. Input parameters used for the unsaturated flow modeling are presented in Table 3-5.

The source term geometry was based on the east-west geologic cross-section. Modeled source coordinates correspond to the basal and eastern slope dimensions of the proposed landfill. Conservative average leakage rates from the preliminary HELP modeling were used as source terms along the base (8.58 gpad) and eastern side slope (40.86 gpad) of the landfill to provide conservative "worst case" estimate of unsaturated flow. The leakage rate for the floor of the landfill was based on HELP modeling simulations between 70 and 200 years. The initial leakage rates for the first 50 years of HELP modeling were excluded from the average because these rates were extremely low and probably not representative of steady state conditions. These simulated leakage rates are based on

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extreme conditions such as waste moisture content conditions which exceed the field capacity of the waste and a termination of leachate pumping following the 30-year post-closure period.

Average site-specific saturated hydraulic conductivity values for the Upper Dockum siltstone (1.22 x 10^{-5} cm/s) and Lower Dockum (5.68 x 10^{-8} cm/s) were used as initial conditions for the first two modeling simulations. The design specifications of the clay berm require material with a permeability on the order of 10^{-7} cm/s. The saturated hydraulic conductivity of the Quaternary alluvium was assumed to be three orders of magnitude less than that of the clay berm. The effective saturation values for the Upper and Lower Dockum simulations were based on site-specific average initial moisture contents (Stoller, 1994). The bubbling pressures for the Upper and Lower Dockum, clay berm, and Quaternary alluvium simulations were based on average values of similar types of geologic materials reported by Bumb and Mckee et al. (1988).

Initial boundary conditions are presented in Figure 3-21, which shows a schematic of the proposed landfill and surrounding hydrostratigraphy. As displayed in Figure 3-21, the Lower Dockum Aquifer is approximately 600 feet (200 meters) below the site. The perched aquifer in the Upper Dockum is located approximately 2,500 feet (755 meters) to the east. The clay berm surrounding the proposed landfill is approximately 20 feet (6 meters) thick and rests on top of the Upper Dockum. The initial soil moisture contents of the surrounding clay berm and strata are assumed to be uniform and at residual saturation.

Modeling Results

The steady state unsaturated flow modeling results are presented in Figures 3-22 through 3-26. The Upper Dockum and clay berm results are presented as a function of lateral distance from the landfill source. The Lower Dockum results are presented as a function of depth from the source. The results of the modeling simulations are in reference to the landfill source.

Figure 3-22 displays the effective saturation at various distances from the source. As the wetting front disperses from the landfill source the chart shows abrupt decreases in saturation. The clay berm/Quaternary alluvium and Upper Dockum simulations show the sharpest decrease in saturation with Se values decreasing by nearly an order of magnitude at less than 100 meters from the source. Although the effective saturation dissipates less rapidly in the Lower Dockum, moisture contents decrease by nearly on order of magnitude at approximately 200 meters from the landfill source. The modeling results indicate that the Lower Dockum maintains greater saturation than the Upper Dockum, clay berm and Quaternary alluvium because fluid movement is driven primarily by gravitational forces; therefore fluid migration is greatest in the vertical direction.

Figures 3-23 and 3-24 display the unsaturated hydraulic conductivity and interstitial water velocity results, respectively. Comparison of these data to the effective saturation distributions (Figure 3-2~~0~~2) show the high degree of correlation between unsaturated flow and soil moisture content. Figures 3-23 and 3-24 show abrupt decreases in unsaturated hydraulic conductivity and interstitial water velocity, respectively, at relatively short distances from the source. Although Figure 3-24 shows that the interstitial water velocities decrease exponentially over distance, gross travel times may be estimated. The simulated interstitial water velocities were used to compute the following contaminant travel times of non-reactive solutes:

- contaminant travel time from the base of the landfill to the Lower Dockum Aquifer, located approximately 200 meters (600 feet) below the site, is estimated at 4,084,674 years;

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- contaminant travel time from the eastern slope of the landfill to the perched groundwater in the Upper Dockum at a lateral distance of 755 meters (2,500 feet) was estimated at 3.4 billion years;

- breakthrough time of the wetting front at the edge of the clay berm (a travel distance of 6 meters or (20 feet) was estimated at 866 years; and,

- contaminant travel time through the clay berm and Quaternary alluvium to a point above the perched groundwater (a distance of 755 meters) was estimated at 574,507,913 years.

Figures 3-25 and 3-26 display the steady state leakage per unit area as a function of distance from the source. Figure 3-26 also shows that the leakage rate at the edge of the clay berm (6 meters from the source) is approximately 10 gpad but quickly dissipates in the Quaternary alluvium. Despite the high leakage rate (10-11 gpad), calculations indicate that it would take a wetting front approximately 866 years to reach the outer edge of the berm.

Explanation of equation parameters:

A = area [L^2]
k = hydraulic conductivity [L/T]
K_o = hydraulic conductivity at maximum saturation [L/T]
n = power in the power-law relationship for K as a function of soil saturation
Q = flow rate or strength of point source [L^3/T]
R = distance from point source [L]
S = saturation of the soil
S_e = effective saturation
S_m = maximum saturation
S_r = irreducible or residual saturation
v = velocity of particles
x,y,z = Cartesian coordinates, z defined positive downward [L]
x',y',z' = location of point source [L]
α = constant defined by n/β [1/L]
β = bubbling pressure [L]
θ = volumetric moisture content
$\varnothing$ = porosity
$\Delta\eta$ = hydraulic potential

3.7 GROUNDWATER PROTECTION REQUIREMENTS

The following sections present general monitoring requirements and detection monitoring requirements, respectively.

3.7.1 General Monitoring Requirements

The selection of a monitoring program to identify contaminant releases from the proposed Facility was based on results of the geologic characterization and RCRA guidance. For the purposes of designing a monitoring program for the site, the Upper Dockum Unit was considered the uppermost aquifer (Section 3.6.2.2). This unit is not saturated within the Facility boundaries.

Two major geologic factors influence the design of a program to monitor potential contaminant releases from the site. These factors are the intermittent nature of saturation in the Upper Dockum downgradient of the Facility and the presence of a low permeability layer (the Lower Dockum) that significantly limits the potential for vertical migration of contaminants. These two factors influence

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potential groundwater transport pathways for contaminants released from the Facility and, therefore, affect the placement of monitoring devises.

There is no regional aquifer developed within the Upper Dockum; however, adjacent to the project boundary, permeable zones have been observed to be saturated. Exploratory drilling upgradient and downgradient of the site has identified isolated pockets of groundwater in permeable facies of the Upper Dockum (Section 3.6.2.2). Downgradient of the site, perched groundwater was detected above the Upper Dockum/Lower Dockum contact, approximately 2,500 feet east of the proposed landfill. Upgradient of the site, an isolated pocket of groundwater was detected at Borehole 14. The low permeability of the underlying Lower Dockum will prevent significant vertical migration of groundwater and will direct flow downdip along the Upper Dockum/Lower Dockum contact in the direction of perched groundwater east of the site. Therefore, potential contaminant releases from the proposed Facility will preferentially migrate downdip along the Upper Dockum/Lower Dockum contact.

Given the geologic and hydrologic features controlling the movement of groundwater at the site, monitoring the Upper Dockum is the most effective manner in which to immediately detect potential releases from the Facility. However, the placement of monitoring wells in the Upper Dockum is limited due to the fact that this unit is unsaturated within the site boundary. The utility of placing groundwater monitoring wells 2,500 downgradient of the landfill is questionable. The most effective monitoring program will involve vadose zone monitoring. ~~A request to utilize the vadose zone system for groundwater monitoring is being submitted under separate cover.~~

A formal groundwater monitoring waiver was submitted to NMED in January 2000 and approved in January 12, 2000. As part of the groundwater monitoring waiver a vadose zone monitoring system was proposed. Details of the vadose zone monitoring system are presented in Section 3.7.2.

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3.7.2 Vadose Zone Monitoring Requirements

~~The proposed design for the Facility includes a vadose zone monitoring system in the sump of each cell.~~ The vadose zone monitoring system will consist of two components. The first will consist of vadose zone sumps in the landfill and the evaporation ponds. The second component will be a series of vadose zone wells downgradient of the facilities. The intent of the sump vadose monitoring system is to provide an immediate indication if there is any leakage from the double composite liner system. Leakage from the secondary liner will be intercepted by the vadose zone sump monitoring system, which will be checked daily for the presence of liquids. The vadose zone monitoring wells are intended -to detect any water flowing from the facilities in a lateral (downdip) direction.

The design of the vadose zone sump monitoring system is shown in the design Drawings 15 through 19 in Volume III. It includes a 60 mil HDPE liner system below the bottom of the secondary liner system in the area of the sump. The vadose zone liner system is limited to an area directly beneath the sump, as this is the area expected to have the most liquids ponded for the longest period of time. Above the HDPE liner in the vadose zone sump, a drainage gravel surrounds a side slope riser pipe that extends into the sump. The side slope riser pipe allows a pump to be installed in the sump to remove accumulated liquids.

The vadose zone sump monitoring system, shown in the design drawings (Volume III) and described above, is expected to be a much more immediate indicator of leakage from the landfill than any other type of groundwater monitoring system. ~~or even a vadose zone monitoring system installed around the perimeter of the landfill.~~ Given the geologic and hydraulic conditions at the base of the landfill (unsaturated Upper Dockum siltstones and claystones), any fluids leaking from the landfill will migrate vertically with limited lateral dispersion and will be very difficult to intercept and detect. Since

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each cell is graded so that leachate will collect in the sump, liquids will be present in this area for the longest period of time, resulting in the sump area having the highest hydraulic head on the liner system. A vadose liner below the sump areas will indicate quickly if liquids are escaping from the liner system. The vadose zone sump will not only provide an indication that the LDRS sump is leaking, but will also provide access to remove the leakage and minimize head buildup in the sumps and in liners above until the source of the leakage is found. The vadose sumps for the landfill and evaporation ponds will be monitored for the presence of liquids whenever the primary or secondary sumps are monitored. As described in Section 5.2.2, these systems will be checked daily during active operations and closure.

~~It is expected that liquids in the vadose sump could occur from two sources. The first is consolidation of the overlying clay liner draining into the sump. This water is expected to be uncontaminated. The second source is leakage from the landfill. This liquid is expected to be similar to the leachate that is collected from the primary sumps. After the start of operations of the landfill, the leachate that is collected and removed from the primary sump will be analyzed to determine its constituents. Based on this analysis a select series of parameters will be identified that can be used to identify leachate from consolidation water. Thereafter, whenever liquids are detected in the vadose sump, they will be removed and sampled. Samples will be analyzed for leachate characteristics. If any of the leachate parameters are identified, the samples will be tested for the complete EPA Appendix IX parameters. If leachate is confirmed to be present in the vadose zone sump, then corrective action measures will be implemented.~~Details of the location, depth and construction for the vadose zone monitoring system wells are presented in (Appendix N, Volume II). In addition, specific procedures for monitoring and sampling the sumps or wells and the required procedures for analyzing the wells collected liquid are presented in the Vadose Zone Monitoring System Work Plan.

3.8 SUMMARY AND CONCLUSIONS

The proposed location of the Facility landfill in eastern Chaves County, New Mexico is ideal. It is located in an unpopulated portion of the county, on privately owned land, and more than 36 miles from the nearest community. The semiarid climate of this region with its high evaporation rate and lack of surface water, will play an important role in the proposed site's ability to confine and control material placed in the landfill.

Large-scale ranching is the primary land use for this portion of Chaves County. However, setting aside the 480 acres proposed for the Facility will have no impact on the ranching industry in the region, as these acres support fewer than five animal units year-long. Since the economic stimulation provided by landfill-related jobs will greatly offset the minimal economic impact of the loss of grazing land, the project has the support of the surrounding community.

A geologic setting for the Facility was selected that will enable the proposed landfill to be developed in an environment that will protect groundwater resources and ensure long-term isolation of wastes. The host rocks for this Facility are the sediments of the Dockum Group of Triassic age. Because these sediments are unsaturated and of low permeability, they represent a stable geologic barrier to the potential migration of contaminants from the proposed landfill.

The proposed landfill will be developed within sediments of the Upper Dockum unit. These sediments, consisting of fluvial, interbedded mudstones (30 percent) and siltstones (70 percent), are unsaturated beneath the proposed site. The nearest groundwater production comes from the Tertiary Ogallala Aquifer. The western boundary of this aquifer forms a topographic feature called the Caprock, which is approximately two miles east and several hundred feet higher than the proposed site.

While the Upper Dockum unit is unsaturated beneath the site, it is partially saturated 2,500 feet east of the proposed landfill (downdip). The source of this groundwater is infiltration from the overlying

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Ogallala Aquifer. Due to this perched groundwater, the Upper Dockum unit is designated as the uppermost aquifer for the purposes of this permit application.

The hydrologic setting of the Facility is extremely protective of groundwater resources. To demonstrate the integrity of the natural barriers present at this site, conservative contaminant transport modeling was performed, in which the most conservative parameters were consistently input into the modeling process. Acceptable conclusions were obtained even though "worst case" assumptions were used. The site's actual values will obviously provide an even larger margin of safety than the conclusions indicate.

For example, conservative transport modeling calculated that it will take 7000 - 8000 years for potential contaminates to migrate laterally through the sediments on the flanks of the proposed landfill to the nearest perched groundwater-bearing intervals within the uppermost aquifer. To emphasize the conservative nature of these calculations, saturated conditions were assumed for this modeling even though the Upper Dockum sediments at the proposed site are unsaturated. The migration pathway was assumed to be entirely through highly permeable siltstones, although close-spaced drilling indicated that 30 percent of this pathway would be comprised of low permeability mudstones. A non-reactive contaminant was also assumed, even though in reality a contaminant would react with the sediments through which it was traveling, adding considerably to the overall travel time.

To illustrate the conservative nature of this 7000 - 8000 year travel time, a second, unsaturated flow modeling approach was applied to the lateral contaminant migration scenario. This more realistic calculation resulted in an estimated travel time of 3.4 billion years.

The character of the Lower Dockum sediments is much different from that of the overlying Upper Dockum unit. The Lower Dockum consists of a 600-foot thickness of homogeneous, lacustrine mudstones overlying a thin basal sandstone. This thick sequence of unsaturated, low permeability mudstones represents a geologic barrier to the potential downward migration of contaminants from the proposed landfill. Unsaturated flow modeling estimated that 4 million years would be required for contaminants to migrate downward through these Lower Dockum mudstones and reach a Lower Dockum aquifer.

The description of the proposed Facility, as presented in this permit application is a result of numerous years of investigation to identify an environmentally sound site in southeastern New Mexico where hazardous wastes could be safely disposed. The location, geology and hydrology of the proposed site present a unique setting, where natural geologic barriers, combined with a well-conceived landfill design, will ensure long-term isolation of hazardous wastes from the environment.

TABLE 3-1
TEMPERATURES AT ROSWELL, 1977 TO 1978

Month	Monthly Average (°F)	Average Daily Maximum (°F)	Average Daily Minimum (°F)
January	38.1	55.4	20.8
February	42.9	60.9	24.8
March	49.3	57.7	30.9
April	59.7	78.2	41.2
May	68.5	86.4	50.5
June	77.0	94.2	59.8
July	79.2	94.7	63.7
August	77.9	93.4	62.3
September	70.4	86.5	54.3
October	59.6	77.0	42.2
November	46.9	64.8	29.0

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TABLE 3-1 TEMPERATURES AT ROSWELL, 1977 TO 1978			
Month	**Monthly Average (°F)**	**Average Daily Maximum (°F)**	**Average Daily Minimum (°F)**
December	39.3	56.8	21.8
Annual	**59.1**	**76.3**	**41.8**

TABLE 3-2
MONTHLY AND ANNUAL PRECIPITATION SUMMARY FOR ROSWELL (INCHES)
1977 THROUGH 1982

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1977	0.07	0.36	0.27	1.25	2.43	0.25	0.46	4.45	0.29	0.62	0.48	0.02	10.95
1978	0.50	0.48	0.39	0.02	1.81	4.31	0.52	3.49	3.58	1.47	1.25	0.43	18.25
1979	0.41	0.44	0.13	0.32	1.25	1.56	1.44	2.28	0.15	0.18	T	0.37	8.53
1980	0.85	0.19	0.00	1.06	0.85	0.29	0.01	2.45	6.58	T	0.77	0.15	13.20
1981	0.27	0.17	0.10	0.79	3.35	4.55	6.27	4.73	2.70	1.02	0.25	0.13	24.33
1982	0.66	0.20	0.12	0.41	0.20	0.76	1.03	0.93	2.00	0.20	0.92	1.62	9.05

Normal = 10.61
T = trace

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TABLE 3-3 TRIASSIC PARK HELP MODEL RESULT SUMMARY FOR CELL FLOOR						
	LCRS Operational Beyond 30 Years Post Closure			LCRS Not Operational Beyond 30 Years Post Closure		
Time (years)	Liner Leakage (gal/acre/day)	Cap Leakage (gal/acre/day)	Final Waste Moisture Content (vol/vol)	Liner Leakage (gal/acre/day)	Cap Leakage (gal/acre/day)	Final Waste Moisture Content (vol/vol)
0	1.3781	NA	0.1410	1.3781	NA	0.1410
20	0.9400	0.0454	0.1222	.9400	0.0454	0.1222
30	0.2735	0.0430	0.1181	0.2735	0.0430	0.1181
50	0.1927	0.0450	0.1125	3.4579	0.0450	0.1125
70	0.1329	0.0450	0.1087	8.0071	0.0450	0.1098
90	0.1007	0.0439	0.1059	9.1465	0.0439	0.1083
100	0.0775	0.0442	0.1049	8.5811	0.0442	0.1076
120	0.0744	0.0453	0.1029	8.8612	0.0453	0.1062
140	0.0629	0.0461	0.1013	8.6989	0.0461	0.1048
160	0.0547	0.0442	0.0999	8.5494	0.0442	0.1034
180	0.0482	0.0442	0.0987	8.4178	0.0442	0.1021
200	0.0431	0.0431	0.0976	8.2818	0.0442	0.1008
NA - Not Applicable						

TABLE 3-4 TRIASSIC PARK HELP MODEL RESULT SUMMARY FOR CELL SLOPE(1)						
	LCRS Operational Beyond 30 Years Post Closure			LCRS Not Operational Beyond 30 Years Post Closure		
Time (years)	Liner Leakage (gal/acre/day)	Cap Leakage (gal/acre/day)	Final Waste Moisture Content (vol/vol)	Liner Leakage (gal/acre/day)	Cap Leakage (gal/acre/day)	Final Waste Moisture Content (vol/vol)
0	173.0000	NA	0.1410	173.0000	NA	0.1414
20	123.0000	0.0453	0.1221	123.0000	0.0453	0.1223
30	53.5373	0.0442	0.1182	53.5373	0.0442	0.1182
50	37.0011	0.0453	0.1152	37.0282	0.0453	0.1152
70	24.5001	0.0461	0.1087	24.5114	0.0452	0.1087
90	18.0529	0.0442	0.1059	18.0583	0.0449	0.1059
100	13.6143	0.0425	0.1049	13.6174	0.0430	0.1049
120	12.9000	0.0443	0.1029	12.9032	0.0450	0.1029
140	10.7627	0.0439	0.1013	10.7642	0.0450	0.1013
160	9.2002	0.0457	0.0999	9.2030	0.0439	0.0999
180	8.0161	0.0462	0.0987	8.0178	0.0457	0.0987
200	7.0994	0.0461	0.0976	7.1002	0.0462	0.0976
Note: (1) Initial HELP Modeling Results were based on landfill liner system without double liner system on side slopes. These should not be confused with HELP results presented in the Engineering Report. NA - Not Applicable						

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TABLE 3-5
INPUT PARAMETERS FOR UNSATURATED FLOW MODELING

	β	Ko			Q		α	Source Coordinates (m)		
Unit	(m)	(m/day)	Sr	Sm	(m^3/day)	n	1/m	x[1]	y[1]	z[1]
Lower Dockum	0.373	4.90E-05	0.279	1	8.00E-05	3	8.042	0, 33, 66, 99, 132, 165, 193, 231, 264, 297, 330, 363, 396, 429, 462	0	0
Upper Dockum	0.2076	1.05E-02	0.161	1	3.80E-05	3	14.45	5.5, 11, 16.5, 22, 27.5, 33, 38.5, 44, 49.5, 55, 60.5, 66, 71.5, 77	0	24.5, 22.6, 20.72, 18.84, 16.96, 15.07, 13.19, 11.31, 9.42, 7.54, 5.65, 3.77, 1.88, 0
Clay Berm	0.37	8.64E-05	0.126[a]	1	3.80E-05	3	8.108	0, 5.5, 11	0	3.77, 1.88, 0
Quaternary Alluvium	0.0726[a]	8.64E-02	0.0458[a]	1	3.80E-05	3	41.32	0, 5.5, 11	0	3.77, 1.88, 0

Key:
β = bubbling pressure; typical values reported by Bumb and Mckee et al. (1988)
Ko = saturated hydraulic conductivity; site-specific means values
Sm = maximum saturation; assumed
Sr = residual saturation; site-specific mean values
Q = leakage rate; based on HELP modeling results
n = curve fitting parameter based on pre size index (Mckee and Bumb, 1988)
α = n/β
1 = Typical values reported by Bumb and Mckee et al (1988)
a = typical values reported by Bumb and Mckee et al. (1988)
b = assumed values

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Insert Figure 3-1, Index Map Proposed Site

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Insert Figure 3-2, Topography South East New Mexico

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Insert Figure 3-3, Wind Rose South East New Mexico

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Insert Figure 3-4, Stratigraphic Column

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Insert Figure 3-5, Basin Map for Triassic Period

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Insert Figure 3-6, Triassic Period Sand Accumulation in Paleobasin

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Insert Figure 3-7, Plan View, 3-Point for the Bedding Strike and Dip Angle

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Insert Figure 3-8, Seismic Activity - South East New Mexico

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Insert Figure 3-9, Surface Geology - Project Area

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Insert Figure 3-10, Stratigraphic Cross-Section

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Insert Figure 3-11, Close-Spaced Drilling Pattern

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Insert Figure 3-12, Proposed Disposal Site

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Insert Figure 3-13, Cross Section 1995 Drill Holes

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Insert Figure 3-14, Structure of Top of Lower Dockum

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Insert Figure 3-15, Total Drill Holes

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Insert Figure 3-16, Air Photo - South East New Mexico

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Insert Figure 3-17, Project Area

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Insert Figure 3-18, Water Wells – 10-Mile radius

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Insert Figure 3-19, Drill Hole Locations

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Insert Figure 3-20, Upper Dockum Perched Water

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Insert Figure 3-21, Landfill Profile

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Insert Figure 3-22, Steady State Effect Saturation vs. Distance

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Insert Figure 3-23, Steady State Effect Conductivity vs. Distance

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Insert Figure 3-24, Steady State Effect Velocity vs. Distance

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Insert Figure 3-25, Steady State Effect Leakage vs. Distance

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Insert Figure 3-26, Steady State Effect Leakage vs. Lateral

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2.0 TREATMENT, STORAGE, AND DISPOSAL

This section provides a general description of the storage, treatment, and disposal processes and units for the Facility. For each of the operational units described in this section, detailed design drawings and associated engineering reports are contained in Volume III of this application. The drawings and specifications present final designs for the RCRA permitted facilities. Details on the non-RCRA components of the facilities will be supplemented during the bidding and construction phase. Gandy Marley will supply the additional details on the non-RCRA components of the design to NMED for review and approval prior to the start of construction.

2.1 FACILITY OVERVIEW

An overview of the Facility layout is provided in Volume III, Drawing 4 of this application. This drawing shows the units used for the five general categories of waste disposal activities at the Facility. These five waste disposal operations are: (1) waste acceptance, (2) waste receiving, (3) waste staging/storage (4) waste treatment, and (5) waste disposal. Each activity is described below.

2.1.1 Facility Waste Acceptance

Prior to initiation of a shipment of waste to the Facility, the generator of the waste must provide a full characterization of its waste and receive approval from the Facility to ship the waste. This process is more completely described in the Waste Analysis Plan presented in Section 4.0. The Facility will use the waste characterization data to perform the following activities:

- ensure that the waste can be accepted in accordance with the RCRA permit;
- verify that the Facility has the capability to properly treat and/or dispose of the waste;
- identify any safety precautions that must be taken to properly manage the waste;
- use the physical characteristics and chemical composition of the waste to determine the most effective treatment and disposal methods for the waste;
- select parameters to be tested to determine the formula for stabilization of appropriate wastes;
- select parameters to be tested upon arrival at the Facility to verify that the waste accepted is the waste characterized; and,
- develop a cost estimate for treatment and disposal.

2.1.2 Waste Receiving

Once approved for acceptance at the Facility, the waste can be shipped. The Facility can be accessed only from New Mexico State Highway 380, as shown in Figure ~~2-1~~1-2. When a shipment arrives at the Facility, a Facility representative will verify that the shipment was scheduled. If unscheduled shipments arrive at the Facility, the Facility manager will be consulted to determine if the appropriate paperwork has been received and the shipment can be accepted.

Insert Figure 2-1, Site Location Map

The shipment and shipping papers will be inspected to ensure that the correct inventory has been received, that the hazardous waste manifest is properly completed, and that a LDR certification is attached. Any discrepancies will be resolved prior to acceptance of the shipment. If discrepancies cannot be resolved, the shipment will be rejected. Representative samples of the waste will be taken and fingerprint testing will be conducted. Fingerprint testing is described in Section 4.~~3~~5 of the Waste Analysis Plan. If the fingerprint test results are inconsistent with the generator's information, several actions can be taken (see Section 4.5). Waste will be processed only if fingerprint tests are consistent with information provided by the waste generator. Containers and drums will be inspected for visible cracks, holes or gaps.

2.1.3 Waste Staging/Storage

Containerized wastes will be moved to the drum handling unit or the roll-off storage area. The objectives of these container storage areas are to provide safe storage of waste prior to its introduction into the treatment or disposal system; to ensure that adequate accumulation space is available during intervals when the treatment or disposal system is temporarily unavailable; and to facilitate repackaging as necessary.

Solid waste will be transferred directly to the landfill for disposal if all applicable LDR requirements are met and, in the case of containerized material, if the container is at least 90 percent full.

Restricted waste at the Facility will be stored solely for the purpose of accumulating sufficient quantities to facilitate proper treatment, or disposal. Procedures will be in place at the Facility so that only that waste will be accepted that either (1) meets LDR treatment standards; or (2) is amenable to treatment using existing and available treatment capabilities at the Facility, such that restricted wastes will not be stored for longer than one year.

2.1.4 Waste Treatment

There are two treatment processes: stabilization and evaporation. Low concentration wastewater from off site generators and leachate from the landfill that meet LDR standards will be placed in the evaporation pond. Pond sludge, contaminated leachate from the landfill that does not meet LDR standards, and various wastes from generators will be treated in the stabilization process. Stabilized waste that meets LDR treatment standards and other operational criteria will be placed in the landfill.

Wastes that carry more than one characteristic or listed waste code must be treated to the most stringent treatment requirements for each hazardous waste constituent of concern. When wastes with different treatment standards are combined solely for treatment, the most stringent treatments standard specified will be met.

2.1.5 Waste Disposal

In general, wastes arriving at the Facility that meet LDR requirements and contain no free liquids will be directly landfilled. When wastes are unable to be directly landfilled, such as during landfill equipment maintenance periods or extreme weather conditions, the waste will be stored in the waste storage area. Wastes stabilized at the Facility that meet LDR requirements will be transferred to the landfill from the treatment or storage areas as necessary.

An access ramp will be constructed from the top of the landfill to the bottom of the active portion of the landfill (see Drawings 8 and 14 in Volume III). Bulk hazardous wastes will be placed and compacted on the bottom of the landfill in 5-foot to 10-foot layers or lifts. Containers (drums) will be placed upright in the cell using a forklift or barrel snatcher. Sufficient space will be left around the containers for the placement and compaction of compatible bulk hazardous wastes or soil. Materials in roll-off containers will be dumped with the bedliners at preselected locations. Containers or bulk waste can be placed adjacent to the roll-off material. A layer of cover soil sufficient to prevent wind dispersal of waste will be placed over the bulk hazardous wastes and containers following emplacement or before the end of each working day (see Section 2.5.1.7). The soil cover will be deposited on top of the waste placement face and then spread and compacted with a tracked bulldozer. The minimum cover thickness will be 0.5 feet.

The landfill will be laid out in an engineered grid system consisting of blocks that are 50 feet wide, 50 feet in length, and 10 feet in depth. Grid stakes will be established by survey. A two-dimensional grid system along with lift elevation designation will provide a three-dimensional record of the location of all wastes placed in the landfill. Records of the location, date of placement, waste source, manifest, and profile numbers will be maintained at the Facility.

2.2 CONTAINER STORAGE AREAS

The site will employ two container storage areas: a drum handling unit and roll-off storage area. Descriptions and conditions specific to these areas are presented in Section 2.2.1 and Section 2.2.2 for the drum handling unit and roll-off storage area, respectively. Sections 2.2.3 through 2.2.14 describe conditions common to both units. Wastes which are either suspected or known to contain free liquids will be managed accordingly. A description of how these wastes will be managed is included in the following sections. More detailed information on the management of wastes containing free liquids can also be found in the Waste Analysis Plan presented in Section 4.0. Both the drum handling unit and the roll-off storage area will be constructed to meet the minimum requirements identified in the detailed design and associated engineering report (Volume III).

2.2.1 Drum Handling Unit

Drawings 37, 38, and 39 presented in Volume III of this application show the detailed design for the drum handling unit. The open sided unit will be roofed to prevent run-on from precipitation. The roof of the building is designed to extend over the unloading dock area to ensure that precipitation does not enter the building or impact unloading operations.

The building will be equipped with fire extinguishers, a sprinkler system, telephones, fire alarm system, public address system, eye washes, safety showers, spill control equipment, and first aid equipment. An office for storing record-keeping information and for administrative functions within the drum handling unit will be located in the building.

The base of the drum handling unit will consist of a compacted subgrade of non-swelling soils placed at a moisture content and density capable of supporting projected loads comprised of the building's structural components, stored waste, and mobile equipment traffic inside the building. A 60-mil geomembrane liner, cushion geotextile, and 1 foot of foundation sand will overlie the subgrade. The steel reinforced concrete floor will be constructed on the prepared subgrade. Design details and the associated specifications are presented in Volumes III and IV of this application.

2.2.1.1 Containment and Detection of Releases

Wastes stored in the drum handling unit will be placed in individual storage cells segregated by waste type and compatibility. Individual storage cells are defined as groupings of drums as shown on Drawing 37. The specific areas to be used for storage will depend on the volume and type of waste being processed at the site. Labels will be added to each section of the drum storage unit to identify the type of waste to be stored. The labels may change depending on the volume and type of waste being received. A chemically resistant epoxy coating (or an equivalent) will be applied to the concrete floor. Chemical resistant water stops and caulking will be installed in all joints. The floor is designed and will be maintained to be free of cracks and gaps and will be inspected regularly to determine if any cracks or gaps have developed or if the epoxy coating has been damaged. Should cracks or gaps develop in the concrete, repairs will be scheduled immediately. The nature of the repair will depend on the extent of the cracking and could range from the application of chemically resistant epoxy fillers or coatings to the replacement of portions of the concrete floor.

Each storage cell will have a concrete floor that slopes toward a trench covered by steel grating. Each trench will lead to a separate secondary containment sump for that cell where any spilled liquids will be accumulated. The trench and sump system design incorporates a double high-density polyethylene (HDPE) geomembrane liner in the~~and~~ leak detection and removal ~~sysytem~~system (LDRS) and leachate collection removal system (LCRS). Both ~~T~~the LDRS and LCRS ~~secondary containment~~ sumps incorporate~~s~~ drainage material surrounding a perforated pipe. The LCRS ~~trench and~~ sump has been sized to contain at least 10 percent of the volume of the containers stored in the cell. The ~~leachate collection and removal system (~~LCRS~~)~~ and ~~leak detection and removal system (~~LDRS~~)~~ sumps in the drum handling unit will be checked regularly for the presence of liquid. If liquids are present, samples will be obtained and chemically analyzed to determine the nature and concentration of any waste constituents. An appropriate treatment or disposal method will be selected in accordance with the Waste Analysis Plan presented in Section 4.0. Pumpable quantities of liquids will be removed with a vacuum truck. Leaks and spills will be removed from the sump in as timely a manner as possible. Because the building is covered, precipitation and the consequent accumulation of liquid are not considered in the design or operation of the drum handling unit.

The ~~TSCA~~ cells that will contain PCB-contaminated waste will be surrounded by a 6-inch concrete berm, in addition to the floor trench and sump.

2.2.1.2 Dimensions

The drum handling unit is 418 feet long by 118 feet wide (see Drawing 37 in Volume III). The building floor and loading dock will be 5 feet above ground level to facilitate the loading and unloading of trucks and prevent run-on from precipitation. An adjustable hydraulic loading platform will align the truck beds with the building floor to allow for the smooth transition of forklifts in and out of the trucks from the floor. An overhang on the front of the building will prevent precipitation from getting on the drums and into the front area.

2.2.1.3 Storage Limits

The ~~Facility~~drum handling unit will contain seven separate containment areas, each 52 by 63 feet as shown on Drawings 37 and 38 in Volume III. Each of the seven areas will have its own floor drain and containment sump, allowing incompatible wastes to be placed in separate cells. Two of the cells will be designed to accommodate only ~~TSCA~~ PCB wastes. Aprons on the ends of the ~~TSCA areas~~cells that store PCB-contaminated waste will be tapered to allow for forklift access over the concrete berms. The total capacity of the drum handling unit will be 1,120 drums (160 drums per containment cell). The drain and sump for each drum cell is dimensioned such that the storage capacity will be a minimum of 118 cubic feet, 10% of the capacity of the drums in each cell. A typical drum layout is shown in Drawing 37 of Volume III.

2.2.2 Roll-Off Storage Area

Roll-off containers will be stored on an open pad, as shown in Drawings 41 through 43 presented in Volume III. This unit will not be covered or enclosed by walls. The pad will be divided into two sections.~~:~~ One section will hold tarped, U.S. Department of Transportation (DOT) approved, lined, roll-off containers with non-stabilized waste awaiting treatment at the stabilization unit. The other section of the pad ~~-~~is intended as a staging area for roll-off containers containing stabilized waste awaiting Toxicity Characteristic Leaching Procedure (TCLP) test results and landfill-disposal approval.

Waste will be characterized and screened as part of the waste acceptance procedures. This procedure will prevent incompatible waste from being stored in the same roll-off containers that are delivered to the site. After the materials have been stabilized, material from a single stabilization batch will not be mixed with material from a different batch, therefore eliminating the potential for incompatible waste to be stored in the same roll-off bin. The individual steel roll-off bins will be stored in the HDPE-lined ~~areas of the~~ roll-off storage unit and physically separated from each other by 4 feet side to side and 2.5 feet end to end. In addition, containers will not be placed within the limits of the roll-off storage area inundated by the rainfall that accumulates for the 25 year, 24 hour storm (see Appendix E-38 in Volume VI) or within 4 feet of the edge of the berm.

~~Landfill operational staff will visually observe trucks leaving the area for excessive accumulation of waste on the tires and/or truck body. If excessive accumulation is noted, the truck will be routed to the truck wash for cleaning.~~

Comment [dld1]: 8/13 #2

This area is restricted to wastes that do not contain free liquids. Prior to exiting the stabilization unit, stabilized waste loads will be tested for free liquids using the paint filter test. Stabilized waste loads that do not pass the paint filter test will be reprocessed using a modified treatment mixture and re-tested before being allowed to exit the stabilization unit. Roll-off containers which hold stabilized wastes that pass the paint filter test will be covered before exiting the stabilization unit and will remain covered while they are staged in the roll-off storage area.

Roll-off containers will be inspected for free liquids prior to acceptance at the unit. Containers which are received for disposal, but are found to contain free liquids upon inspection will be managed in accordance with stabilization procedures described in Section 2.4. If the waste generator will not allow the Facility to prioritize handling of the load to eliminate free liquid, the load will not be admitted to the Facility. Otherwise, free liquids will be removed with a vacuum truck, characterized, and managed in accordance with stabilization procedures described in Section 2.4. The volume of free liquids in the roll-off containers is expected to be minimal. Following the removal of free liquids, the waste (in the roll-off container) will either be managed through the stabilization process or landfilled, whichever is appropriate. Section 2.2.12 describes the methods that will be used to separate incompatible wastes. The area will be equipped with fire extinguishers, a telephone, alarm systems, spill control, and first aid kits.

Waste in the roll-off containers that meet the requirements for free liquids (or lack thereof) will be placed in the landfill. Other wastes in roll-off containers that do not pass the appropriate acceptance testing (i.e. paint filler test) will be transferred to the stabilization area for treatment. Upon completion of the stabilization process, the waste will once again be tested to ensure that it meets the landfill criteria.

2.2.2.1 Containment and Detection of Releases

~~There is a potential for free liquids to exist in incoming waste.~~ The roll-off storage area is designed to store ~~any~~ non-stabilized and stabilized waste ~~that may contain free liquids~~. Secondary containment of the roll-off storage area is shown in Drawing 41 through 43 in Volume III.

The floor and slopes of the lined cell will consist of, from bottom to top, a prepared subgrade; a geomembrane liner that will be composed of a component material compatible with the anticipated waste; a geocomposite drainage layer; a structural-fill; and a roadbase surface. A sump will be incorporated into the drainage layer. To accommodate this installation, the floor will be sloped to a sump located in the corner of the storage area. Any liquids would collect in the containment sump, which is designed to have the pumping capacity to remove liquids resulting from the 25-year, 24-hour storm event.

The roll-off containment area is surrounded by a berm with a minimum height of 2.0 feet (Drawing 41). This berm will divert run-on surface water around the perimeter of the truck roll-off area. Culverts will be placed under each of the access ramps to allow surface water flow to the west towards the run-off detension basin.

The containment sump is designed to collect precipitation falling inside the bermed area of the truck roll-off storage area. During heavy rain events, a portion of the water will drain along the roadbase surface to the sump area located in the corner of the cell. The remaining volume will percolate through the roadbase and structural fill and will be collected in the geocomposite drainage layer. Water collecting on the surface of the sump or in the sump drainage gravel will be removed by vacuum truck. Samples of sump liquids will be chemically analyzed to determine the presence and concentration of any waste constituent. After this determination, an appropriate method of treatment or disposal will be selected in accordance with the criteria prescribed in the Waste Acceptance Plan (see Section 4.0). Leaks, spills, and precipitation will be removed from the sump as soon as possible. The entire roll-off storage area will be surrounded by a berm which ranges in height from 4 feet to 8 feet.

The purpose of the drainage system below the storage area surface is to allow rainfall to be collected and removed from the contained area. This will reduce ponding and mud formation on the storage area surface and will allow the surface to support truck traffic almost immediately following a rainstorm. The presence of free liquids inside the roll-off container/bed liner system can occur if liquids are inadvertently loaded in the container, rainfall enters a hole in the roll-off container cover during transportation, or liquids separate from solids during transport. These free liquids will be identified when the roll-off container is visually inspected at the untarping station.

It is possible, but unlikely, that free liquids could be generated after inspection in the staged roll-off containers. For example, if a faulty roll-off container cover allows rainfall to enter the container and both the plastic and containment fail, a leak can occur on the surface of the roll-off storage area. A leak will appear as a drop or a stain on the storage area surface. In the case of a leak, the liquids in the roll-off container will be handled as described in Section 2.4 and the stained soil will be excavated and handled as a potential hazardous waste.

2.2.2.2 Dimensions

The entire roll-off storage area (including both halves) will measure approximately 410 feet by 330 feet from the outer edge of the berms. The berm height surrounding the area will range from 4 feet to 8 feet. The storage areas will be accessed by 35-foot-wide compacted soil ramps at the center of each storage area. The halves will measure approximately 180 feet by 310 feet inside the berms.

2.2.2.3 Storage Limits

The permitted capacity of the incoming waste cell will be 66 roll-off containers. The stabilized waste cell also will have a capacity of 66 roll-off containers, for a total storage capacity of 132 containers. The actual number of roll-off containers placed in the roll-off storage area may vary slightly depending on placement arrangements as determined by operations.

2.2.3 Warning Signs

Signs containing the legend "Danger - Unauthorized Personnel Keep Out" will be conspicuously posted on the outside and at entrances to the storage areas. In the areas where ignitable or reactive wastes will be stored, "No Smoking" signs will be posted. All signs will be in both English and Spanish.

2.2.4 Proper Waste Storage

Compatibility codes established during the initial receipt of waste will be assigned to ensure the proper storage of containers within the Facility (see Section 4.0). Containers which are discovered upon receipt to have free liquids will not be accepted or will be handled at the stabilization unit as a priority load.

2.2.5 Ignitable/Reactive Wastes

Ignitable or reactive wastes will be protected from any sources of ignition or reaction. All containers storing ignitable or reactive waste will be stored at least 50 feet inside the fence around the Facility shown in Volume III, Drawing 4. "No Smoking" rules will be enforced and open flames prohibited where ignitable or reactive waste is being handled.

2.2.6 Precautions to Prevent Reactions

Precautions to prevent reactions are described in Section 5.0, Procedures to Prevent Hazards.

2.2.7 Inspection Methods

As required in 40 CFR 164.174, all container storage areas will be visually inspected at least once a week for leaking containers and deterioration of the containers and containment area. Inspectors will enter the area and visually inspect the area and the containers. All inspection information will be recorded, and any problems noted during the inspection will be resolved in a timely manner (see Section 5.0). Workers will be instructed and trained on the procedures for identifying and reporting any signs of leaks or deterioration that appear between the weekly inspections. Any identified leaks will be resolved as described in Section 2.2.10. Containers with more than 500 ppmw volatile organic compounds will be inspected at least once a month for cracks, holes or gaps in the container, cover or closure devices. Defects detected will be repaired according to CFR 264.1086 (d)(4)(iii).

2.2.8 Types of Containers

Hazardous wastes will be stored in 10-gallon, 35-gallon, or 55-gallon drums, in 40 cubic yard or similar roll-off containers, or in other DOT approved containers. Overpack drums will be used as necessary.

2.2.9 Labels

All containers of hazardous waste in storage will be labeled with a hazardous waste label identifying the contents of the container. The label will also be clearly marked to indicate the date of accumulation or the date of receipt. The label will not be obstructed from view during storage.

2.2.10 Condition of Containers

All containers of hazardous waste will be managed by the following conditions:

- containers will be maintained in good condition. If a container is not in good condition (e.g. severe rust, apparent structural defects, or leaks), the hazardous waste will either be transferred to a container that is in good condition or be managed in some other way, such as direct placement in the landfill or stabilization unit;
- containers of hazardous waste stored at the drum handling unit will be closed during storage, except when it is necessary to add or remove waste;
- the container storage area will be inspected prior to placement of containers to ensure that no conditions exist which could damage the waste containers; and,
- all containers will be handled in a manner, and with equipment compatible to their design and construction, to minimize the potential for damage to the container.

The roll-off units to be placed in the roll-off area will be covered with a tarp. The covers will not be removed until the material is placed in the stabilization unit. Roll-off units used to store stabilized material will also be placed on the roll-off unit with covers. It is not expected that the tarps will be removed during storage except for re-sampling of the material, if required.

2.2.11 Compatibility with the Container

All hazardous waste will be compatible with the container or liner as defined by the following conditions:

- all containers used to store hazardous waste will be made of, or lined with, material that will not react with, or otherwise be incompatible with, the waste being stored so that the ability of the container to hold waste is not impaired; and,
- hazardous waste will not be placed in an unwashed container that has previously held incompatible waste or material.

2.2.12 Compatibility with Other Waste

Incompatible liquid hazardous wastes stored within the units will be separated by a berm, catch pan, or other physical barrier which adequately prevents commingling of incompatible wastes. Incompatible solid hazardous wastes stored within the container storage areas will be separated by a distance of at least 10 feet unless separated by a berm, catch pan, or other physical barrier. Incompatible wastes will not be placed in the same container.

2.2.13 Aisle Space

Aisle spacing will be maintained to assure inspectability and accessibility for operational and emergency equipment to containers. The spacing will allow for the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment in the event of an emergency, as required by 40 CFR 264.35.

A minimum 2.5 foot aisle space will be maintained in the drum handling unit between rows of containers side by side. Containers will be stored in single rows only if they are against a wall or other barrier that prohibits inspection from all sides. Roll-off containers will be spaced 4 feet apart side to side and 4 feet from the edge of the berm.

2.2.14 Record Keeping

The results of all container storage waste analyses, trial tests, waste compatibility analyses, and ignitable and reactive waste handling documentation pertaining to compliance will be maintained in the Facility operating record. Inspection records will be maintained in the inspection log for each unit.

2.3 STORAGE IN TANKS

The liquid waste receiving and storage unit is shown in Volume III, Drawing 40. It will house four aboveground tanks for the storage of regulated bulk liquid hazardous wastes prior to stabilization. The unit will not be covered by a roof or enclosed by walls.

Each tank will have a capacity of approximately 9,000 gallons. The tanks will be double-walled and constructed of high~~-~~density polyethylene materials that are compatible with the wastes to be placed in the tanks. Compatibility of the tanks with different types of waste has been provided by the manufacturer and is ~~indicated~~ presented in Volume VI~~III~~, Appendix H3. Facility procedures for waste acceptance and the associated criteria ~~and~~ in the waste acceptance plan will ensure that wastes incompatible with the tank material are not placed in the storage tanks. ~~These compatibilities are assessed in the design specifications and engineering report (see Volume III).~~ The tanks will be ~~elevated above~~placed on an imperviously coated reinforced concrete pad. All piping systems within the facility will comply with API Publication 1615 (November 1979) or ANSI Standard B31.2 and ANSI Standard B31.4. Waste will be transferred from the tanks to the stabilization unit by pumping into transfer tankers.

Comment [dld2]: 8/10 #4

Each of the storage tanks will be clearly marked with a description of the contents and records will be kept documenting the quantity of waste received, and the date each period of accumulation begins. This information will be documented in the Facility operating record.

2.3.1 Containment and Detection of Releases

The outer tank of the double walled poly tank system will provide secondary containment of sufficient strength and thickness to prevent failure due to pressure gradients, physical contact with waste, climatic conditions, or the stress of daily operations. The tank system will be placed on a concrete base capable of supporting the system, providing resistance to pressure gradients below the system, and preventing failure due to settlement, compression, or uplift. The secondary tank is designed to contain 100 percent of the tank contents.

Each tank will be surrounded by a concrete area which will be sloped to provide drainage to a sump. The floor and berm of the concrete area will be maintained in good condition and free of cracks and gaps, as described in Section 2.2.1.1, in order to protect the effectiveness of the containment.

All ancillary equipment will be provided with secondary containment except aboveground piping (exclusive of flanges, joints, valves, and other connections), welded flanges, welded joints, and welded connections that are visually inspected for leaks each operating day. Secondary containment will be provided by the concrete pad.

Daily visual inspection will be used to detect releases to the secondary containment. Response to releases from tank systems will be initiated immediately upon discovery, and regulations specified in 20 NMAC 4.1 Subpart V, 40 CFR 264.196(d) or 40 CFR 264.56 will be followed as appropriate (see Section 5.0), including notification of the Hazardous and Radioactive Materials Bureau (HRMB) of the New Mexico Environment Department (NMED) and National Response Center (NRC). The secondary containment tank will be emptied by pumping fluids from the drainage port located near the base of the tank or by the use of a vacuum truck.

2.3.2 Management of Incompatible Wastes

Only the waste types approved for a tank system will be placed in the tank. No new waste types will be placed into an existing tank system unless (1) the compatibility of the new waste type with the prior contents of the tank is determined by testing or documentation; or (2) the existing tank system is cleaned or flushed to the extent necessary to ensure compatibility with the new waste type.

2.3.3 Spill and Overfill Prevention

Appropriate controls and practices will be used to prevent spills from and overfills of the tank or containment systems.

Spill prevention is primarily maintained by hard-plumbed piping. When transfer lines are not hard plumbed or when open-ended lines are used, one or more of the following spill prevention controls or an equivalent device will be used:

- *Dry Disconnect Couplings* - a pipe connection designed to cap the flow of liquids as soon as the fitting is disconnected;
- *Direct Monitoring* - the transfer is monitored continuously to prevent spills; and/or,
- *Overfill Prevention* - one or more of the following spill prevention controls or an equivalent device will be used:
  - ◊ *Automatic Feed Cutoff* - a device used to stop flow into a tank when it is filled to operating capacity or another predetermined level;
  - ◊ *High-Level Alarm* - a device used to detect the level in a tank, sounding an audible alarm or displaying a visual alarm when the operating capacity level or another predetermined level is reached;
  - ◊ *Level Indicator* - a device used to visually display the level of material in a tank; if a level indicator is used for overfill prevention, the indicator must be monitored during liquid transfers or checked prior to transfers to ensure that sufficient capacity exists in the receiving tank. Level indicators may include sight gauges , level meters, or graduations placed directly on opaque poly tanks; and/or,

◊ *Bypass* - a device or plumbing arrangement used to divert flow from the tank being filled to a second tank of sufficient capacity after the operating or predetermined level has been reached.

2.3.4 Feed Mechanism, Pressure Controls, and Temperature Controls

The tanks will be operated at ambient pressure and temperature when storing liquids. One of the following feed mechanisms for tank systems or an equivalent transfer mechanism will be used:

- *Pump Transfer* - liquids will be pumped into or out of the tank through permanent or temporary transfer lines; or,
- *Gravity Drain* - liquids will be allowed to drain by gravity through permanent or temporary transfer lines.

2.3.5 Management of Ignitable or Reactive Wastes

Ignitable or reactive wastes will not be placed into any tank system unless the tank system is protected from sources of ignition by measures including, but not limited to, the following: signs prohibiting smoking, open flames or welding; an inert atmosphere blanket; enclosed vents isolated from sources of ignition.

2.3.6 Inspections

A visual inspection of tank systems will be conducted each operating day. Each tank system will be visually inspected, including, but not limited to, the tanks and ancillary equipment, monitoring and leak detection systems, and the construction materials and area immediately surrounding the tank system. The results of each inspection will be documented in the daily operating record. Inspections are further described in Section 5.0, Procedures to Prevent Hazards.

2.3.7 Corrosion Protection

All liquid hazardous waste materials will be stored in double walled poly tanks. Corrosion protection is not required for double walled poly tanks that do not come into contact with soil or water.

2.3.8 Tank Assessments

The tank system proposed has sufficient structural integrity and is acceptable for the storing and treating of hazardous waste. The assessment has been prepared by the engineer of record and is based on the tank design drawings (see Volume II, Appendix I~~–~~). After construction of the tank, it's integrity will be assessed by an independent New Mexico registered professional engineer in accordance with 20 NMAC 4.1.500 (incorporating 40 CFR 264.192(a)). The engineering report presented with the tank design drawings in Volume III includes a list~~discussion~~ of wastes to be excluded from storage in poly tanks due to their excessive corrosive effects.

2.3.9 Ancillary Equipment

All ancillary equipment will be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction, according to API Publication 1615 (November 1979) or ANSI Standard B31.2 and ANSI Standard B31.4.

Hazardous waste will be transferred from the tanks to the tankers through a limited piping system, as shown in Drawing 40 and discussed in Volume III, Section 8.2.2. This piping system will be considered part of the tanks and will be drained and dismantled as part of the tank closure.

2.3.10 Installation and Tightness Testing

Proper handling procedures will be developed and followed to prevent damage to the system during installation. A qualified installation inspector will inspect the installed system to ensure adequate construction/installation. Any discrepancies will be resolved before the system is placed in service.

The tanks and ancillary equipment will be tested for water tightness, and any necessary repairs will be performed prior to the system being placed in service.

Written statements by those who certify the design and supervise installation will be maintained in the operating record.

2.3.11 Repair and Certification of Tank Systems

If a release occurs from the primary tank system, the tank will be removed from service immediately. Wastes in the tank will be removed within 24 hours to the extent necessary to prevent further release and allow inspection and repair of the tank system. All released materials will be removed from the secondary containment as soon as possible and within 24 hours of detection.

The tank system will be repaired or replaced prior to returning it to service. An independent New Mexico registered professional engineer will certify major repairs. The certification will be submitted to the NMED within seven days after the tank system is returned to service. Major repairs include repair of a ruptured primary containment vessel and replacement of secondary containment.

2.3.12 Transfer of Liquids from Liquid Waste Storage to the Stabilization Unit and to the Evaporation Pond

Transfer of liquids from the liquid waste storage tanks to the stabilization unit will be accomplished by tanker trucks approved for liquid waste transfer. Approved tanker trucks, such as vacuum trucks or DOT approved tankers, will be used to transfer liquids from the storage tanks to the evaporation pond. Tanker trucks will be cleaned following a transfer operation to ensure that subsequent transfers do not result in mixing of incompatible or reactive wastes.

Personnel performing liquid waste transfer operations will comply with all personal protective equipment (PPE) requirements and transfer operation procedures, including spill cleanup. Impervious concrete coatings will be applied to the liquid waste storage tank containment area and the evaporation pond discharge station. Hose and pipe connections will be inside the concrete containment area boundaries.

2.4 STABILIZATION

Drawings 33 through 36 presented in Volume III of this application show the stabilization building floor plan, a typical bin, and vault sections. The stabilization process will use four in-ground double lined stabilization bins, two dry reagent silos, two liquid reagent tanks, and a water tank. Trucks and other vehicles will access the unit via the gravel aprons. Additionally, there will be a control room from which operations will be directed and coordinated.

Bulk liquids, semi-solids, sludges, and solids that do not meet LDR treatment standards, as well as solids that may contain free liquids, will be treated in the stabilization unit. Dilution of restricted wastes will never be used as a substitute for adequate treatment. If toxic characteristic wastes and listed wastes are amenable to the same type of treatment and aggregation is a part of treatment, the aggregation step does not constitute impermissible dilution.

As discussed in the Waste Analysis Plan in Section 4.0, wastes will be tested prior to stabilization to determine the appropriate reagent formula. Both dry and liquid reagents may be used in the stabilization process. Waste may be offloaded directly from trucks into the stabilization bins or transferred from the drum handling unit or roll-off storage area. The bins will be covered while dry reagents are being added to control particulate air emissions. The cover will be removed and a backhoe positioned adjacent to the bin will mix the waste and reagents.

Wastes that are treated on site in the solidification unit will be tested after treatment and before disposal to verify that LDR standards have been met. ~~T~~The stabilized waste will be either transferred to the roll-off area for testing or taken directly to the landfill if testing has been completed. ~~T~~The stabilized waste will ~~need to~~ be stored temporarily at the roll-off unit while tests are conducted~~mpared~~ to determine how and if the material can be disposed of in the landfill. ~~All stabilized waste would require temporary storage only if TCLP tests are necessary.~~

The backhoe bucket and stabilization bin will be thoroughly cleaned before a load of waste which is not compatible with the waste previously stabilized in that bin is mixed. After the last bin load of a specific stabilization mixture has been loaded out, Facility personnel will use a high-pressure water hose located near the bins to rinse the backhoe bucket and the bin walls. This rinsing will cause residual clods of stabilized waste to fall to the bottom of the bin along with the rinse water. Reagents will then be added to the bin at the same mixture proportions and the remaining waste and rinse water will be stabilized, tested for free liquids, and loaded out before a different waste stabilization mixture is processed in that bin.

The nominal dimensions of the bins are 25 feet long by 10 feet wide by 10 feet deep, resulting in an approximate volume of 2,500 cubic feet. The volume of waste to be treated in each batch will be variable but less than 2,500 cubic feet, depending on the addition of stabilization materials. The overall process volume is based on four bins. However, the actual process design will be dependent on the characteristics of the incoming waste (time to mix each batch) and the volume of stabilization materials required. Assuming that 15 batches per bin are processed per day with 4 bins, a total of 150,000 cubic feet of waste are treated per day. The ends of the bins have been shaped to conform to the reach profile of the backhoe selected for mixing in the stabilization unit. The bins will be contained in a concrete vault, which will also provide support. All mixing bins will be equipped with ventilation and air pollution control systems to remove any air pollutants generated during the mixing process. Potential contaminants may include particulates, low concentration volatile organic compounds, or acid fumes.

2.4.1 Contaminant and Detection of Releases

The bins will be of steel construction. Waste which is incompatible with the steel used in construction will not be stabilized in the bins. An assessment of the compatibilities of the bin materials and waste, is contained in the engineering report (Volumes III). The design requirements and limitations will be incorporated into Facility procedures. The waste acceptance plan and associated criteria will ensure that waste which is incompatible with the bin construction material will not be introduced into the bins.

The bins will be double-walled steel tanks with the space between the walls serving as the LDRS. Shock absorbing coiled wire rope isolators will maintain separation between the bins.

The tank secondary containment (the outer shell) will be of sufficient volume to contain the contents of the inner tank, because the inner tank will be completely enclosed within the outer shell. The vault will not be used as secondary containment; therefore, it does not have to be lined or meet other requirements for secondary containment. Its purpose will be to isolate the tank system from the surrounding soil, provide a monitoring and collection point if leakage were to occur from both the primary and secondary systems, and means to inspect and repair the secondary containment.

Releases into the LDRS will be detected within 24 hours by liquid sensing instruments (e.g. a magnehelic gauge) or inspection. Accumulated liquids will be removed within 24 hours of detection. The secondary containment will be emptied by pumping accumulated liquids into a temporary storage tank or into another stabilization bin. Releases to the LDRS could occur if a breach occurred in the primary steel liner. In such a case, the bin will be removed from service and repaired.

All ancillary equipment will be provided with secondary containment unless it is aboveground piping (exclusive of flanges, joints, valves, and other connections), welded flanges, welded joints, and welded connections that can be visually inspected for leaks each operating day. Secondary containment will be provided by a concrete pad.

2.4.2 Management of Incompatible Wastes

New waste will not be placed in the bins unless (1) the compatibility of the new waste type with the prior contents of the bin is determined by testing or process knowledge documented in the operating record or (2) the existing tank system is cleaned or flushed to the extent necessary to ensure compatibility with the new waste type using procedures specified in Section 2.4.

2.4.3 Spill and Overfill Prevention

Spill and overfill prevention will be accomplished by continuous direct monitoring of transfer operations. Additionally, the delivery system will be computerized and will be designed to ensure that the mixture used for stabilization prevents overfilling.

2.4.4 Feed Mechanism, Pressure Controls, and Temperature Controls

The stabilization bins will be operated at ambient temperature and pressure. Reagents will either be pumped from reagent tanks or manually fed. Liquid hazardous wastes will be pumped from the liquid waste receiving and storage unit or from vacuum trucks or tanker trucks. Other wastes may be manually transferred directly from the incoming waste hauler truck or from the container storage areas.

2.4.5 Management of Ignitable or Reactive Waste

The stabilization bins will be protected from sources of ignition through the use of signs and procedures prohibiting smoking, open flames, or welding. If ignitable or reactive wastes are placed in the bins, they will be immediately mixed with sufficient quantities of fly ash and/or cement to render them non-ignitable or non-reactive.

2.4.6 Inspections

Each stabilization bin will be visually inspected once each operating day as described in Section 5.0, Procedures to Prevent Hazards. At least once per month, the daily visual inspection will be conducted on empty bins to ensure the integrity of the bin and welds. An annual sonic test will be conducted to ensure that the thickness of the inner tank and outer shell is maintained.

2.4.7 Corrosion Protection

Corrosion is not anticipated to be a significant problem for the stabilization bins because of low humidity and the fact that the units are located indoors. No corrosion protection will be provided other than cathodic grounding. The thickness of the inner tank and outer shell compensates for the abrasion and impact forces of the backhoe bucket during waste stabilization mixing. The structural steel design of the bins is presented in the engineering report (Volume III).

Inspection of the bins is discussed in Sections 2.4.6 and 5.2.6. Visual inspection of the empty bins will be accomplished monthly, and sonic testing will be conducted annually. The system has been designed so that the inner tank and outer shell can be easily removed and replaced, if necessary.

2.4.8 Tank Assessments

The stabilization bins proposed have sufficient structural integrity and are acceptable for the storing and treating of hazardous waste. The assessment has been prepared by the engineer of record and is based on the design drawings~~.~~ (see Volume II, Appendix I). After construction of the tank, it's integrity will be assessed by an independent New Mexico registered professional engineer in accordance with 20 NMAC 4.1.500 (incorporating 40 CFR 264.192(a)). The engineering report presented with the tank design drawings in Volume III includes a discussion of wastes to be excluded from treatment in the bins due to their excessive corrosive effects. The engineering report presented with the ~~preliminary~~ tank design drawings in Volume III include a discussion of wastes to be excluded from storage or treatment in steel tanks due to their excessive corrosive effects.

2.4.9 Ancillary Equipment

All ancillary equipment will be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction; according to API Publication 1615 (November 1979) or ANSI Standard B31.2 and ANSI Standard B31.4.

2.4.10 Installation Inspection and Tightness Testing

Proper handling procedures will be developed and followed to prevent damage to the system during installation. A qualified installation inspector will inspect the installed system to ensure adequate construction/installation. Any discrepancies will be resolved before the system is placed in service. The bins and ancillary equipment will be tested for water tightness, and any necessary repairs will be performed prior to the system being placed in service. Written statements by those who certify the design and supervise installation will be maintained in the operating record.

2.4.11 Repair and Certification of Tank Systems

If a release occurs from a primary tank system, the tank will be removed from service and all materials will be removed from the tank or secondary containment within 24 hours or as soon as reasonably possible. The tank system will be repaired prior to return to service. Major repairs will be certified by an independent New Mexico registered professional engineer. The certification will be submitted to the NMED within seven days after the tank system is returned to service.

2.5 LANDFILL

This section describes the design, construction, and operation of the landfill. As with the Facility units discussed previously in this section, the detailed design for the landfill is contained in Volume III of this application. The ~~overall~~ ~~complete~~overall landfill will be constructed in ~~P~~phases~~.~~, ~~A~~as shown on ~~d~~Drawing 4. The first phase to be considered will be Phase 1A. This permit application refers only to Phase 1A. However, potential expansions of the landfill in future phases have been included in the general layout drawing for completeness. Detailed design drawings are only submitted for Phase 1A. The landfill design is presented on Drawings 6 through 27 in Volume III, and a list of these drawings is provided on Drawing 1, Sheet 2 (Volume III).

2.5.1 Design of Landfill

The landfill design specifies a double-lined landfill with a LCRS above the primary liner and a LDRS between the primary and secondary liners. The detailed design presented in Volume III specifically describes the relationship between the existing site topography and the landfill subgrade.

2.5.1.1 Nature and Quantity of Waste

As specified in the Waste Analysis Plan in Section 4.0, the Facility will accept RCRA hazardous waste and ~~TSCA~~ PCB waste, excluding selected waste. The excluded waste is listed in the Waste Analysis Plan (Section 4.0). ~~the following waste types:~~

- ~~radioactive waste;~~
- ~~dioxin contaminated waste;~~
- ~~medical waste;~~
- ~~MSW and C&D waste;~~
- ~~explosives;~~
- ~~compressed gases;~~
- ~~liquid waste containing PCBs greater than 50 parts per million; and,~~
- ~~solid waste containing PCB's greater than 500 parts per million.~~

The wastes which will be accepted for placement in the landfill include all wastes listed in Part A of this application (presented in Volume I). All waste to be placed in the landfill must meet LDR treatment standards. Additional details on wastes to be accepted at the Facility can be found in Section 4.1.1, Waste Analysis Plan.

The total landfill will have an area of approximately 100 acres and a capacity of approximately 10 million cubic yards of waste. The Phase 1A area will include approximately 35 acres (estimated final cover area) ~~47 acres~~ and have a capacity of approximately 553,200 cubic yards ~~of water~~.

2.5.1.2 Liner Systems

The liner system will be installed to cover all surrounding earth that may come in contact with waste or leachate (see Drawings 9 and 11 in Volume III). The primary system will consist of, from top to bottom, a 2-foot layer of protective soil, a geocomposite drainage layer, and a HDPE geomembrane liner. The secondary system will consist of a geocomposite drainage layer, HDPE geomembrane liner, geosynthetic clay layer (GCL), and 6 inches of prepared subgrade. Both the primary and secondary systems will extend over the floor and slope areas of the landfill.

The primary and secondary geomembrane liners will be constructed of HDPE as defined in the construction specifications presented in Volume IV. This material will have sufficient strength and thickness to prevent failure as a result of pressure gradients, physical contact with waste or leachate, climatic conditions, stress of installation, and stress of daily operations. The liner systems and geosynthetic drainage layers will rest upon a prepared subgrade capable of providing support to the geosynthetics and preventing failure due to settlement, compression, or uplifting.

The liner system will be installed in stages as the landfill expands both in the vertical direction up slope and in the horizontal direction by phase. The three horizontal phases of landfill expansion are shown in Drawings 4, 6 and 7 in Volume III. The benching technique considered for expansion of the landfill vertically up slope is shown in Drawings 8 through 11 (Volume III) for Phase IA. Geosynthetic liner component tie-ins for the vertical expansion will be made on the access ramps leading into the landfill.

Stresses to the liner system can result from consolidation settlement of the subgrade during waste filling and localized equipment loading during protective soil placement. The subgrade consists of the 6 inch thickness of prepared soil subgrade and the existing ground formations below the landfill (see Drawing 7, Volume III). Because the existing ground formations have been prestressed by overburden forces prior to landfill excavation, additional consolidation settlement during waste filling will be minimal.

Consolidation settlement of the 6 inch prepared soil subgrade layer will also be minimal because it is limited by the thickness of this layer and because this material will be compacted during installation. Localized equipment loading to the liner during protective soil placement will be controlled by specifying maximum equipment ground pressures in the construction specifications and by monitoring the placement of this material. Monitoring can be performed by individuals operating the placement equipment or by grade checkers who will observe the material placement to assure that appropriate thicknesses have been installed.

2.5.1.3 Leachate Collection and Removal System (LCRS)

The LCRS will be located above the primary liner system. Drawing 12 in Volume III provides the design details of the LCRS. A filtered LCRS layer consisting of a geocomposite drainage material will be constructed. Within the floor area of the LCRS layer will be the primary leachate collection piping, which is used to remove leachate from the landfill during the active life and post-closure care period. The piping as shown in Drawing 12 (Volume III) is nominally 8 inches in diameter.

As demonstrated in the engineering report (Volume III), the LCRS will be (1) constructed of materials that are chemically resistant to the waste managed in the landfill and the leachate expected to be generated; (2) of sufficient strength and thickness to prevent collapse under pressure exerted by overlying wastes, waste cover material, and equipment used in the landfill; and (3) designed and operated to minimize clogging during the active life and post-closure care period through selection of an appropriate geotextile for the filtration application (see Volume III, Section 3.1.3).

The LCRS is sloped so that any leachate above the primary liner will drain to one of three sumps. The sumps and liquid removal methods will be of sufficient size to collect and remove liquids from the sumps and prevent liquids from backing up into the drainage layer.

The sump will be lined with the same liner system components as elsewhere in the landfill except that the drainage layer will expand to include gravel and a compacted clay liner material beneath the primary and secondary geomembranes which will fill the sump area. Leachate that collects in the sumps will be pumped through a pipe to the surface of the landfill where it will be collected in temporary storage tanks.

The leachate storage tanks will be chemically resistant, double lined poly tanks anchored to a concrete crest pad as shown in Sheets 1 and 2 of Drawing 19 (Volume III). To prevent overfilling of the tanks, an individual tank will be installed for each landfill phase, and each tank will be equipped with high-level control switches, which will automatically shut down the leachate collection or leak detection sump pumps. In addition, an alarm will be activated that will notify personnel that the system requires maintenance. Pumps will be hard piped to the leachate storage tanks, and flow meters will be installed to monitor leachate pumping from the landfill should a catastrophic tank or pipe failure occur. All piping will be located within the concrete tank pad. The pump control panel will be located inside the tank pad with electrical wiring enclosed in waterproof conduits.

Because leachate is generated by the landfill, the leachate collection tanks will be used as 90-day storage units and managed accordingly. They are not required to be permitted.

The sump system will provide a method for measuring and recording the volume of liquid removed. Drainage materials will meet the minimum drainage requirements per the specifications. Sump design, filter fabric selection, floor pipe design, pump design, disposal system design, and action leakage rate (ALR) calculations involving removal of leachate flow from a 1-mm^2 hole/acre are discussed in the engineering report (Volume III). All pumpable liquid in the sump will be removed in a timely manner to prevent the head on the primary liner from exceeding 12 inches.

2.5.1.4 Leak Detection and Removal System (LDRS)

The design of the LDRS is similar to the design of the LCRS. The LDRS will be capable of detecting, collecting, and removing leaks of hazardous constituents through areas of the primary liner during the active life and post-closure care period. A filtered LDRS layer consisting of a geocomposite will be constructed below the primary geomembrane. Within the LDRS layer will be the LDRS piping, which will be used to detect and remove liquid from between the primary and secondary liners. The piping arrangement is shown on Drawing 18 in Volume III.

As demonstrated in the engineering report (Volume III), the LDRS will be (1) constructed with a bottom slope of one percent or more; (2) constructed of a geocomposite with a hydraulic conductivity that exceeds 1 x 10^{-2} cm/sec; (3) constructed of materials that are chemically resistant to the waste managed in the landfill and the leachate expected to be generated; (4) of sufficient strength and thickness to prevent collapse under pressure exerted by overlying wastes, waste cover material, and equipment used at the landfill; and (5) designed and operated to minimize clogging during the active life and post-closure care period.

In addition, the sump and liquid removal methods are designed to be of sufficient size to collect and remove liquid from the sump and prevent liquid from backing up into the drainage layer (see ALR calculations in Volume VI). A method will be provided for measuring and recording the volume of liquid present in the sump and liquid removed. All pumpable liquid in the sump will be removed in a timely manner to maintain the head on the secondary liner at less than 12 inches. The pump for the LDRS sump is located at the sump's low point so that pumpable liquids can be removed to the maximum extent possible.

2.5.1.5 Vadose Zone Monitoring System

The vadose zone monitoring sump serves as a detection system for leaking in the secondary LDRS system. Located directly beneath the LDRS sump, leakage through the secondary liner system will flow into the vadose sump, allowing it to be detected and removed. The vadose pipe and gravel arrangement is similar to the LCRS and LDRS arrangements. Drawings 16 through 18 in Volume III show the vadose zone in the sump.

2.5.1.6 Run-On/Run-Off Control

The run-on/run-off system is designed to be constructed, operated and maintained to control at least the water volume resulting from a 24-hour, 25-year storm.

The run-on/run-off control system design is provided in Volumes III and IV. The purpose of the run-on/run-off control system is to prevent any contamination present onsite from migrating off site by ~~ensure that the~~ minimizing the ~~amount~~volume of liquid entering the landfill ~~is kept to a minimum because the liquids~~ and therefore, limiting the potential to ~~could serve as a~~ transport ~~medium for~~ contaminants placed in the landfill~~, and to prevent any contamination present onsite from migrating off site~~.

Run-on/run-off will be collected in one of three different collection basins, depending ~~managed according to~~on ~~its~~the source of the water. The collection basins are listed and discussed in detail below:

- The Facility Stormwater Detention Basin
- The Phase 1A Landfill Stormwater Collection Basin
- The Phase 1A Landfill Contaminated Water Basin

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The Facility Stormwater Detention Basin is located northwest of the landfill area, as shown on Drawings 6 and 25 in Volume III. Run-on originating from around the landfill ~~off site~~ will be directed away from the proposed landfill area using unlined landfill perimeter ditches (see Drawing 25, Volume III). These ditches will prevent water from outside the landfill from entering the active portion of the landfill. Based on the topography of the site, the run-on is expected to move from the east/southeast to the west/northwest and be diverted to the Stormwater Detention Basin. The Stormwater Detention Basin is also intended to collect run-off from the rest of the Facility (not including the landfill) and will be lined with a single 60 mil HDPE liner as a precaution. The detention basin will be pumped after rainfall events that result in the accumulation of water in the basin.

The Phase 1A Landfill Stormwater Collection Basin is located at the toe of the inter-phase cut slope in the landfill, as shown on Drawings 10 and 13 in Volume III. This basin will collect run-off from the inactive portion of the Phase 1A landfill. During the initial stages of the landfill operation, run-off from the landfill side slopes above the liner system will be channeled away from the waste by the slope drainage interceptor ditch. The water in the Stormwater Collection Basin will be handled as clean water because it will not ~~have~~ come in contact with the landfill waste. The basin is lined with a single 60 mil HDPE liner.

The Phase 1A Landfill Contaminated Water Basin is located at the bottom of the Phase 1A landfill, as shown on Drawing 10 in Volume III. This basin overlies the entire landfill liner system. Run-off from the active portion of the landfill, which does not infiltrate into the LCRS, will be collected in this basin and will be pumped out of the landfill within 24 hours of a storm event. The water pumped out of the basin will be collected using vacuum trucks and sampled and analyzed for hazardous constituents. Contaminated water will be treated either in the stabilization process or the evaporation pond, and treatment residuals will be disposed of in compliance with appropriate regulations. The contaminated water basin will be maintained to ensure that the adequate amount of protective cover soil (2 feet) is present over the liner system.

~~During the initial stages of the landfill operation, run-off from the landfill side slopes above the liner system will be channeled away from the waste by the slope drainage interceptor ditch. This water will flow to a lined collection basin located at the toe of the inter phase cut slope as shown on Drawings 10 and 13 in Volume III. This water will be handled as clean water because it will not have come in contact with the landfill waste.~~

~~Run-off from the Facility, but not from the active portion of the landfill (including run-on/ run-off from the landfill perimeter drainage ditch), will be directed to the stormwater retention basin. The retention basin will be pumped after rainfall events that result in the accumulation of water in the basin.~~

2.5.1.7 Wind Dispersal Control Procedures

Wind dispersal control will consist of a daily soil cover obtained from excavation. Typically, the daily cover will consist of soil spread on top of the waste placement area to a depth of approximately0.5-feet.

Depending on the local wind conditions, traffic, and the number of fine particles in the soil cover, dust may be generated from the surface. Typically, this dust generation is reduced by restricting traffic to predetermined haul roads on the surface of the daily cover and applying small amounts of water spray to moisten the soil surface. The water will be applied with a water truck equipped with a pump, piping, and an array of nozzles that spray very small water droplets onto the soil cover.

The frequency of the water application depends on the climate and traffic. In areas on the daily cover surface where traffic is not present, an occasional water spray will cause a crust to form on the soil surface, inhibiting dust formation. Sufficient moisture will be applied to all soil surfaces, including roads, on an as needed basis to prevent wind erosion of the daily cover. However, the application of water will be limited so that ponding in the landfill does not occur. Because the water is a topical surface application, the majority of it will evaporate rather than seep into the waste to become leachate.

2.5.1.8 Gas Generation Management

Because the landfill will not receive MSW or C&D waste, gas generated as a result of biological decomposition of organic wastes will be minimal. Organic wastes placed in the landfill will meet LDRs, which will limit the organic gas generation potential. The waste acceptance procedures at the Facility will be designed to limit receipt of wastes with potential for significant gas generation. The waste acceptance program is described in Section 4.3 and outlines the procedures that will be used to test for reactive cyanides and sulfides, other reactive chemical groups, waste compatibility, and biodegradability of sorbents.

During the operational phase of the landfill, periodic checks will be made within the landfill to detect the presence of hazardous gases and volatile organics. Surveys of the active landfill surface area and the riser pipes with an organic vapor meter (OVM) or comparable device will be performed quarterly to detect the presence of organic compounds. PPE levels and respiratory protection levels will be modified accordingly, if necessary. This testing will be conducted in addition to the fingerprint testing conducted on incoming waste. The data from both tests will be evaluated to determine what steps are necessary to reduce the generation and/or release of these gases to levels which meet prescribed regulatory air quality standards.

Prior to closure of the landfill, an assessment will be made of the landfill waste gas generating potential. This assessment will be based on review of fingerprint test data and data gathered in the landfill during operations. Based on this assessment, if it is concluded that gas generation may result in gas build-ups beneath the barrier layer of the cover or releases following closure exceeding regulatory air quality standards, then provisions will be made to collect and monitor gas generation and release during the post-closure period. If this occurs, the latest technology available will be implemented into the construction of the cover system, which may require a modification to the Permit.

2.5.1.9 Cover Design

The design of the final cover is described in Section 8.0, Closure and Post-Closure of Permitted Units. Additional details of the final cover design are shown in Volume III of this application.

2.5.1.10 Landfill Location Description

The proposed site is in eastern Chaves County, New Mexico.

Geographic Location

The proposed site is located in a remote, unpopulated portion of New Mexico, 36 miles from the city of Tatum. The primary land use in the surrounding area is ranching, which will not be impacted by landfill operations.

Geologic Setting

The proposed site is to be developed within impermeable, geologically stable sediments of the Dockum Group of Triassic age (see Section 3.4). The base of the proposed landfill will be designed to rest on 600-foot thickness of unsaturated mudstone of the Lower Dockum. This thick sequence acts as a geologic barrier to potential vertical migration of contaminants. Potential lateral migration through unsaturated Upper Dockum sediments will be retarded by the low permeability of the host sediments (siltstones and mudstones) and engineered barriers such as the liner systems.

2.5.2 Construction

Construction activities will consist of site preparation; excavation and preparation of landfill bottoms and subsurface sides; and construction of the liner, LCRS, and LDRS in accordance with the specifications and Construction Quality Assurance (CQA) Plan. The CQA plan is included as Appendix B of the engineering report presented in Volume IV.

2.5.2.1 Site Preparation

Existing site drainage will be modified to route any run-on away from the landfill area. Additionally, drainage of the landfill area itself will be modified to route water away from the initial fill area.

Access roads and weighing units will be constructed. A fence will also be installed around the Facility. These components and installations are shown in Drawing 4 presented in Volume III.

2.5.2.2 Excavation and Preparation of Landfill Bottom and Subsurface Sides

The landfill will be constructed and excavated in sections to allow a smaller portion of the landfill surface to be exposed to precipitation at any one time. The initial working area of the landfill will be excavated to design depth. The excavated material will be stockpiled on unexcavated soil near the active area for use as cover material. The landfill bottom will be sloped toward the central axis of each phase to provide drainage of leachate to the sump. The EPA minimum required slope of 1 percent has been exceeded in all cases. The upper 6 inches of the subgrade will consist of a soil material which has been sized, moisture conditioned, compacted, and trimmed to provide a smooth stable surface for geosynthetic material placement.

2.5.2.3 Construction Quality Assurance Plan

Appendix B of the engineering report presented in Volume IV of this application contains the Construction Quality Assurance Plan. Implementation of CQA procedures will result in increased leachate collection efficiency and reduced leakage through the landfill and evaporation pond liners. Additionally, use of CQA will result in fewer costly repairs to the landfill after wastes have been received, fewer occasions of exceeding the ALR, and a decreasing need for corrective action.

The CQA Plan describes the CQA procedures for the installation of the soil and geosynthetic components for the hazardous waste landfill, evaporation pond, and other units requiring subsurface containment systems comprised of soils and geosynthetic components constructed at the Facility. These procedures apply to construction of the lining systems and final cover systems, including the LCRS and LDRS systems.

The objectives of the CQA program include the following:

- development of a clearly defined organizational structure within which the project can be planned and completed;
- assurance that the methods, techniques, and procedures used to collect, analyze, verify, and report data will produce sound, documented, and defensible results;
- assurance that equipment or instrumentation used in field or laboratory testing activities has been properly maintained and calibrated as required;
- assurance that the required documentation of quality performance is properly generated and that such documentation is adequate and complete for the activity;
- development of permanent project CQA document files identifiable and traceable to each activity;
- systematic control of items, equipment, materials, or activities not in conformity with established requirements or methods, and assurance of prompt and effective corrective action when nonconforming conditions are identified;

- regular evaluation of the adequacy of the CQA program by means of quality audits coupled with the effective action necessary to correct deficiencies and prevent recurrence;

- assurance that technical and CQA personnel are qualified and trained to perform the work activities to which they have been assigned; and,

- assurance that subcontractors and consultants used in assisting project activities have an acceptable CQA program or are participating in accordance with the Facility CQA program guidelines.

Upon completion of construction activities, the Facility will submit certification signed by the New Mexico registered professional engineer serving as the CQA certifying engineer, which states that the unit has been constructed in accordance with the design drawings, Construction Quality Assurance Plan, and Construction Specifications and meets the requirement of 40 CFR 264.19. Documentation supporting the certification will be maintained in the operating record and will be furnished to the NMED upon request. Wastes will not be accepted at the constructed portion of the landfill until the NMED either approves the certification or waives the approval requirement.

2.5.3 Operation

The landfill will be operated in a safe and proper manner, in accordance with the following requirements:

2.5.3.1 Inspections and Monitoring

Section 5.0, Procedures to Prevent Hazards, contains information on inspections and monitoring.

2.5.3.2 Maintenance and Repairs

The landfill structure will be maintained through a routine preventive maintenance program which will be fully defined in the final site operations plan. Preventative maintenance will involve regular visual inspections of the landfill liner (where feasible) and review of leachate collection and analysis results. Equipment, such as pumps, generators, electrical lighting, and warning systems, will be subject to manufacturer recommended programs. Preventative maintenance information will be documented and any deviation from normal conditions will be closely tracked and corrected as necessary.

2.5.3.3 Warning Signs

Section 5.0, Procedures to Prevent Hazards, contains information about warning signs.

2.5.3.4 Record Keeping

All documentation pertaining to the results of waste analyses, waste compatibility analyses and waste handling compliance will be maintained in the Facility operating record. The Facility will be capable of determining exactly where a waste has been placed within a three-dimensional grid system. Landfill inspection records will be maintained on file for at least 3 years, in accordance with 40 CFR 264.15(d) (see Section 5.2.2).

2.5.3.5 List of Hazardous Wastes to be Placed in Landfill

The wastes to be placed in the landfill are described in Section 4.0, Waste Analysis Plan.

2.5.3.6 Specific Requirements for Ignitable/Reactive Wastes

Wastes that do not meet LDRs, as defined in Section 4.5 of the Waste Analysis Plan, will not be placed in the landfill. Therefore, untreated ignitable and reactive waste (as defined in 20 NMAC 4.1) will not be placed in the landfill.

Procedures That Render Wastes Nonreactive

Reactive waste will be treated or mixed prior to placement in the landfill so that the resulting waste mixture no longer meets the definition of reactive waste.

Procedures for Preventing Reactions

Reactive waste will be separated from sources of reaction, including but not limited to open flames, smoking, cutting and welding, hot surfaces, frictional heat, sparks, spontaneous ignition, and radiant heat. When reactive waste is being handled, smoking and open flames will not be permitted. "No Smoking" signs written in English and Spanish will be conspicuously placed wherever there is a hazard from ignitable or reactive waste.

Procedures that Render Wastes Nonignitable

Ignitable waste will be treated or mixed prior to placement in the landfill so that the resulting waste mixture no longer meets the definition of ignitable waste.

2.5.3.7 Procedures for Protecting Wastes

Procedures for the handling of incompatible wastes, lab packs, bulk and containerized liquids, and containers that are less than full are discussed below.

Procedures for Ensuring Safe Disposal of Incompatible Wastes

Procedures for identifying incompatible wastes are discussed in Section 4.0, Waste Analysis Plan. At a minimum, incompatible wastes will be spaced a sufficient distance apart in the landfill to prevent commingling. The landfill placement operation will be based on a set of grids along the north end of the landfill and along both the east and west sides of the landfill. Incompatible waste will be placed with a minimum of one grid in between the loads. Grids are normally spaced at approximately 50 to 100 foot intervals. Therefore, the minimum spacing would be 50 feet.

Procedures for Identifying Contents and Ensuring Proper Landfilling of Incoming Lab Packs

Lab packs may be placed in the landfill only if they meet the requirements in 40 CFR 264.316. Containers must be non-leaking and appropriate to the waste being contained. Appropriate non-biodegradable sorbents will be used. The Waste Analysis Plan presented in Section 4.0 will ensure that lab packs meet all of the applicable requirements prior to disposal. As with all other waste, lab packs must be properly characterized prior to acceptance at the Facility and meet the LDR treatment criteria prior to disposal. Lab packs will not be accepted if incompatible wastes are placed within the same lab pack or if reactive wastes have not been treated to render them non-reactive. Lab packs will meet all applicable LDR (40 CFR 268) requirements.

Special Requirements for Bulk and Containerized Liquids

Bulk and containerized wastes will not be placed in the landfill unless they meet the requirements in 40 CFR 264.314. Containers holding free liquids will not be placed in the landfill unless all free liquid has been eliminated by absorption, decanting, solidification, or other method. Very small containers, such as ampules or containers designed to hold liquids for use other than storage, may be placed in the landfill (40 CFR 264.314[d]).

Special Requirements for Containers

Containers, except those that are very small such as ampules, will be 90 percent full when placed in the landfill. Containers less than 90 percent full will be crushed, shredded, or otherwise reduced in volume to the maximum extent possible prior to placement in the landfill.

2.5.3.8 Action Leakage Rate

The ALR proposed for the landfill is 900 gallons per acre per day (gpad). This proposed ALR was selected based on a discussion in the preamble to the January 29, 1992, final rule for Liners and Leak Detection Systems for Hazardous Waste Land Disposal Units (57 FR 3462). A discussion of the proposed ALR and supporting calculations are presented in the engineering report in Volumes III and VI.

The average daily flow rate in the LDRS sump will be calculated in accordance with the Action Leakage Rate and Response Action Plan~~.~~ which is also presented in the engineering report.

2.5.3.9 Response Action Plan

The elements of the response action plan for the landfill and evaporation pond include (1) reducing the head on the liner to the maximum extent possible to aid in the prevention of leaks, (2) determine the failure mechanism of any leaks, and establish procedures to minimize the potential for reoccurrence of this failure mechanism, and (3) responding immediately and appropriately to a leak exceeding the ALR. Each of these elements is described below. The response action plan will apply to both the landfill and the evaporation pond. Activities that apply to the landfill only are specified.

Reducing the Head on the Landfill Liner

The head on the liner will be reduced by:

- monitoring the leachate collection system sumps weekly and after all significant precipitation events;
- removing pumpable liquids from the sump when monitoring indicates the presence of liquid. A reasonable effort will be made to remove as much liquid as possible. As previously described, it is standard landfill design practice to locate a low point or sump box in the base of the landfill sump. The pump for the sump is located at this low point, and it is from here that pumpable liquids are removed to the maximum extent possible; and,
- ~~Vacuum trucks to remove as much of this water as possible before it can seep into the waste.~~
- ~~Utilizing~~ if ~~during a heavy rain event,~~ water ponds on the surface of the daily cover due to a heavy rain event, vacuum trucks will be utilized to remove as much of the standing water as possible before it can seep into the waste.

Leak Detected Below the Action Leakage Rate

Flow rates less than the ALR are expected under normal operation conditions. However, the following actions will be taken in response to a leak below the ALR:

- determine whether the leak can be attributed to some operational disturbance such as an equipment or power failure;
- verify that the sump pump is working as designed;
- increase the pump rate on the leachate collection system pump;
- for the landfill only: remove all standing water, if any, from the surface of the landfill;
- assess operations to determine if waste receipt should be temporarily curtailed or waste should be removed for inspection, repair, or controls;
- determine if the flow rate varies with precipitation;

- for the landfill only: repair any damage to the exposed portion of the liner in a manner which conforms to original design specifications and by qualified technicians in accordance with the CQA Plan (see Volume IV);

- document any damage and repairs in the Facility operating record; and,

- investigate alternative sources of liquids.

Leak Detected Above Action Leakage Rate

If a leak is detected above the ALR, the following actions will be implemented in response:

- Notify the NMED in writing of the exceedance within 7 days of the determination;

- Submit a preliminary written assessment to NMED within 14 days of the exceedance determination, as to the amounts of liquids, likely sources of liquids, possible location, size, and cause of any leaks, and short-term actions taken and planned.

- Determine, to the extent practicable, the location, size, and cause of any leak;

- Determine whether waste receipt should cease or be curtailed, whether any waste should be removed from the unit for inspection, repairs, or controls, and whether or not the unit should be closed;

- Determine any other short-term and long-term actions to be taken to mitigate or stop any leaks;

- Within 30 days after the notification that the action leakage rate has been exceeded, submit to NMED the results of the determinations described above, the results of the actions taken, a description of the actions planned;

- Monthly, as long as the action leakage rate continues to be exceeded, submit a report to NMED summarizing the results of any remedial actions taken and planned; and

- In making the determinations described in this section, either conduct the following investigation or document why such an investigation is not needed:

  ◊ Assess the source and amount of liquid from each source collected in the sump.

  ◊ Conduct a hazardous constituent analysis of the liquid collected in the sump and use the results to help identify the source(s) of the liquid and possible location of any leaks as well as the potential hazard associated with the liquid and its mobility.

  ◊ Assess the seriousness of any leaks in terms of potential for escaping into the environment.

2.5.3.10 Closure

A description of landfill closure is provided in Section 8.0, Closure and Post-Closure of Permitted Units.

2.6 TREATMENT IN EVAPORATION POND

Only waste that meets LDR treatment standards will be placed in the evaporation pond. Waste will be received from off site generators and from the leachate collection system associated with the landfill or other site units (i.e. waste storage areas). Evaporation will be the only treatment occurring in the evaporation pond.

2.6.1 Design of Evaporation Pond

The Facility is proposing design and operating practices for the evaporation pond in accordance with 40 CFR 264.221~~(c)~~. The evaporation pond design is provided on Drawings 28 through 32 in Volume III and will have an approximate operating capacity of 5.2 million gallons over an approximate area of ~~75,240~~~~78,600~~78,600 square feet.

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The evaporation pond has been designed as a double-lined unit with a LDRS between the primary and secondary liners. The unit is designed and will be constructed, maintained, and operated to prevent overtopping resulting from normal or abnormal operations; overfilling; wind and wave action; rainfall; run-on; malfunctions of level controllers, alarms, and other equipment; and human error.

2.6.1.1 Liner System

The liner system, shown in Drawings 29 and 32 of Volume III, will include a primary (top) geomembrane liner above a geonet layer and a secondary (bottom) geomembrane liner, supported by 3 feet of compacted clay liner material with a hydraulic conductivity of no more than 1 x 10^{-7} cm/sec. Soil liner leachate compatibility tests (two stage permeability testing using ASTM D 5084) will be conducted prior to construction. In addition, a test fill will be constructed, as per the procedures outlined in the CQA Plan. Soil liner compatibility is normally not a problem unless the leachate contains high concentrations of organics (Eklund, 1985; Peterson and Gee, 1985; Mitchell and Madsen, 1987; Finno and Schubert, 1986; Lo et al., 1994; Day, 1994; Shackel ford, 1994). The Waste Analysis Plan (Section 4) does not allow the site to accept high concentrations of organics, therefore the soil and leachate compatibility is not expected to be a problem.

The compacted clay surface will provide a stable foundation for the liner and resistance to pressure gradients above and below the liner. The evaporation pond liner system will be located on top of the excavated subgrade which will be located approximately 15 feet below the existing ground surface. At this depth the basal portions of the evaporation pond will lie in either the Quaternary sand or Upper Dockum units. Settlement evaluations presented in the engineering report (see Appendix E in Volume V) demonstrate that either of these units will adequately serve as a foundation for the evaporation pond. Near surface evaporation pond slope areas will be located on top of Quaternary soil materials. The engineering report also presents settlement evaluations for the evaporation pond subgrade within the Quaternary soil materials and stability evaluation of any load bearing embankments.

Design and operating practices, together with the geologic setting of the Facility, will prevent the migration of any hazardous constituent to adjacent subsurface soil, surface water, or groundwater. The top liner is designed to minimize the migration of hazardous constituents through the liner system during the active life and closure period of the evaporation pond. A 60-mil HDPE geomembrane material will be used for the primary liner component. HDPE liners have been shown to be chemically resistant to landfill leachates based on operational performance and on EPA 9090 compatibility tests conducted on actual landfill leachates and synthetically generated leachates.

Calculations that define the stresses on the evaporation pond liner system due to thermal expansion and contraction are also provided in the engineering report (Appendix E, Volume VI).

Drawing 32 in Volume III shows that the bottom liner will be a two-component system, including a geomembrane and a compacted clay liner. The lower component, the 3 feet of compacted clay, will minimize the migration of hazardous constituents if a breach through the upper components occurs. Material for the evaporation pond compacted clay liner will be siltstone or mudstone obtained during landfill excavation within the Upper Dockum. During landfill excavation, appropriate siltstone and mudstone materials will be stockpiled and if necessary, conditioned such that compacted soil liner specifications are met. The test results presented in Appendices D and E (Volumes V and VI) indicate that the unprocessed material has an intact permeability close to 1 x 10^{-7} cm/sec. Therefore, with processing, the material can be placed and compacted to meet the permeability specification of 1 x 10^{-7} cm/sec or less. Additional laboratory tests will be conducted on processed siltstone and mudstone samples during the test fill program to confirm their permeability characteristics.

The liners will be constructed of materials that will be chemically resistant to the waste managed in the evaporation pond and any liquid that has accumulated in the leak detection system. The liner system materials will have appropriate chemical properties and sufficient strength and thickness to prevent failure as a result of pressure gradients, physical contact with the waste or leaked liquid to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation.

Information pertaining to the chemical properties and physical strength of the liner system materials was supplied by the manufacturer and is included in the construction specifications presented in Volume IV.

The geonet drainage system is capable of effectively minimizing the head developing on the secondary evaporation pond liner. Geonet clogging, which reduces the overall drainage capacity, has been incorporated into the design of the drainage system as a factor of safety. This safety factor has been applied in the ALR calculation presented in the engineering report (Volumes III and VI). This approach is suggested in EPA guidance for determining the ALR in the preamble to the January 29, 1992, final rule for Liners and Leak Detection System for Hazardous Waste Land Disposal Units (57 FR 3462).

Stresses on geosynthetics during installation are likely to be negligible. The evaporation pond slope lengths will be less than 40 feet, and the slope ratio is relatively shallow, causing little tensile stress to be exerted in the liner. Also, there will be no horizontal seams in the geosynthetic liner material. Traditional anchoring methods will be used. 60-mil HDPE material will be used, which, when properly installed and welded, is of sufficient tensile strength to withstand the stresses of installation.

2.6.1.2 Leak Detection and Removal System/Vadose Monitoring System

The LDRS consists of a geonet layer of cross-linked ribbed HDPE, a sump, and associated detection and liquid removal pipes. A pump located in the LDRS pipe will be used to remove leachate accumulating in the leachate collection systems. When leachate accumulates, it will be pumped to a tanker truck and either returned to the evaporation pond, stabilized in the onsite treatment unit, or stored in one of the liquid waste storage tanks.

The LDRS unit will have the following characteristics:

- be constructed with a bottom slope of 1% or more;

- be constructed of synthetic or geonet drainage materials with a minimum transmissivity of 5 x 10^{-3} m^2/sec;
- be constructed of materials that are chemically resistant to the waste managed in the evaporation pond and any leachate generated in the landfill;
- of sufficient strength and thickness to prevent collapse under pressure exerted by overlying wastes, and equipment used at the evaporation pond;
- designed and operated to minimize clogging during the active life and closure period of the evaporation pond; and,
- constructed with sump and liquid removal methods.

LDRS details are presented in Drawing 32 in Volume III. The LDRS will be sloped so that any leachate below the primary liner will drain to the centrally located sump. The sump pit design is also shown in the drawing.

The collection system has been designed to be of sufficient size to collect and remove liquids from the sump and prevent liquid from backing up into the drainage layer. A sump pump and associated piping will be installed in the lower portion of the sump. The sump system will be covered with gravel to bring the area to the level of the evaporation pond floor. The gravel will serve as an expanded drainage layer providing space for the piping.

The sump system will be provided with a method for measuring and recording the volume of liquids present and the volume of liquid removed. All pumpable liquids in the sump will be removed in a timely manner to maintain the head on the bottom liner below 12 inches.

A pump operating level will be established to ensure that backup into the drainage layer does not occur, and the head in the sump is maintained at less than 12 inches.

Methods and equipment to be used to measure and record liquid handling volumes during evaporation pond operation will include survey monuments and elevation rods, flow meters, and fluid level transducers. Elevation rods will be placed in the evaporation pond following pond construction. The rods will be fixed to a ballasted base, which will rest on the primary geomembrane liner. The rods will have graduated markings from which pond liquid elevations and critical freeboard levels can be observed and pond volumes can be determined. Rod elevations will be checked periodically by survey. Flow meters will be used to record volumes of liquid discharged into the pond and removed from the LDRS drainage system sump. The transducers located in the LDRS sump will provide a reading for the liquid levels in the sump at any time during operation. The evaporation pond vadose monitoring sump serves as a detection system for leakage of the LDRS sump. Leakage through the secondary liner system will flow into the vadose sump. This will allow the leakage to be detected and moved. The vadose pipe and gravel arrangement is similar to the LDRS arrangement.

2.6.1.3 Separator Berm System

The evaporation pond design incorporates a separator berm between the two pond sections, Pond 1A and Pond 1B (see Drawing 28 in Volume III). This pond design provides two independent treatment areas. Thus, in the event that a leak should occur in one section of the pond, liquids could be pumped into the other section until repairs are completed. Two feet of freeboard will be maintained in the evaporation pond at all times. The evaporation pond design and ongoing proper maintenance of the unit will ensure sufficient structural integrity to prevent massive failure. The evaporation pond will be of sufficient volume and freeboard capacity to contain the 100-year 24-hour storm event. This design capacity, coupled with the management of surface water and routine inspections, will help prevent overtopping (see Section 2.6.4.3).

2.6.1.4 Run-On/Run-Off Control

The run-on/run-off system is designed to be constructed, operated and maintained to control at least the water volume resulting from a 24-hour, 25-year storm. Run-on originating off-site will be directed around the proposed evaporation pond into the site wide surface diversion channels shown in Drawing 25, using unlined ditches. ~~Run-off in the pond will be pumped out within 24-hours of a storm event with vaccum trucks. Contaminated water will be treated in the stabilization bins and treatment residuals will be disposed of in compliance with appropriate regulations~~

2.6.1.5 Evaporation Pond Location Description

As indicated in Drawing 4 presented in Volume III, the evaporation pond, will be located in the northwest corner of the active portion of the Facility.

2.6.2 Construction

Construction activities will consist of site preparation; excavation, and preparation of the bottom and sides of the evaporation pond; construction of dikes; installation of the liners, LDRS and vadose system; and CQA.

2.6.2.1 Site Preparation

Existing site drainage will be modified to route any run-on away from the evaporation pond area. Access roads and a truck discharge station will be constructed. These engineered controls and components are shown on Drawings 4, 5, and 31 in Volume III.

2.6.2.2 Excavation and Preparation of Evaporation Pond Bottom and Subsurface Sides

The evaporation pond will be constructed and excavated to a design depth of approximately 15 feet. The excavated material will be stockpiled for future use. The evaporation pond bottom will be constructed with a 2% (approximate) slope toward the central sump location.

2.6.2.3 Structural Fill Areas

Areas of the evaporation pond requiring structural fill will be constructed according to the specifications presented in Specifications, Section 02110 Site Preparation and Earthwork, Volume IV.

2.6.2.4 Liner, LDRS, and Vadose System Installation

Three feet of clay will be installed directly on the excavated subgrade, forming the lower portion of the secondary liner. The clay will have a permeability of 1×10^{-7} cm/sec or less. A geomembrane liner will be placed over the entire clay liner, including the sump area and the separator berm. A geonet layer of cross-linked ribs, which will serve as the LDRS, will be installed next. The sump and associated piping will then be installed, and gravel will be placed in the depression to bring the surface level of the sump area to that of the evaporation pond floor. A filter geotextile will surround the gravel in the sump area to protect the geomembrane liner and to reduce the sediment clogging of the geonet.

The liners will be installed to cover all surrounding soils likely to be in contact with the waste or leachate.

The sump pump and pressure transducers (or other) liquid detection device will be installed next to the LDRS and vadose pipes during construction. These devices will be attached to a control panel. Any time liquids are detected at a specified level, the sump pump will be activated and the liquid will be removed. The pump activation level is related to the sump design and pump type selected. The wastewater will be sampled, analyzed and handled in accordance with the Facility requirements.

2.6.2.5 Construction Quality Assurance Plan

Section 2.5.2.3 contains information detailing the CQA Plan. In addition, the CQA plan is contained in Volume IV of this application.

2.6.3 Nature ~~and Quantity~~ of Waste

Hazardous wastes which may be placed in the evaporation pond include all wastes listed in Part A of the application (Volume I), provided that LDR treatment standards are met prior to placement of the wastes. Potential contaminants in the wastewater will include those found in wastes accepted at the landfill and in other wastes as specified in the Waste Analysis Plan (see Section 4.0). In general, these wastes include RCRA hazardous wastes and ~~TSCA~~ PCB wastes (less than 50 ppm), excluding the waste types listed in Section 2.5.1.1 and the wastes covered by 20 NMAC 4.1.500 (including 40 CFR 264, Subparts BB and CC).

2.6.4 Operation of the Evaporation Pond

Operation of the evaporation pond will involve three main activities: (1) waste acceptance and receiving; (2) placement of wastewater into the evaporation pond; and (3) inspection, monitoring, and repair of the unit. Each of these activities is described below.

2.6.4.1 Waste Acceptance and Receiving

Off site generators must provide a full characterization of their waste to the Facility prior to receiving approval to ship the waste to the Facility. After approval has been received, shipment of waste to the Facility will proceed as described in Section 2.1.2. Tanker trucks will then transport their waste to the tanker discharge pad at the evaporation pond.

Once the waste is received onsite, it will be sampled and fingerprint tested to verify that it is the same waste that was previously characterized. Landfill leachate waste must also be sampled and analyzed prior to being placed in the evaporation pond. Waste analysis and fingerprint testing are more fully described in Section 4.0, Waste Analysis Plan. This waste analysis and characterization data will be used to ensure that the waste acceptance criteria specified in the RCRA permit are met and to identify any safety precautions that must be taken to properly manage the waste.

Following a determination that the leachate from the landfill meets the acceptance criteria, the waste will be pumped from the leachate collection tank to a tanker truck. Approved leachate trucks and off site waste trucks will transport the waste to the tanker discharge pad at the evaporation pond.

Landfill leachate collection waste and off site waste that is determined not to meet LDR treatment standards will be treated in the stabilization unit or shipped to other appropriate treatment facilities.

2.6.4.2 Placement of Wastewater into the Evaporation Pond

Tanker trucks will be unloaded directly into the evaporation pond through a series of hoses, valves and pipes. The tanker discharge pad will be constructed of concrete and will be sloped toward the evaporation pond to drain any spills or leaks into the pond. Details of the tanker discharge pad are provided in Sheets 1 and 2 of Drawing 31 (Volume III).

2.6.4.3 Inspections, Monitoring, and Repairs

The evaporation pond structure and dikes will be maintained through a routine inspection program. The volume of liquids in the ponds will be dependent on the waste market. Net evaporation (total evaporation minus rainfall) for the site is in the range of 80 inches per year. The freeboard level will be routinely inspected to ensure that approved or acceptable freeboard levels are maintained and that overtopping does not occur. Pond overtopping will be controlled operationally by maintaining evaporation pond fluid levels below the freeboard elevation and by ensuring that any storm water run-on from surrounding areas is diverted around the evaporation pond. Sludge will be removed by vacuum trucks and treated in the stabilization bins. Sludge will be removed on a routine basis to maintain the operational level in the pond. The vacuum trucks will park on a concrete pad during sludge removal. Sludge will be removed by means of pumps and flexible hoses. Vacuum trucks will be washed thoroughly in the truck wash unit after sludge removal and transporation to the stabilization bins. Grading of the surrounding surface area has been included as a part of the surface water management. Inspections will occur on a weekly basis and after storms to detect evidence of deterioration, malfunction, improper operation of overtopping control systems or sudden drops in the liquid level. The liner exposed above the operating pond level will be inspected to make sure that the liner is not damaged.

The engineering report includes a discussion of the evaporation pond LDRS ALR (see Section 4.0 in Volume III). LDRS drainage layer flow capacity, LDRS sump capacity, fluid head calculations, and flow rate conversions are included, as well as response actions for ALR exceedance.

The two evaporation pond sections allow for one section of the pond to be removed from service if the liquid level suddenly drops for an unknown reason. If liquid losses exceed daily evaporation losses and no other reasonable explanation is found, then that section of the evaporation pond will be shut down and authorities at the NMED will be notified immediately. If a section of the evaporation pond must be removed from service, flow of waste to that section will be stopped, leakage will be stopped by draining the pond to below the level of the leak, surface leakage will be contained, and all necessary steps will be taken to repair the liner system and prevent a future failure. Responses to such situations, including NMED notification, are described in Section 6.0, Contingency Plan.

Additional inspection and monitoring information is provided in Section 5.0, Procedures to Prevent Hazards.

2.6.4.4 Specific Requirements for Ignitable, Reactive, and/or Incompatible Wastes

Wastes that are ignitable, reactive, and/or incompatible will not be placed in the evaporation pond at the same time. Waste acceptance procedures, described in Section 4.0, Waste Analysis Plan, will ensure that such wastes are not inadvertently placed together in the evaporation pond.

2.6.4.5 Warning Signs

Section 5.0, Procedures to Prevent Hazards, contains information on warning signs.

2.6.4.6 Record Keeping

All documentation pertaining to the results of waste analyses or waste compatibility analyses will be maintained in the Facility operating record. Inspection records will be maintained in the inspection log for the evaporation pond.

2.6.4.7 Action Leakage Rate

The proposed ALR for the evaporation pond is 1,000 gpad. This ALR was selected based on a discussion in the preamble to the final rule for Liners and Leak Detection Systems for Hazardous Waste Land Disposal Units (57 FR 3462), in which the EPA indicates that an ALR below 1,000 gpad should not be required.

The average daily flow rate to the sump system will be calculated and recorded weekly during the active life and closure period of the evaporation pond to ensure that the ALR is not exceeded.

2.6.4.8 Response Action Plan

The response action plan is described in Section 2.5.3.9.

2.6.4.9 Closure

A description of how hazardous waste residues will be removed from the evaporation pond at closure is provided in Section 8.0, Closure and Post-Closure of Permitted Units.

2.7 OPERATIONS AND MAINTENANCE

All of the regulated facilities will be constructed in accordance with the Design Drawing, Specifications and Construction Quality Assurance Plan presented in Volume III and IV. The operations and maintenance of the units will be in accordance with the Operations and Maintenance Plan presented in Volume II, Appendix O. In general, all maintenance and repairs to the facilities will be completed to meet the requirements of the original Design Drawings and Specifications and will be monitored in compliance with the Construction Quality Assurance manual.

1.0 GENERAL FACILITY STANDARDS

This section provides a general description of the Triassic Park Waste Disposal Facility (Facility), including waste management practices, site environment and climate, location information, emergency management, and traffic patterns.

Part A and Part B of the permit application are included in the two volumes described below.

- *Volume I* - Part A and Part B (Text and Figures)
- *Volume II* – Part B Appendices A - M

Supporting documentation for Part B is provided in four additional volumes. These volumes present the engineering report and associated appendices as outlined below.

- *Volume III* - Engineering Report Text and Appendix A (Design Drawings)
- *Volume IV* - Appendix B (Construction Quality Assurance Plan) and Appendix C (Construction Specifications)
- *Volume V* - Appendix D (Laboratory Data) and Appendix E (Engineering Calculations)
- *Volume VI* - Appendix E (cont.), Appendix F (Surface Water Design), and Appendix G (Action Leakage Rate and Response Action Plan)

This is considered a complete submittal and supersedes all previous submittals.

1.1 GENERAL DESCRIPTION

The Facility will be a full-service Resource Conservation and Recovery Act (RCRA) Subtitle C waste treatment, storage, and disposal operation. The Facility will be located in Southeastern New Mexico on approximately 480 acres of privately owned land in Chaves County, New Mexico (see Figure 1-1 at the end of this section). By road, this location is approximately 43 miles east of Roswell and 36 miles west of Tatum, as shown on Figure 1-2.

~~Hazardous wastes which may be placed in the evaporation pond include all wastes listed in Part A of the application, provided that Land Disposal Restriction (LDR) standards are met prior to placing the wastes in the evaporation pond.~~ All waste placed in the ~~evaporation pond at the~~ Facility will meet Land Disposal Restrictions (LDR) ~~LDR standards~~ prior to disposal. The Facility will accept ~~Toxic Substances Control Act (TSCA)-regulated~~ polychlorinated biphenyl (PCB) wastes that are not regulated by Toxic Substances Control Act (TSCA), that is ~~but~~ only PCB wastes at concentrations of less than 50 parts per million (ppm) in liquids and 500 ppm for bulk PCB remediation waste. ~~in soils.~~ The Facility will offer the following RCRA-regulated services, which are described in this permit application.

1.1.1 Treatment

Two treatment processes will be used at the Facility, including an evaporation pond for managing wastewaters that meet LDR standards and a stabilization process for treating liquids, sludges, and solids to ensure that no free liquids are present and that LDR standards are met prior to placing wastes in the landfill. Dilution of restricted waste will not be used as a substitute for adequate treatment. All stabilized wastes will be tested, as a final step in the stabilization process, to ensure that no free liquids are present. The Paint Filter Liquids Test, U.S. Environmental Protection Agency (EPA) Method 9095, will be used to make this evaluation. Prior to treating wastes in the stabilization unit, waste characteristics will be analyzed to ensure that proper measures can be taken to safely manage ignitable, reactive, and incompatible wastes. Procedures for properly identifying and verifying

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ignitable, reactive, and incompatible wastes are described in Section 4.5 of the Waste Analysis Plan. Once these wastes are identified, they will be managed in accordance with applicable regulatory requirements and permit conditions (see Section 5.5).

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1.1.2 Solid Waste Storage

Two container storage areas (roll-off storage area and drum handling unit) will be used to stage waste at the Facility for treatment or disposal. These units will ensure that waste is stored in compliance with RCRA requirements for permitted storage. Neither of the units will be used for long-term storage of waste. All containers being stored will be clearly marked with hazardous waste labels which identify the contents of each container as well as the date of receipt (accumulation date). All labels will be clearly visible while containers are being stored. All containers will remain closed during storage, except when waste is removed or added. Further, container storage and handling procedures will be developed to ensure that containers are not opened, handled, or stored in a manner that may cause them to rupture or leak.

1.1.3 Liquid Waste Storage

Four aboveground storage tanks will be utilized to accumulate regulated bulk liquid hazardous wastes prior to stabilization. Handling of reactive materials, tank corrosion, tank assessments, tank inspection and tightness testing, and repair and certification of tank systems is discussed in Section 5.0. Description of contents, quantity of hazardous waste received, and the date each period of accumulation begins will be documented in the facility records and will be included on labels for each storage tank. Design, dimensions, capacity, and other tank specifications are included in Volumes III and IV of this permit application.

1.1.4 Land Disposal

A landfill will be utilized for the disposal of waste that meets LDR standards. Support units and structures include a chemical laboratory, administration building, weigh scale area, maintenance shop, truck wash unit, clay processing area, clay liner material stockpiles, daily cover stockpiles, and a stormwater retention basin.

Because the Facility has not yet been constructed or operated, there are no solid waste management units (SWMUs) at this time. Satellite and/or 90-day accumulation areas may possibly be located at the chemical laboratory, the truck wash unit, and the maintenance shop. Other areas at the Facility that may be designated as SWMUs include the untarping, sampling, and weigh scales area, the truck staging area, and the stormwater retention basin. Detailed information on location, unit type and dimensions, and a structural description of these units is provided in the design of the Facility contained in Volumes III through VI of this application.

The future debris encapsulation area and the future waste processing area identified in the Facility layout are possible future RCRA treatment units envisioned for the Facility that are not being designed at this time. Prior to construction of these units, a RCRA permit modification request will be submitted.

1.1.5 Facility Name

Gandy Marley, Inc. (GMI) owns the Facility. The waste disposal operations covered by this permit will operate under the name of the Triassic Park Waste Disposal Facility.

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1.1.6 Facility Contact

Larry Gandy, Vice President
Gandy Marley, Inc.
Tatum, New Mexico
505/398-4960

1.1.7 Facility Address

1109 East Broadway
P. O. Box 827
Tatum, New Mexico 88267

1.1.8 Purpose of Facility

The purpose of the Facility will be the treatment and permanent disposal of hazardous wastes in a manner protective of human health and the environment. Wastes that do not meet LDR standards will not be accepted for placement into the landfill or evaporation pond until appropriate treatment is performed. Infectious wastes and radioactive wastes will be prohibited at this Facility. The Waste Analysis Plan contains more details regarding wastes that can be accepted at the Facility and wastes that are prohibited.

1.1.9 Facility Location

The Facility will be located in Southeastern New Mexico on approximately 480 acres of privately owned land in Chaves County, New Mexico, Sections 17 and 18 of R31E, T11S (see Figure 1-1). By road, this location is approximately 43 miles east of Roswell and 36 miles west of Tatum, as shown on Figure 1-2. The only major road in the vicinity is U.S. Highway 380, which runs east and west approximately 4 miles north of the proposed site. State Highway 172, which runs north and south, is approximately 4 miles east of the proposed site. State Highway 172 is not a major thoroughfare and does not provide access to the proposed site.

1.1.10 Hazardous Waste Generation

Some hazardous waste will be generated as a result of normal Facility operations. Various treatment and handling processes and support operations will likely generate such wastes. Examples of typical hazardous waste forms likely to be generated during normal Facility operations include solvents, oils, acids and bases, laboratory chemicals and equipment, paint and paint strippers, sludges, solvent contaminated solids, and personal protective equipment. Non-recyclable hazardous wastes will be disposed of onsite in accordance with the requirements outlined in Section 4.5.6 of the Waste Analysis Plan.

1.1.11 Sanitary Waste Generation

Sanitary liquid wastes will be generated in most Facility buildings. This waste form consists primarily of shower water, janitorial wastes, rest room wastes, and liquid wastes generated from cleaning operations. Non-hazardous liquid wastes will be managed as sewage and disposed of a~~ccordingly~~ offsite.

1.1.12 Non-hazardous Refuse Generation

Non-hazardous municipal solid waste (MSW) and construction and demolition (C&D) waste will be generated during building and normal operations at the Facility. These wastes will include such things

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as cardboard packing containers, garbage, paper refuse, and construction debris. Collection, transportation, and disposal of non-recyclable waste will be contracted to a MSW and C&D waste disposal company. Recyclable wastes, such as office paper, will be sent off site for usable materials recovery. The disposal of non-routine waste materials will be administratively controlled on a case-by-case basis in accordance with applicable regulatory requirements.

1.2 SITE ENVIRONMENT AND CLIMATE

The selected site for the Facility is on the western edge of a geological bench known locally as the Caprock. The Caprock is characterized by rocky terrain which runs north and south. Detailed information about the geologic characteristics of the site is contained in Section 3.0.

The site is approximately 4,150 feet above sea level. Climatic conditions of the area are typical of semi-arid regions and are characterized by dry, warm winters with minimal snow cover and hot, somewhat more moist summers. The frost-free season averages from 190 to 215 days per year. The mean annual soil temperature ranges from 59 to 65 degrees Fahrenheit. The average annual precipitation ranges from 10 to 13 inches. Winter precipitation usually consists of occasional snowfall from November through April. Snowfall typically melts within a short period of time. Most precipitation (approximately 80 percent of the annual total) occurs between June and September.

Normally, two-thirds of the summer days reach temperatures in excess of 90°F with maximum temperatures commonly 100°F or higher. Night temperatures during the winter months commonly fall below freezing, occasionally reaching below 0°F. The average annual temperature is 62°F.

The prevailing wind is from the south. Winds of up to 40 miles per hour are common during the spring and in association with summer thunderstorms.

Area vegetation consists primarily of Tobosa, Buffalo Grass, Vine-Mesquite, Mesquite, Cactus, Sand Dropseed, Little Bluestem, Sand Bluestem, Sandbur, Three-Awn, Shinnery Oak, Yucca, and Sand Sagebrush. According to the New Mexico Forestry and Resources Conservation Division of the State Department of Energy, Minerals, and Natural Resources, there are no rare or endangered plant species located in either Section 17 or 18.

According to the Bureau of Land Management (BLM) - Roswell Resource Area, there are 54 bird species, 33 species of mammals, and 36 species of reptiles and amphibians in what is designated as the Caprock Wildlife Habitat Area. The Facility location is within that wildlife habitat designation.

One bird species, the ferruginous hawk (*Buteo regalis*), is classified as a "Category 2" candidate for listing as threatened or endangered by the United States Fish and Wildlife Service of the U.S. Department of Interior. Currently, it is not listed. No other documented species in the area of the proposed Facility site are federally protected or candidates for federal protection.

The sand dune sagebrush lizard (*Scelopurus graciosus arenicolous*) is currently listed as a threatened species by the State of New Mexico. Population and habitat studies are ongoing for use by the state in determining whether to give the species protected status. The sand dune sagebrush lizard is not classified for federal protection.

GMI will continue to monitor the existence of threatened or endangered species in the area. Should any threatened or endangered species be identified within the Facility area, GMI will take measures to ensure that these species are protected. GMI will implement protective measures for the wildlife population in the area. These measures include the use of restrictive fencing around the operational portions of the Facility and the use of protective netting over the evaporation pond.

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1.3 LOCATION INFORMATION

A topographic map of the site has been developed from a 1997 aerial photograph and U.S. Geological Survey (USGS) 7.5 minute series map (Mescalero Point, New Mexico, 1973) and is presented in Volume III, Drawing 3. This drawing illustrates Facility boundaries, access roads, access control locations, internal roads, and site fences. The Facility layout is presented as Drawing 4 in Volume III of this application.

The site is located in eastern Chaves County, in an area that has historically been utilized primarily as range land for livestock grazing and for limited oil and gas activities. The residence nearest the site is owned by Marley Ranches, Ltd. and is located approximately 2.9 miles to the east-southeast. Land ownership for a 4-mile radius around the site is shown in Figure 1-2 at the end of this section. All of the residences within a ten-mile radius of the site are listed in Figure 1-3.

The site will encompass 480 acres and will be enclosed by a 3-strand barbwire fence. Gates to the same height as the perimeter fence will be constructed. The area will be secured and monitored so that only authorized personnel or personnel being accompanied and supervised by authorized personnel are allowed onsite. Employees responsible for site security will be present at all times to prevent unauthorized entry and to report unusual events and/or emergencies. Site security personnel will be responsible for conducting regular inspections and routine maintenance of the perimeter area (see Section 5.0).

Land use plans and/or zoning maps have not been developed for Chaves County. All areas within the county, except those within municipal boundaries, are designated as Zone A (agricultural). The eastern half of the county is further designated as Area 1 and the western half as Area 2. Area 1 and Area 2 are zoning Land Use Areas, whose boundaries have been determined by a joint-powers agreement between the Board of Chaves County Commissioners and the Roswell City Council. Existing uses in Area 1 are livestock grazing, mineral exploration and production, wildlife habitat, and extensive recreation. Single-family dwellings require permits in Area 1. Area 2 covers an important part of the recharge area of the Roswell Artesian Basin. Existing uses in Area 2 are livestock grazing, mineral exploration and production, extensive recreation, wildlife habitat, and flood control structures and floodways. Any new parcels created in the area must be five acres or larger.

Approximately 2 miles northwest of the Facility location, the Mescalero Sands recreational “complex” has been established for use by off-road vehicles. The South Dunes area of Mescalero Sands has been designated as an “Outstanding Natural Area” (ONA) and is utilized by the public primarily for wildlife observation activities.

The land in the area of the Facility is used predominantly for grazing cattle and to a much lesser extent for oil and gas exploration activities. The nearest production well is 3 miles from the site. Additional information about the drilling activities in the area is contained in Section 3.0 of this document.

All abandoned wells in the area have been plugged in accordance with New Mexico Oil Conservation Division (OCD) regulations. These regulations require the use of mud-laden fluids, cement and plugs in the well "in a way to confine crude petroleum oil, natural gas, or water in the strata in which it is found and to prevent it from escaping into other strata." Surface reclamation of abandoned wells prevents surface water from entering and contaminating subsurface strata.

1.3.1 Flood Plain Information

Sections 17 and 18, T11S, R31E are included on Federal Insurance Rate Map #350125. This map has not been printed because the National Flood Insurance Program has determined that this is an area of

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minimal flood hazards. This information was provided to GMI by the Director of Planning and Environmental Services, Chaves County, New Mexico.

Additionally, rainfall run-off calculations were performed to determine whether the site falls within the flood plain of a 100-year, 24-hour storm event. Based on information in the Precipitation Frequency Atlas published by the National Oceanic and Atmospheric Association, a rainfall amount of 5.3 inches was used in the calculations. The nearest drainage to the site was determined from the USGS 7.5-minute series topographic map of the Mescalero Point Quadrangle (see Section 3.0). This drainage flows westerly from Mescalero Point, which is approximately three-quarters of a mile south of the site.

Storm run-off flows were calculated for the area using the Rational Method (see Appendix F-3 in Volume VI of this application). A run-off coefficient of 0.3 was used in the calculations. It was determined that the maximum flow could be accommodated in a triangular section occupying a width of 76 feet. It may be concluded from this comparison that a flood plain does not exist for the drainage and that there are no flood plains within 1 mile of the site. It may be further concluded that flood plain regulations are not applicable to this Facility.

1.3.2 Fire Control and Emergency Response

Fire control and emergency response will be the responsibility of the Emergency Coordinator (EC) who is on call or duty at the time of an incident. Each EC will be trained to handle emergencies and to notify appropriate authorities (see Section 7.0). Each EC will have the authority to commit resources necessary to implement the site Contingency Plan described in Section 6.0.

In addition to onsite emergency response capabilities, cooperative agreements will be established with local emergency response organizations in surrounding communities to respond to and assist in any emergencies that arise at the Facility (see Section 6.0).

1.4 TRAFFIC PATTERNS

The flow of traffic within the Facility boundary will not be significant except during shift changes. The number of employee vehicles will not be substantial enough to require elaborate signage or other traffic control systems. All personnel will be given written instructions that will caution them to be alert to other vehicles and pedestrians. Each vehicle must enter and exit through the security gate at the northeast corner of the perimeter of the Facility boundary. The arrival and departure of trucks transporting waste will not be scheduled during peak traffic times. Drawing 26, Sheet 2 in Volume III illustrates traffic flow patterns for the operations and waste processing area, traffic control signage and truck staging areas.

1.4.1 Traffic Control

Access to the Facility will be gained through the security gate at the northeast corner of the perimeter fence (see Drawing 26, Sheet 2 in Volume III). Authorization to enter the Facility will be verified for each vehicle. Visitors will be required to sign in at the guard shack and will be escorted while onsite unless other arrangements are made with the Facility. Only authorized persons will be allowed past the security gate guard shack.

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1.4.2 Onsite Transportation of Wastes

All trucks transporting wastes will be stopped at the security gate prior to entering the Facility. Security personnel will record the license number, transportation company, arrival time, and other pertinent information with regard to the vehicle and driver.

After being granted access to the Facility through the security gate entrance, waste transport vehicles will be directed to the untarping/sampling area. Here, a sample of the waste will be collected for fingerprint testing, along with the shipment manifest and other pertinent documentation. While the sample is being analyzed at the chemical laboratory, the truck will be directed to the weigh scales and finally to the truck staging area. The truck will remain at the staging area until laboratory analysis verifies that the waste meets acceptance criteria and the waste characteristics are consistent with profile information from the shipment manifest.

Following determination that waste acceptance criteria have been met, the truck will be directed either to the landfill, in cases where wastes can be directly landfilled (for instance, when all LDR treatment standards are met), or to another station for staging/storage or further processing.

1.4.3 Routes

Transporters must use U.S. Highway 380 to reach the Facility. U.S. Highway 380 runs east and west between Roswell and Tatum, New Mexico as shown in Figure 1-2.

1.5 REMAINDER OF PERMIT APPLICATION

Treatment, storage, and disposal; groundwater protection; Facility design; waste analysis; procedures to prevent hazards; contingency plan; personnel training; closure; waste minimization; corrective action; and organic air emissions are discussed in the remainder of the permit application. A list of s references used for the preparation of this application is also provided.

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Prepared for:

GANDY MARLEY, INC
Post Office Box 827
1109 E. Broadway
Tatum, New Mexico 88267

OPERATIONS AND MAINTENANCE PLAN

December 1997
(Revised October 2000)

Prepared by:

MONTGOMERY WATSON MINING GROUP
1475 Pine Grove Road Suite 109
Steamboat Springs, CO 80477
(970) 879-6260

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1.0 OPERATIONS AND MAINTENANCE PLAN

1.1 GENERAL

The Triassic Park hazardous waste facility will be a full-service Resource Conservation and Recovery Act (RCRA) Subtitle C waste treatment, storage, and disposal operation. The Facility will offer the RCRA-regulated services described in the following paragraphs: treatment, storage and disposal.

Support units and structures include a chemical laboratory, administration building, weigh scale area, maintenance shop, truck wash unit, clay processing area, clay liner material stock piles, daily cover stockpiles, stormwater retention basin, stormwater diversion ditches, perimeter vadose zone monitoring wells and access roads.

This Operations and Maintenance Plan refers to the treatment, storage and disposal units, and the site run-off and drainage control system.

1.2 TREATMENT

Two treatment processes will be used at the Facility, including an evaporation pond for managing wastewaters that meet LDR standards and a stabilization process for treating liquids, sludges, and solids to ensure that no free liquids are present and that LDR standards are met prior to placing wastes in the landfill.

1.3 STORAGE

Four aboveground storage tanks will be utilized to accumulate regulated bulk liquid hazardous wastes prior to stabilization. Two container storage areas (roll-off storage area and drum handling unit) will be used to stage waste at the Facility for treatment or disposal. These container storage units will ensure that waste is stored in compliance with RCRA requirements for permitted storage. Neither of the container storage units will be used for long-term storage of waste.

1.4 LAND DISPOSAL

A landfill will be utilized for the disposal of waste that meets LDR standards.

2.0 DESCRIPTION OF UNITS AND DRAINAGE SYSTEM

2.1 LANDFILL

The Phase IA of the landfill will have an area of approximately 47 acres and will have a capacity of approximately 553,200 cubic yards of waste. This unit has been designed as a double-lined landfill with a LCRS above the primary liner and a LDRS between the primary and secondary liners. A vadose zone monitoring system has also been included as a detection system for leaking in the secondary LDRS system. Leachate that collects in the sumps of the LCRS, LDRS and vadose zone will be pumped through a pipe to the surface of the landfill where it will be collected in temporary storage tanks located on a crest riser pad at the north end of the landfill.

A run-on/run-off system is contemplated to control water volume resulting from a 24-hour, 25-year storm. Run-on originating off site will be directed around or away from the proposed landfill area using unlined ditches. Run-off in the active portion of the landfill will be collected in the bottom of the landfill and pumped out within 24 hours of a storm event. Contaminated water will be treated either in the stabilization process or the evaporation pond. Run-off from the unit, but not from the active portion of the landfill will be directed to the stormwater collection basin located at the south end of the landfill (Dwg. 10).

A daily cover consisting of soil will be spread on top of the waste placement area to limit wind dispersal. Dust generation will be reduced by restricting traffic to predetermined haul roads on the surface of the daily cover and by applying small amounts of water spray to moisten the soil surface.

Access to the landfill will be provided by two roads located on the east and west slopes. During interim filling stages, the landfill will be partially lined to the axis of the access roads (Dwg. 10). A ramp will be provided to access the stormwater collection basin.

2.2 EVAPORATION POND

The evaporation pond will have an approximate operating capacity of 5.2 million gallons over an approximate area of ~~75,240~~~~78,600~~ 78,600 square feet. The evaporation pond has been designed as a double-lined unit with a LDRS between the primary and secondary liners. A vadose zone sump has been located beneath the liner system. Pumps will be used to transfer leachate collected in the sumps to tanker trucks. Leachate will either be returned to the evaporation pond, stabilized in the on-site treatment unit, or stored in one of the liquid waste storage tanks. The truck discharge and leachate collection stations are located on the south and east side of the pond. The pond is divided in two sections by a separator berm, providing two independent treatment areas in case repairs need to be completed in one of them.

A run-on/run-off system is contemplated to control water volume resulting from a 24-hour, 25-year storm. Run-on originating off site will be directed around the proposed evaporation pond into the site wide surface water diversion channels shown in Drawing 25.
~~Run-off in the pond will be pumped out within 24 hours of a storm event with vacuum trucks. Contaminated water will be treated in the stabilization unit.~~

2.3 LIQUID WASTE STORAGE TANKS

The liquid waste receiving and storage unit will house four aboveground tanks. Each tank will have a capacity of approximately 9,000 gallons. The tanks will be double-walled and constructed of high density polyethylene. The tank system will be placed on a surrounding concrete base. The concrete

area will be sloped to provide drainage to a sump. This concrete area will provide secondary containment for all ancillary equipment.
Liquids in the storage tanks will be transferred to the stabilization unit with tanker trucks. Tanker trucks will be parked over a concrete pad while discharging or removing liquids from the tanks. All connections to the trucks will be with dry connect valves.

2.4 STABILIZATION

The stabilization unit will consist of four in-ground double lined steel stabilization bins, two dry reagent silos, two liquid reagent tanks, and a water tank. Additionally, there will be a control room from which operations will be directed and coordinated. The stabilization bins will be located inside the stabilization building.

Waste may be offloaded directly from trucks into the stabilization bins or transferred from the drum handling unit or roll-off storage area. The bins will be covered while dry reagents are being added to control particulate air emissions. The cover will be removed and a backhoe positioned adjacent to the bin will mix the waste and reagents.

The nominal dimensions of the bins will be 25 feet long by 10 feet wide by 10 feet deep. The ends of the bins will be shaped to conform to the reach profile of the backhoe selected for the mixing. The bins will be contained in a concrete vault. The bins will be double-walled tanks with the space between the walls serving as LDRS. Shock absorbing coiled wire rope isolators will maintain separation between the bins. In order to ensure no fugitive dust emissions during stabilization processing, the bins and the stabilization building will be equipped with an exhausting ventilation system which will maintain a negative pressure inside the building. Dust will be removed from the exhaust air in the bag house located on the west side of the building. Collected dust will be processed in the stabilization facility.

2.5 DRUM HANDLING

The Facility will contain seven separate containment areas (cells). Each of the areas will have its own floor drain and containment sump, allowing incompatible wastes to be placed in separate cells. Two of the cells will be designed to accommodate only TSCA PCB wastes. The TSCA cells will be surrounded by a 6-inch concrete berm. The drums will be stored in an open-sided and roofed building to prevent run-on from precipitation.

Each cell will have a concrete floor that slopes toward a trench covered by a steel grating. Each trench will lead to a separate secondary containment sum for that where any spilled liquids will be accumulated. The trench and sump system include a double HDPE geomembrane liner and leak detection and leachate removal system.

2.6 TRUCK ROLL-OFF

Roll-off containers will be stored on an open pad. The pad will be divided into two sections. One section will hold tarped, DOT approved, lined roll-off containers with non-stabilized waste awaiting treatment at the stabilization unit. The other section of the pad is intended as a staging area for roll-off containers containing stabilized waste awaiting TCLP test results and landfill disposal approval.

Secondary containment of the roll-off storage area will be provided by a geomembrane liner. The floor will be sloped to a sump located in the corner of the storage area. The entire roll-off storage area will be surrounded by a 4 to 8 feet high berm.

Roll-off containers will be inspected for free liquids prior to acceptance at the unit. Containers which are received for disposal, but are found to contain free liquids upon inspection, will be managed in accordance with stabilization procedures described in Section 2.4 of the application text. If the waste generator will not allow the Facility to prioritize handling of the load to eliminate free liquid, the load will not be admitted to the Facility. Otherwise, free liquids will be removed with a vacuum truck characterized, and managed in accordance with stabilization procedures described in Section 2.4. The volume of free liquids in the roll-off containers is expected to be minimal. Following the removal of free liquids, the waste (in the roll-off container) will either be managed through the stabilization process or landfilled, whichever is appropriate. Section 2.2.12 of the application text describes the methods that will be used to separate incompatible wastes. The area will be equipped with fire extinguishers, a telephone, alarm systems, spill control, and first aid kits.

Waste in the roll-off containers that meet the requirements for free liquids (or lack thereof) will be placed in the landfill. Other wastes in roll-off containers that do not pass the appropriate acceptance testing (i.e. paint filler test) will be transferred to the stabilization area for treatment. Upon completion of the stabilization process, the waste will once again be tested to ensure that it meets the landfill criteria.

2.7 RUN-OFF AND DRAINAGE CONTROL SYSTEM

Facility storm water control is provided by a network of surface water run-on and run-off diversion channels and collection and detention basins. A diversion channel located on the east of the Facility will provide run-on control from the east watershed area. To control the run-off from the facilities area, several collection channels and culverts will be built to divert discharges from storm events to a storm water detention basin. The location of the collection channels, culverts, and detention pond are shown on Drawing 25.

3.0 OPERATIONS

3.1 WASTE ACCEPTANCE

Prior to initiation of a shipment of waste to the Facility, the generator of the waste will provide a full characterization of its waste and receive approval from the Facility to ship the waste. The Facility will use the waste characterization data to perform the following activities:

- ensure that the waste can be accepted in accordance with the RCRA permit;
- verify that the Facility has the capability to properly treat and/or dispose of the waste;
- identify any safety precautions that must be taken to properly manage the waste;
- use the physical characteristics and chemical composition of the waste to determine the most effective treatment and disposal methods for the waste;
- select parameters to be tested to determine the formula for stabilization of appropriate wastes; and,
- select parameters to be tested upon arrival at the Facility to verify that the waste accepted is the waste characterized.

The following sections provide details of the waste acceptance procedures that will be implemented at the Facility.

3.1.1 Pre-Shipment Procedures

A. Prior to entering into an agreement to manage a waste stream for a generator, the Facility will require the generator to supply enough data to determine the physical and chemical characteristics of the waste stream as well as the EPA waste codes applicable to the waste stream.

B. The Facility will work with the waste generator to assure that all waste analyses and waste characterization information are provided to meet the applicable requirements 20 NMAC 4.1. If the data supplied are not adequate to provide a complete characterization of the waste stream, the Facility will either require additional data from the generator or will not accept the waste.

C. Before a waste stream may be accepted by the Facility for treatment, storage, or disposal, the generator must provide the following information:

C.1 A completed Waste Profile Form (EPA 530-R-94-024) or a comparable form approved by the Facility and signed by an authorized agent of the generator. The typical parameters that the generator should include in the waste stream profile are provided are discussed in Sections 4.3.3.~~in Table 4.2. The methods for characterization of these parameters are identified in Table 4.3.~~

C.2 A representative sample of the waste.

C.3 A description of the process that generated the waste.

C.4 A Land Disposal Restriction Notification.

C.5 All supporting data required by 40 CFR 268.7.

C.6 If the waste is an LDR waste that the generator has ~~been~~ treated to applicable BDAT standards, the generator must supply applicable LDR Certification specified in 40 CFR 268.7, a copy of the waste analysis plan required by 268.7, and the applicable LDR Certification and analytical data necessary to show compliance with 40 CFR 268.7.

C.7 If the waste is an LDR waste that the generator has determined meets the BDAT treatment standards without any type of secondary treatment, applicable LDR Certification and analytical data necessary to show compliance with 40 CFR 268.

C.8 Documentation that supports the information presented on the waste profile form.

D. The representative sample submitted during the pre-acceptance process will be analyzed by an independent laboratory. Each waste with reactive properties will also be tested for compatibility with the landfill and surface impoundment materials ~~containers~~. The analytical results will be compared with the generator's waste profile form, and the discrepancies will be resolved with the generator prior to approval being granted to the generator to ship the waste. Information from the waste profile form and analytical results will be compared with the Facility's permit to ensure that the waste is acceptable for storage, treatment and disposal at the Facility.

E. The Facility will conduct required/supplemental analysis according to EPA or ASTM methods on all incoming hazardous waste to further characterize the waste. Supplemental analyses will be performed on all waste suitable for direct landfilling from the generator if slight discrepancies exist between the Waste Profile Form and the shipped waste. Sampling methods are described in Section 4.5.~~4.6. Required and supplemental analyses are indicated in Tables 4.4 and 4.5, respectively.~~

F. The Facility may waive one or more of the analyses under the following conditions:

F.1 The waste is a portion of continuously shipped, well documented waste stream.

F.2 The waste has been approved for receipt by NMED on an emergency basis.

F.3 Facility personnel at the point of generation sampled, or oversaw the sampling of the waste and the required/supplemental analyses have been conducted.

F.4 A representative sample cannot be practically obtained.

F.5 Other factors are introduced which preclude the need for required/supplemental analyses.

F.6 The Facility will document the reason for the waiver of required/supplemental analyses.

G. Generators will conduct random sampling and analyses of waste streams. The procedures for selecting and sampling waste are described in Section 4.6.

3.1.2 First-Time Waste Acceptance Procedure

A. When a waste has been approved for treatment and/or disposal at the Facility, the waste may be scheduled for shipment. Twenty-four hour notice will be required from each generator prior to waste shipment. This time will enable the Facility to prepare for receipt of the waste. Such preparation will include ensuring that adequate capacity exists in the storage areas or treatment units, preparing for sample collection and fingerprint analyses, and preparing all necessary documentation on the waste shipment. If adequate capacity to receive the waste is not available, the generator will be told not to ship the waste until notified by the Facility.

B. Upon arrival at the Facility, the waste will be analyzed to determine if it matches the Waste Profile Form and representative sample (Table 4.4). If discrepancies are noted, the waste will be further analyzed using supplemental analyses methods (Table 4.5). In addition, the Facility may specify any testing that is deemed necessary to ensure that the waste is properly characterized.

C. Any waste that does not meet the waste acceptance criteria will be returned to the generator.

3.1.3 Ongoing Waste Acceptance Procedure

A. Confirmatory analyses will be performed according to Section 4.4.

~~C.~~B. The Facility will conduct random sampling and analysis of incoming hazardous waste.

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3.2 WASTE HANDLING

This section refers to the general procedures and analyses that will be performed once a waste stream has been accepted in the Facility. Specific procedures for waste handling within each unit are addressed in specific sections for each unit.

3.2.1 Incoming Load Procedures

A. When a waste shipment arrives at the Facility, the truck will be routed to a parking area outside the Facility gate while documents are reviewed. Required documentation will include a waste manifest, an LDR certification, and a copy of the Waste Profile Form (or waste profile number if the form is already on file). The paperwork will be reviewed for completeness and checked against the waste shipment to verify that the numbers of containers and waste labels match the description on the manifest.

B. If the paperwork is in order, the truck will be routed to the truck sample station, a staging area inside the Facility gate.

C. If a discrepancy is found in the paperwork, the Facility will contact the generator for resolution prior to acceptance of the load and will reject the load if the discrepancy cannot be resolved (generally in less than 24 hours). During the time the discrepancy is being resolved, the waste shipment will remain in a secure area inside the Facility gate.

D. In those instances where a discrepancy with the manifest cannot be resolved within 15 days of receiving the waste, a letter will be submitted to NMED describing the discrepancy and the attempts to reconcile it. A copy of the manifest or shipping paper at issue also will be provided to NMED, as specified in 40 CFR 264.72(b). All discrepancy resolutions will be documented in writing and maintained in the Facility operating record.

3.2.2 Ongoing Complete Waste Analysis

A. If one or more waste shipments in a calendar year from any single generator do not match the fingerprint tests, full sample analyses of each waste stream from the generator will be performed annually.

B. If all waste shipments in any given calendar year from a single generator match the fingerprint analyses, full sample analyses of each waste stream from that generator will be performed ~~biennially~~annually.

C. On an annual basis, the Facility will randomly sample and analyze a minimum of 10% of the incoming waste streams that are to be directly landfilled. The sampled will be split into a minimum of two aliquots. One will be retained and the other analyzed for conformance to the LDR requirements. If the results of the analysis indicate that the waste does not conform with the applicable LDR requirements, the Facility will immediately contact the generator and suspend the placement of that waste stream into the landfill. Disposal of the waste stream will be discontinued until the discrepancy regarding compliance with the LDR requirements has been resolved and the generator has demonstrated that its ongoing program for compliance with LDR requirements is adequate.

3.2.3 Waste Tracking

A. A Facility specific number will be assigned to each waste stream. The designated number will identify the generator, a sequential number specific to the substance and source and the delivery date.

B. The number will be recorded on: (1) all incoming paperwork from the generator; (2) samples received from the generator; (3) samples taken on site; and (4) site-generated records.

3.2.4 Compliance With Regulations for Storage, Treatment and Disposal

A. Additional analyses may be required dependent on the interim and final disposition of the waste.

B. Containers will be inspected to ensure that the integrity of the container is suitable for storage.

C. Containerized wastes that are not compatible will be segregated within the storage area. Storage procedures within each storage unit are detailed in the following sections.

D. Solid wastes that exceed 500 ppmw of volatile organics will only be stored in DOT containers approved for shipment of hazardous waste. No wastes which exceed 500 ppmw of volatile organics will be stored in the liquid waste tanks.

E. A second representative sample of any waste that will require stabilization prior to placement in the landfill will be supplied by the generator. This sample will be used for bench-scale testing to determine regulated constituent leaching based on varying admixes and ratios. The stabilization process will result in a dry and structurally stable material that is suitable for compaction and landfilling.

F. Wastes that are treated on site in the solidification unit will be tested after treatment and before disposal to verify that LDR standards have been met.

G. No wastes will be placed in the landfill until those wastes meet applicable LDR standards. All information obtained to document LDR compliance will be maintained in the Facility operating record.

H. Wastes that carry more than one characteristic or listed waste code will be treated to the most stringent treatment requirements for each hazardous waste constituent of concern prior to disposal in the landfill. When wastes with differing treatment standards are combined solely for the purpose of treatment, the most stringent treatment specified will be met for each constituent of concern in the combined waste prior to land disposal.

I. Prior to disposal, hazardous wastes contained in lab packs will be treated to meet applicable treatment standards for each waste type.

J. Reactive hazardous waste will not be placed in the landfill until is has been rendered non-reactive by treatment.

K. F001 – F005 spent solvents will not be disposed of in the landfill unless applicable treatment standards, set forth in 40 CFR 368 Subpart D, are met.

L. "California List Wastes" will not be accepted at the Facility unless they can be treated to LDR standards.

M. Unacceptable PCB contaminated wastes are defined in Section 4.1.2 of the Waste Analysis Plan.

N. The Facility will accept contaminated debris only in the cases where that debris will remain hazardous after it has been treated in accordance with 40 CFR 268.45(b) or (c).

3.3 GENERAL PROCEDURES FOR HAZARDOUS WASTE GENERATED AT THE FACILITY

A. The types of waste that might be expected to be generated at the site are discussed in Section 4.5.6.

B. During inspections of these facilities, if waste materials are identified, they will be removed from the system, characterized, and managed according to the waste analysis plan. Management of spill residues that do not require the implementation of the contingency plan will be managed in accordance with site procedures. Spills or releases that require implementation of the contingency plan will be managed in accordance with the requirements of the plan.

C. Leachate collected in the unit sumps will be pumped into tanker trucks. It will then be tested to assure compliance with LDR requirements defined in 40 CFR Part 268 for F039 listed wastes. Based on the test results, the frequency of sampling and required parameters for leachate analysis will be determined. Leachate that meets applicable LDR requirements will be placed in the evaporation pond. Leachate that does not meet applicable LDR requirements will be stabilized ~~treated~~ before landfilling.

D. Wastes will be treated at the stabilization unit prior to disposal in the landfill and may be sampled and characterized to determine an appropriate treatment mixture prior to their acceptance.

E. After wastes have been treated at the stabilization unit, they will be retested prior to placement in the landfill to determine if they meet LDR requirements. All solidified wastes will be tested for the presence of free liquids using the paint filter test and will be analyzed for other parameters determined by the characterization of the waste before solidification. For most materials, the TCLP extraction method will be performed, followed by an analysis of the leachate for the appropriate parameters (refer to EPA test method 1311, 40 CFR Part 261, Appendix II).

3.4 LANDFILL OPERATION

3.4.1 Records

A. The Facility will maintain complete records of the wastes disposed of in the landfill. The documentation will contain results of waste analyses, waste compatibility analyses and waste handling compliance. Additional documentation will register the exact location of a waste within a three-dimensional grid system. Grid spacing will be a minimum of 50 feet.

B. Records of inspections of the landfill will be maintained in an operating record kept in the administration building.

C. Preventative maintenance information will be documented and kept in the operating record in the administration building.

D. Maintenance performed on the structures and equipment part of the landfill unit will be documented in the operating record kept in the administration building.

3.4.2 Procedures for Ignitable/Reactive Wastes

A. Reactive wastes will be treated or mixed prior to placement in the landfill so that the resulting waste mixture no longer meets the definition of reactive waste.

B. Ignitable waste will be treated or mixed prior to placement in the landfill so that the resulting waste mixture no longer meets the definition of ignitable waste.

C. Reactive wastes will be separated from sources of reaction.

3.4.3 Waste Placement

A. The landfill will be accessed by means of ramps indicated in Drawing 10.

B. The active areas of the landfill will be accessed by temporary roadways that will be established on top of the waste and daily cover.

C. Incompatible wastes will be spaced at least one grid distance to prevent commingling.

D. Lab packs may be placed in the landfill only if they meet the requirements in 40 CFR 264.316. Lab packs will not be accepted if incompatible wastes are placed within the same lab pack or if reactive wastes have not been treated to render them non-reactive.

E. Bulk and containerized wastes will not be placed in the landfill unless they meet the requirements in 40 CFR 264.314.

F. Containers less than 90% full will be crushed, shredded, or otherwise reduced in volume to the maximum extent possible prior to placement in the landfill.

G. Wind dispersal will be controlled with a daily cover consisting of soil spread on top of the waste with a minimum thickness of 0.5 feet.

H. Dust generation will be reduced by applying small amounts of water spray to moisten the soil surfaces. The water will be applied with a water truck equipped with a pump, piping and an array of nozzles that spray very small water droplets. The frequency of the water application will depend on the climate and traffic. Sufficient moisture will be applied to all soil surfaces on an as needed basis to prevent wind erosion. However, the application of water will be limited so that ponding in the landfill does not occur.

I. ~~I.~~ Waste placement operations will be halted when wind speed exceeds 35 mph.

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~~I.~~J. Landfill operational staff will visually observe trucks leaving the area for excessive accumulation of waste on the tires and/or truck body. If excessive accumulation is noted, the trucks will be routed to the truck wash area for cleaning.

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3.4.4 Operation of Leachate Collection and Detection Systems

A. Pumpable liquid in the LCRS, LDRS and vadose sump will be removed in a timely manner to prevent the head on the respective liners from exceeding 12 inches above the floor liner system. The depression in the sump will be used to provide sufficient head to activate the pumps.

B. The leachate collected from the sumps will be temporarily stored in tanks.

C. Overfilling of the tanks will be controlled with high-level control switches which will automatically shut down the sump pumps. An alarm will be activated that will notify personnel that the system requires maintenance. Volume of leachate pumped will be monitored by means of cumulating flow meters. Total liquids pumped will be recorded daily.

D. The leachate collection tanks will be used as 90-day storage units and managed accordingly.

E. Once the leachate levels in the riser crest pad tanks exceed 50 percent of the holding capacity the liquids will be removed by tanker truck to the main liquid waste storage tanks.

F. A fluid level pressure transducer will be installed in the LCRS, LDRS, and vadose sump. The pressure transducer will be wired to a digital readout box located at the crest riser pad. The readout box will show the depth of leachate in the sump. The readout box will be checked during the routine inspections which are presented in Table 5-1. When the leachate level is 12 inches or greater then the pump will be activated to remove leachate from the sump. The pump will be turned off when the leachate inflow rate becomes too small for the pump to stay activated. Volumes of leachate will be recorded as previously stated in paragraph C of this section.

G. In the event of large rain storms both the side slope riser pipe pumps and the vertical riser pipe pumps will be used to minimize head. Liner systems facility staff will be available to address large rain storm events by utilizing vacuum trucks or portable pumps to remove excess leachate and contaminated runoff, if required. Vacuum trucks typically have a capacity range of 2,000 to 3,000 gallons. Portable pumps with a pumping rate in the range of 10 to 25 gpm may also be used, if needed.

3.4.5 Inspection and Monitoring

A. Inspections will be performed according to the schedule matrix indicated in Table 5-1.

B. The schedule matrix will be expanded, as necessary, to reflect new equipment or changes to existing equipment inspection frequencies.

C. The landfill and associated equipment will be inspected weekly and after storms.

D. The LCRS, LDRS and vadose sumps will be checked daily for the presence of liquid. Pressured transducers will be used to measure the presence of liquids in the sump. The elevation of the transducer will be determined during installation. The transducer elevation combined with the fluid pressure on the transducer will allow calculation of the fluid elevation at any time.

E. The leachate collection tank will be inspected according to the procedures indicated in Section 5.2.5.

F. Ancillary equipment will be inspected according to the manufacturer recommended programs.

G. Surveys of the active landfill surface area and the riser pipes with an OVM or comparable device will be performed quarterly to detect the presence of organic compounds.

H. The landfill will be inspected by properly-trained personnel for items such as spills, leaks, odors, wind-blown particulate matter, deterioration of the landfill itself, malfunction or improper operation of the run-on/run-off control systems.

I. Inspections will be documented in inspection checklists that will be kept for at least 3 years.

J. If deterioration or any other abnormalities are noted, the inspector's supervisor will be notified and will determine the appropriate course of action for correction. If the supervisor is not available, the EC will be summoned to make the determination.

K. The stormwater and contaminated water basin will be inspected to ensure that liquid has not accumulated. The collection systems will be emptied as quickly as possible to ensure that the design capacity of the system is not exceeded. Vacuum trucks will be used to empty the basins. Contaminated water that meets applicable LDR requirements will be placed in the evaporation pond. Contaminated water that does not meet applicable LDR requirements will be ~~treated~~stabilized before landfilling.

L. The sump pumping and instrumentation system will be checked annually to ensure that it is functioning properly. The pumping system will be turned on to check if the system works. If the system is not functioning properly the systems will be repaired in accordance with the manufacturers recommendations or will be replaced. If there is adequate leachate in the sump, visual observation of flow into the storage tanks will be used to determine if the system is functioning properly. If there is insufficient leachate, then audible indications that the pump has engaged will be used to determine if the pump is functioning. The pressure transducers will be extracted from the sump and placed in the solution of known depth to determine if the transducer is functioning properly.

M. If either the pumping system or transducer fail to function as designed, then the failing piece of equipment will either be replaced or fixed.

N. Determination if the Action Leakage Rate (ALR) has been exceeded in the landfill will be conducted in accordance with 40 CFR 264.302(b). This is discussed in further detail in the Action Leakage Rate and Response Action Plan report included in the engineering report.

O. The average daily flow in the LDRS sump will be calculated as follows:
- Determine volume from cummulative flows for the week
- Determine landfill area based area of landfill in service (horizontal protected area)
- Calculate average daily flow by calculating total gallons for the week/seven/area of landfill in service.

The Response Action Plan will be implemented if leaks are detected.

P. Trucks will be inspected to prevent tracking of waste out of the landfill on vehicles tires or bodies.

Q. Wind speed will be monitored using a hand-held wind meter to determine if wind speed exceeds 35 mph. Waste placement operations will be halted when wind speed exceeds 35 mph.

3.5 EVAPORATION POND OPERATION

3.5.1 Records

A. Results of waste analyses will be maintained in an operating record kept in the administration building.

B. The Facility will maintain complete records of the wastes disposed of in the evaporation pond.

C. Inspection records will be maintained in the inspection log for the evaporation pond. This log will be kept in the administration building.

D. Preventative maintenance information will be documented and kept in an operating record in the administration building.

E. Maintenance performed on the structures and equipment part of the evaporation pond will be documented in the operating record kept in the administration building.

F. The average daily flow rate to the sump system will be calculated and recorded weekly during the active life of the evaporation pond to ensure that ALR for the evaporation pond (1,000 gpd) is not exceeded.

3.5.2 Procedures for Ignitable/Reactive Wastes

A. Wastes that are ignitable, reactive, and/or incompatible will not be placed in the evaporation pond at the same time.

3.5.3 Waste Placement

A. Off site and on site waste will be analyzed according to the Waste Analysis Plan to ensure that the waste acceptance criteria specified in the RCRA permit are met and to identify any safety precautions that must be taken to properly manage the waste. Hazardous waste which may be placed in the evaporation pond includes all wastes listed in Part A of the application (Volume I), provided that LDR treatment standards are met prior to placement of the wastes. Hazardous wastes that require compliance with CFR 264, Subparts BB and CC will not be placed in the evaporation pond.

B. Approved off site waste and on site leachate tanker trucks will transport the waste to the tanker discharge pad at the evaporation pond.

C. Tanker trucks will be unloaded directly into the evaporation pond through a series of hoses, valves and pipes, as shown on Drawing 31 in Volume III.

D. The pond is separated into two independent sections by~~e~~ a separator berm. In the event that a leak should occur in one section of the pond, liquids could be pumped into the other section until repairs are completed.

E. Two feet of freeboard will be maintained in the evaporation pond at all times.

F. Sludge will be removed by vacuum trucks and treated in the stabilization unit. Sludge will be removed on a routine basis to maintain the level of waste in the pond below the maximum operational level.

G. The vacuum trucks will park on the concrete pad during sludge removal. Sludge will be removed by means of pumps and flexible hosing.

~~H.Run-off in the pond will be pumped out within 24-hours of a storm event with vacuum trucks,which have a capacity ranging from 2,000 to 3,000 gallons. Contaminated water will be disposed of in compliance with appropriate regulations.~~

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~~I.~~H. Site personnel will be present during all fluid discharge and transfer operations to ensure that pond overtopping does not occur in the event of equipment malfunction or other human error.

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3.5.4 Operation of Leachate Detection and Vadose Zone Monitoring Systems

A. Pumps located in the LDRS pipe and vadose zone sump will be used to remove leachate accumulating in the leachate collection systems. When leachate accumulates it will be pumped to a tanker truck and either returned to the evaporation pond, stabilized in the onsite treatment unit, or stored in one of the liquid waste storage tanks. Any time liquids are detected at a specified level, the sump pump will be activated and the liquid will be removed. The pump activation level will be related to the pump selected.

B. All pumpable liquids in the sumps will be removed in a timely manner to maintain the head on the bottom liner below 12 inches above the floor liner. The depression in the sump will be used to provide sufficient head to activate the pumps.

C. The volume of liquids removed from the sumps will be recorded in cumulating flow meters. Total liquids pumped will be recorded after each pumping event.

3.5.5 Inspection and Monitoring

A. Inspections will be performed according to the schedule matrix indicated in Table 5-1.

B. The freeboard level will be inspected daily to ensure that approved or acceptable freeboard levels are maintained and that overtopping does not occur. Liquid elevations will be checked by visual observation against the staff-gauges. The staff gauges will consist of a rod made of relatively inert material which will be labeled in feet and marked every tenth of a foot. In order to prevent overtopping, the maximum liquid level allowed to maintain the minimum freeboard level will be marked on the staff-gauge or noted on the inspection checklists. The bottom of the staff gauge will be fixed to a heavy base that will sit on the pond bottom. It is not anticipated that the staff gauge will require maintenance or repair, the pond level could be lowered or a boat could be used to access the staff gauge. The data will be recorded on standard forms and filed with the operating records.

C. Elevation rods, survey monuments, staff gauges, flow meters and fluid level transducers will be used to measure and record liquid handling volumes.

D. Flow meters will be used to record volumes of liquids discharged into the pond and removed from the sumps. Transducers located in the sumps will provide a liquid level reading in the sumps. The elevation of the transducers will be determined during installation. The transducer elevation combined with the fluid pressure above the transducer will allow calculation of the fluid elevation at any time.

E. Inspections will occur on a weekly basis and after storms to detect evidence of deterioration, malfunction, improper operation of overtopping control systems (portable pump) or sudden drops in liquid levels in the pond.

E1.The overtopping control system (portable pump) will be started during the course of routine inspection. If the pump does not function as designed, the pump will be replaced or fixed. Pump operation inspection will be completed by visual inspection.

E2.Sudden drops in liquid levels will be determined using a staff gauge system discussed in paragraph B in conjunction with criteria outlined in paragraph F of this section. The liquid level will be compared to the previous liquid level reading and adjusted for estimated evaporation loss and documented liquid addition and removal to determine whether an unexplained drop in the liquid level has occurred.

F. If liquid losses exceed daily evaporation losses and no other reasonable explanation is found, then that section of the pond will be shut down and authorities at the NMED will be notified immediately.

G. Weekly visual inspections will be conducted to verify the integrity of the liners and associated systems. Visible portions of the leachate collection pipes and pump will be visually inspected for deterioration.

H. The concrete pad for tanker discharge will be visually inspected weekly for accumulation of liquids.

I. The area around the pond will be inspected weekly for any signs of deterioration, leaks or erosion. The evaporation pond berm will be inspected for any sign of abnormal deterioration, which may include excessive sloughing or the development of significant cracks.

3.6 LIQUID WASTE STORAGE OPERATION

3.6.1 Records

A. The results of each daily inspection will be documented in a daily operating record.

B. The quantity of waste received and the date each period of accumulation begins will be documented for each tank.

C. Inspection records will be maintained in the Facility operating record, which will be kept in the administration building.

D. Maintenance performed on the structures and equipment part of the storage tank unit will be documented in the operating record kept in the administration building.

3.6.2 Procedures for Ignitable/Reactive Wastes

A. Only the waste types approved for a tank system will be placed in the tanks. No new waste types will be placed into an existing tank system unless:

A.1 The compatibility of the new waste type with the prior contents of the tank is determined by testing or documentation.

A.2 The existing tank system is cleaned or flushed to the extent necessary to ensure compatibility with the new waste type.

B. Ignitable or reactive wastes will not be placed into any tank system unless the tank system is protected from sources of ignition be measures including but not limited to the following: signs prohibiting smoking, open flames or welding; an inert atmosphere blanket; enclosed vents isolated from sources of ignition.

3.6.3 Waste Placement and Storage

A. Each storage tank will be clearly marked with a description of the contents and records will be kept documenting the quantity of waste received, and the date each period of accumulation begins.

B. Only the waste types approved for a tank system will be placed in the tanks. No new waste types will be placed into an existing tank system unless:

B.1 The compatibility of the new waste type with the prior contents of the tank is determined by testing or documentation.

B.2 The existing tank system will be cleaned or flushed to the extent necessary to ensure compatibility with the new waste type.

C. The tanks will be operated at ambient pressure and temperature when storing liquids. One of the following feed mechanisms for tank systems or an equivalent transfer mechanism will be used.

C.1 Pump transfer: liquids will be pumped into or out of the tank through permanent or temporary transfer lines.

C.2 Gravity drain: liquids will be allowed to drain by gravity through permanent or temporary transfer lines.

D. Appropriate controls and practices will be used to prevent spills from and overfills of the tank or containment systems.

E. Spill prevention will be primarily maintained by hard-plumbed piping. When transfer lines are not hard plumbed or when open-ended lines are used, one or more of the following spill prevention controls or an equivalent device will be used as described in Section 2.3.3.

F. Response to releases from tank systems will be initiated immediately upon discovery, and regulations specified in 20 NMAC 4.1 Subpart V, 40 CFR 264.196(d) or 40 CFR 264.56 will be followed as appropriate (see Section 5.0), including notification to the Hazardous and Radioactive Materials Bureau (HRMB) of the New Mexico Environment Department (NMED) and National Response Center (NRC). The secondary containment tank will be emptied by pumping fluids from the drainage port located near the base of the tank or by use of a vacuum truck.

G. Transfer of liquids from the liquid waste storage tanks to the stabilization unit will be accomplished by tanker trucks approved for liquid waste transfer. Tanker trucks will be cleaned following a transfer operation to ensure that subsequent transfers do not result in mixing of incompatible or reactive wastes.

H. The contingency plan for leaks or spills is indicated in Section 6.3.5.2.

3.6.4 Inspection and Monitoring

A. The floor and berm of the concrete area will be inspected regularly for gaps and cracks.

B. Daily visual inspection will be used to detect releases to the secondary containment.

C. Inspections will be performed according to the schedule matrix indicated in Table 5-1. Inspections will focus on: (1) overfill control; (2) equipment condition to detect signs of corrosion or releases of waste from the tanks or ancillary equipment; and (3) data gathered from monitoring and leak detection equipment. A typical inspection checklist is provided in Appendix I in Volume II.

D. Ancillary equipment, monitoring and leak detection systems will be inspected daily.

3.7 OPERATION OF STABILIZATION UNIT

3.7.1 Records

A. Inspection records will be maintained in the administration building. The results of each daily inspection will be documented in a daily operating record.

B. Maintenance performed on the structures and equipment part of the stabilization unit will be documented in the operating record kept in the administration building.

3.7.2 Procedures for Ignitable/Reactive Wastes

A. Prior to treating wastes, waste characteristics will be analyzed to ensure that proper measures can be taken to safely manage ignitable, reactive, and incompatible wastes.

B. If ignitable or reactive wastes are placed in the bins, they will be immediately mixed with sufficient quantities of fly ash and/or cement to render them non-ignitable or non-reactive.

3.7.3 Waste Placement and Treatment

A. Operations in the stabilization building will be directed and coordinated from the control room.

B. As indicated in Section 4.0, wastes will be tested prior to stabilization to determine the appropriate reagent formula.

C. Wastes may be offloaded directly from trucks into the stabilization bins or transferred from the drum handling unit or roll-off storage area. Waste receiving will involve positioning the loaded waste hauler at the end of the bin, dumping the waste load, and washing out any residue left in the truck bed into the bin.

D. The bins will be covered while dry reagents are being added to control particulate air emissions. Reagent addition involves placing a cover on top of the bin, connecting ventilation and dry reagent delivery ducts, and injecting reagents into the bin. Reagent delivery to the bins will be controlled by a process controller system which will automatically sequence and deliver the necessary quantities of reagent based on a predetermined waste processing recipe.

E. A backhoe positioned adjacent to the bin will mix the waste and reagents.

F. Following mixing, the waste will be sampled and a paint filter test will be conducted to ensure that no free liquids are present. If necessary, samples will be gathered for toxicity characteristic leachate procedure (TCLP) testing. If the paint filter test is passed, the backhoe will load the stabilized waste into a waste hauler (roll-off truck) and the trucks roll-off cover will be positioned over the waste. The stabilized waste will be stored temporarily at the roll-off unit while tests are completed to determine how and if the material can be disposed of in the landfill.

G. Wastes that are treated on site in the solidification unit will be tested after treatment and before disposal to verify that LDR standards have been met.

H. The backhoe bucket and stabilization bin will be thoroughly cleaned before a load of waste which is not compatible with the waste previously stabilized in that bin is mixed. After the last bin load of a specific stabilization mixture has been loaded out, Facility personnel will use a high-pressure water hose located near the bins to rinse the backhoe bucket and the bin walls. The rinsing will cause residual clods of stabilized waste to fall to the bottom of the bin along with the rinse water. Reagents will then be added to the bin at the same mixture proportions and the remaining waste and rinse water will be stabilized, tested for free liquid, and loaded out before a different waste stabilization mixture is processed in that bin.

I. Releases into the LDRS will be detected within 24 hours by liquid sensing instruments or inspection. Accumulated liquids will be removed within 24 hours of detection. The secondary containment will be emptied by pumping accumulated liquids into a temporary storage tank or into another stabilization bin by portable pumps.

J. In case a breach should occur in a bin, such bin will be removed from service and repaired.

K. Spill and overfill prevention will be accomplished by continuous direct monitoring of transfer operations.

L. The stabilization bins will be operated at ambient temperature and pressure.

M. Reagents will either be pumped from reagent tanks or manually fed.

N. Liquid hazardous wastes will be pumped from vacuum or tanker trucks. Other wastes may be manually transferred from the incoming waste hauler truck or from the container storage areas.

O. The contingency plan for leaks or spills is indicated in Section 6.3.5.2.

P. Dust will be removed from the exhaust air in the bag house. Collected dust will be processed in the stabilization bins.

3.7.4 Inspection and Monitoring

A. Inspections will be performed according to the schedule matrix indicated in Table 5-1.

B. Each stabilization bin will be visually inspected once each operating day.

C. The concrete vault area of the stabilization unit will be inspected monthly. If liquids are found they will be removed with a portable pump and transported to the liquid waste storage unit.

D. At least once per month, the daily visual inspection will be conducted on empty bins to ensure integrity of the bins and welds.

E. An annual sonic test will be conducted to ensure the thickness of the inner tank and outer shell is maintained.

F. Ancillary equipment and monitoring systems will be inspected once each operation day.

3.8 DRUM HANDLING OPERATION

3.8.1 Records

A. Records of inspections of the drum handling unit will be maintained in an operating record kept in the administration building.

B. The results of all container storage analyses, trial tests, waste compatibility analyses, and ignitable and reactive waste handling documentation pertaining to compliance will be maintained in the Facility operating record.

C. Maintenance performed on the structures and equipment part of the drum handling unit will be documented in the operating record kept in the administration building.

3.8.2 Procedures for Ignitable/Reactive Wastes

A. Ignitable or reactive wastes will be protected from any sources of ignition or reaction.

B. If ignitable wastes are handled, special precautions will be instituted, including the use of special non-sparking bung wrenches or other tools for opening drums.

3.8.3 Waste Placement and Storage

A. All containers being stored will be clearly marked with hazardous waste labels which will be clearly visible while containers are being stored.

B. All containers will remain closed during storage except when they are sampled.

C. Handling procedures will be developed to ensure that containers are not opened, handled, or stored in a manner that may cause them to rupture or leak.

D. Wastes stored will be placed in individual storage cells segregated by waste type and compatibility. Labels will be added to each section of the unit to identify the type of waste to be stored.

E. Two of the cells will be designed to accommodate only TSCA PCB wastes.

F. Containers will be managed according to the conditions indicated in Section 2.2.10.

G. Aisle spacing will be maintained to assure inspectability and accessibility for operational and emergency equipment to containers. A minimum 30-inch aisle space will be maintained between double rows of containers. Containers will be stored in single rows only if they are against a wall or other barrier that prohibits inspection from all sides.

3.8.4 Operation of Leachate Collection and Detection Systems

A. Liquids present in the LCRS and LDRS sumps will be sampled and analyzed to determine the nature and concentration of waste constituents. An appropriate treatment and disposal method will be selected in accordance with Section 4.0.

B. Pumpable quantities of liquids will be removed with a vacuum truck.

C. Leaks and spills will be removed from the sumps in a timely manner.

3.8.5 Inspection and Monitoring

A. Inspections will be performed according to the schedule matrix indicated in Table 5-1.

B. The floor will be inspected regularly to determine if any gaps or cracks have developed or if the epoxy coating has been damaged.

C. The leachate collection and removal system (LCRS) and leak detection and removal system (LDRS) sumps will be checked regularly for the presence of liquid.

D. Drum storage areas will be visually inspected at least once a week for leaking containers and deterioration of the containers and containment area. If a container is found to be in poor condition, the inspector's supervisor will be notified, who will arrange to transfer the hazardous waste to a new container, repair the existing container as specified by the manufacturer, or place the container in an overpack drum.

E. Containers with more than 500 ppmw volatile organic compounds will be inspected at least once a month for cracks, holes or gaps in the container, cover or closure devices. Defects detected will be repaired according to 40 CFR 264.1086(c)(4)(iii) and 40 CFR 264.1086(d)(4)(iii), for container Levels 1 and 2, respectively.~~.~~

F. Weekly visual inspections will be performed to identify the status of warning signs, condition of containers and labels, availability and accessibility of spill control and PPE, and the adequacy of aisle space and access/egress routes.

G. Secondary containment areas will be inspected weekly. Inspections will focus on (1) the condition of the sump pits and trenches to ensure that they are free of cracks or gaps and are sufficiently impervious to contain leaks, spills, and accumulated liquids until the collected material is detected and removed; and, (2) pump operation.

H. Ancillary equipment will be inspected according to manufacturer recommended programs.

3.9 OPERATION OF TRUCK ROLL-OFF UNIT

3.9.1 Records

A. Results of container waste analyses, trial tests, waste compatibility analyses, and ignitable and reactive waste handling documentation pertaining to compliance will be maintained in the Facility operating record.

B. Records of inspections of the roll-off storage unit will be maintained in an operating record kept in the administration building.

C. Maintenance performed on the structures and equipment part of the roll-off storage unit will be documented in the operating record kept in the administration building.

3.9.2 Procedures for Ignitable/Reactive Wastes

A. Ignitable or reactive wastes will be protected from any sources of ignition or reaction.

3.9.3 Waste Placement and Storage

A. Containers being stored will be ~~will be~~ clearly marked with hazardous waste labels which identify the contents of each container as well as the date of receipt (accumulation date). All labels will be clearly visible while containers are being stored.

B. All containers will remain closed during storage, except when waste is removed or added.

C. Containers will be managed according to the conditions indicated in Section 2.2.10.

D. Container storage and handling procedures will be developed to ensure that containers are not opened, handled, or stored in a manner that cause them to rupture or leak.

E. The unit is divided in two sections. One section will hold tarped, U.S. Department of Transportation (DOT) approved, lined, roll-off containers with non-stabilized waste awaiting treatment. The other section will be a staging area for roll-off containers containing stabilized waste TCLP test results and landfill disposal approval.

F. Waste will be characterized and screened as part of the waste acceptance procedures. This will confirm that no free liquids are present in the roll-off units. If liquids are found they will be pumped and removed. In addition, this procedure will prevent incompatible wastes from being stored in the same roll-off containers that are delivered to the site.

G. Materials from a single stabilization batch will not be mixed with material from a different batch.

H. Hazardous waste will be compatible with the container or liner as defined by the following conditions:

H.1 All containers used to store hazardous waste will be made of, or lined with, material that will not react with, or otherwise be incompatible with, the waste being stored so that the ability of the container to hold waste is not impaired.

H.2 Hazardous waste will not be placed in an unwashed container that has previously held incompatible waste or material.

~~I. Individual bins will be physically separated from each other by a minimum of 1 foot and will be stored inside the covered steel roll-off bins and the HDPE bed liners.~~

~~J.~~I. Incompatible solid wastes stored within the container storage areas will be separated by a distance of at least 10 feet unless separated by a berm.

~~K.~~J. Roll-off containers will be spaced 4 feet apart side to side, 2.~~-~~5 ft. end to end and 4 feet from the edge of the berm. Roll-off containers will not be placed within the storage area inundated

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by the 25 year, 24 hour storm. The inundation limits for the 25 year, 24 hour storm will be marked in the storage area.

~~L.~~K. Operational staff will visually observe trucks leaving the area for excessive accumulation of waste on the tires and/or truck body. If excessive accumulation is noted, the truck will be routed to the truck wash for cleaning.

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~~M.~~L. Roll-off containers will be covered before exiting the stabilization unit and will remain covered while they are staged in the roll-off storage area.

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~~N.~~M. Free liquids found upon inspection of ~~C~~containers ~~which are~~ received for disposal~~, but are found to contain free liquids upon inspection, free liquids~~ will be removed with a vacuum truck, characterized and managed in accordance with stabilization procedures.

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~~O.~~N. Liquids collected on the surface of the sump or in the sump drainage gravel will be removed by vacuum truck.

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~~P.~~O. Samples of sump liquids will be chemically analyzed to determine the presence and concentration of any waste constituent. After this determination, an appropriate method of treatment or disposal will be selected in accordance with the criteria prescribed in the Waste Analysis Plan (Section 4.0).

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~~Q.~~P. Leaks, spills and precipitation will be removed from the sump as soon as possible.

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~~R.~~Q. In the case of a leak, the liquids in the roll-off container will be stabilized and the stained soil will be excavated and handled as a potential hazardous waste.

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3.9.4 Inspection and Monitoring

A. Inspections will be performed according to the schedule matrix indicated in Table 5-1.

D. Container storage areas will be visually inspected at least once a week for leaking containers and deterioration of the containers and containment area. All inspection information will be recorded and any problems noted during the inspection will be resolved in a timely manner.

E. Identified leaks will be resolved as described in Section 2.2.10.

F. Containers with more than 500 ppmw volatile organic compounds will be inspected at least once a month for cracks, holes or gaps in the container, cover or closure devices. Defects detected will be repaired according to 40 CFR 264.1086(c)(4)(iii) and 40 CFR 264.1086(d)(4)(iii), for container levels 1 and 2, respectively~~.~~

G. Weekly visual inspections will be performed to identify the status of warning signs, condition of containers and labels, availability and accessibility of spill control and PPE, and the adequacy of aisle space and access/egress routes.

4.0 MAINTENANCE

4.1 LANDFILL

A. The landfill structure will be maintained through a routine preventative maintenance program which will be fully defined in the final operations plan.

B. Preventative maintenance will involve regular visual inspections of the landfill liner where feasible and review of leachate collection and analysis results.

C. Defects detected in the liner systems will be repaired according to the procedures indicated in the Construction Specifications: Sections 02710, 02775 and 02780. Soil surfaces that need to be repaired will be removed and placed according to the Construction Specifications: Sections 02226 and 02119.

D. The LCRS and LDRS equipment, such as pumps, transducers, generators, electrical lighting, and warning systems, will be subject to manufacturer's or standard preventative maintenance procedures.

E. Preventive maintenance information will be documented and any deviation from normal conditions will be closely tracked and corrected as necessary.

F. Landfill run-on/runoff control systems will be maintained/repaired after regular inspections (as described in Table 5-1) that determine that the design criteria are not met. Once a deficiency in the run-on/runoff control system is noted, it will be repaired in a timely manner to a state such that it meets or exceeds design criteria.

4.2 EVAPORATION POND

A. If a section of the evaporation pond must be removed from service, flow of waste to that section will be stopped by draining the pond to below the level of the leak, surface leakage will be contained, and all necessary steps will be taken to repair the liner system and prevent future failure.

B. Preventative maintenance will involve regular visual inspections of the evaporation pond liner where feasible and review of leachate collection analysis results.

C. Defects detected in the liner systems will be repaired according to the procedures indicated in the Construction Specifications~~:~~. Soil surfaces that need to be repaired will be removed and placed according to the Construction Specifications:

D. The LDRS equipment, such as pumps, generators, electrical lighting, transducers and warning systems, will be subject to manufacturer's or standard preventative procedures.

E. ~~Landfill~~ Evaporation pond run-on/runoff control systems will be maintained/repaired after regular inspections (as described in Table 5-1) that determine that the design criteria are not met. Once a deficiency in the run-on/runoff control system is noted, it will be repaired in a timely manner to a state such that it meets or exceeds design criteria.

4.3 LIQUID WASTE STORAGE

A. Should gaps or cracks develop in the concrete, repairs will be scheduled immediately. The nature of the repair will depend on the extent of the cracking and could range from the application of chemically resistant epoxy fillers or coatings to the replacement of portions of the concrete floor.

B. If a release occurs from the primary tank system, the tank will be removed from service immediately. Wastes in the tank will be removed within 24 hours to the extent necessary to prevent further release and allow inspection and repair of the tank system. All released materials will be removed from the secondary containment as soon as possible and within 24 hours of detection.

C. The tank system will be repaired or replaced prior to returning it to service. An independent New Mexico registered professional engineer will certify major repairs. The certification will be submitted to the NMED within seven days after the tank system is returned to service.

D. Tanks, pumps, generators, electrical lighting and warning systems will be maintained according to manufacturers recommended programs.

4.4 STABILIZATION UNIT

A. If a release occurs from a primary tank system, the tank will be removed from service and all materials will be removed from the tank or secondary containment within 24 hours or as soon as reasonably possible. The tank system will be repaired prior to return to service. Major repairs will be certified by an independent New Mexico registered professional engineer. The certification will be submitted to the NMED within seven days after the tank system is returned to service.

B. Equipment such as pumps, generators, electrical lighting, and warning systems, will be subject to manufacturer recommended maintenance programs.

C. The stabilization unit run-on/run-off will be maintained/repaired after regular inspections (as described in Table 5-1) that determine that the design criteria are not met. Once a deficiency in the run-on/runoff control system is noted, it will be repaired in a timely manner to a state such that it meets or exceeds design criteria.

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4.5 DRUM HANDLING UNIT

A. Should cracks or gaps develop in the concrete, repairs will be scheduled immediately. The nature of the repair will depend on the extent of the cracking and could range from the application of chemically resistant epoxy fillers or coatings to the replacement of portions of the concrete floor.

B. Equipment such as pumps, generators, electrical lighting, and warning systems, will be subject to manufacturer recommended maintenance programs.

C. The drum handling unit run-on/run-off will be maintained/repaired after regular inspections (as described in Table 5-1) that determine that the design criteria are not met. Once a deficiency in the run-on/runoff control system is noted, it will be repaired in a timely manner to a state such that it meets or exceeds design criteria.

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4.6 ROLL-OFF CONTAINER STORAGE UNIT

A. Equipment such as pumps, generators, electrical lighting, and warning systems, will be subject to manufacturer recommended maintenance programs.

B. The roll-off container storage unit run-on/run-off will be maintained/repaired after regular inspections (as described in Table 5-1) that determine that the design criteria are not met. Once a deficiency in the run-on/runoff control system is noted, it will be repaired in a timely manner to a state such that it meets or exceeds design criteria.

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4.7 DRAINAGE DITCH

A. Drainage ditches will be inspected weekly ~~monthly~~ and immediately after a major storm event.

B. Excess debris that prevents flow in accordance with the design specifications will be removed manually or with a backhoe.

~~B.~~C. Drainage ditches will be maintained/repaired after regular inspections (as described in Table 5-1) that determine that the design criteria are not met. Once a deficiency in the run-on/runoff control system is noted, it will be repaired in a timely manner to a state such that it meets or exceeds design criteria.

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INSPECTION CHECKLIST – OPERATIONAL DAYS

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Inspections shall be conducted once every operational day (except as noted). An operational day is defined as a day in which waste management activities occur at the site. For purposes of this definition, laboratory operations do not constitute an operational day.

The recording of liquid level readings for Leak Detection Systems, Leachate Collection Systems, collection tanks and freeboard shall be maintained in Facility log books. Only the indication of a problem for each system shall be noted and recorded on the inspection checklist.

Inspectors are required to date, record the time of the inspection and sign their names on the Inspection Checklist that they complete. All items shall be responded to by indicating that an item is either a problem or is not a problem. If a problem is observed, a description of the problem will be recorded. If an item is not inspected, the Inspector shall respond by writing "NI" in the Problem column with an explanation of why it was not inspected. In the event the Inspector cannot complete a checklist, the new Inspector shall continue with the same inspection and shall date and sign his/her name to that checklist.

An Inspection Corrective Action Report, which will include the date and time of repairs and remedial actions taken shall be initiated and distributed by the Inspector. The remediator will retain the original copy until the item has been corrected. A second copy will be given to management and the third copy will remain with the Inspector. The signed original will then be filed with the originating checklist upon completion.

INSPECTION CORRECTIVE ACTION REPORT

CURRENT ITEMS	NEW ITEMS	CORRECTED ITEMS	COMMENTS~~ PAGES~~
1	1	1	Reference Corrective Action Report, (Title and Date) for any corrections.
2	2	2	
3	3	3	
4	4	4	
Reviewed by Manager of Environmental Affairs and Regulatory Compliance:			***Date:***

PRECIPITATION AND WIND READINGS

1. **Precipitation**

Date and time recorded:__________________

Amount and type since last daily inspection to the nearest .1 inch:________________

Gauge working: Yes____ No____

2. **Wind Readings**

Date and time recorded:__________________

Wind Direction:_________________

Wind speed in mph:__________________

Recorder working: Yes____ No____

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____

Date of Inspection: ____

GENERAL SITE

1. **Drainage Ditches**
   Date and time inspected:____________________

Ditches Checked	**~~If, Yes~~ Description and ~~Ditch No.~~General Condition**
1 ______________	______________________________
2~~–~~ ______________	______________________________
3~~–~~ ______________	______________________________
4~~–~~ ______________	______________________________
5~~–~~ ______________	______________________________
6~~–~~ ______________	______________________________
7 ______________	______________________________

Inspection Item	**Problem Yes No**	**If, Yes Description and Ditch No.**
Erosion	___ ___	______________________________
Obstructions	___ ___	______________________________
Overflow or Imminent overflow	___ ___	______________________________
Runoff Present	___ ___	______________________________
Windblown Debris	___ ___	______________________________
Spill Present	___ ___	______________________________

2. **Security Fencing and Gates**
   Date and time inspected:___________________

a. Any unauthorized entry. noted:	___ ___	______________________________
b. Repairs required	___ ___	______________________________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ______________________________

Date of Inspection: ______________________________

~~3. General Inspection for Spill or Ponding (Weekly)~~

Inspection Item	Problem Yes No	If, Yes Description
~~4~~3. **Sampling Station**		
Time Inspected: ____________		
a. Spills, Leaks or unauthorized discharges	___ ___	____________
b. Obstructions in floor collection trenches	___ ___	____________
c. Spills or Ponding		
• On roadways	___ ___	____________
• On access ramps	___ ___	____________
• On loading and Unloading areas	___ ___	____________

~~If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.~~

~~Inspector's Signature: ____________~~

~~Date of Inspection: ____________~~

~~5~~4. **Tanker and Truck Parking Area**

Date and time Inspected:____________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____________

Date of Inspection: ____________

Problem Inspection Item		Yes No	If, Yes Description
a.	Entry areas:		
	• Deterioration	___ ___	______________________________
	• Cracking	___ ___	______________________________
	• Corrosion	___ ___	______________________________
b.	Spills or Ponding		
	• On roadways	___ ___	______________________________
	• On access ramps	___ ___	______________________________
	• On loading and Unloading areas	___ ___	______________________________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ______________________________

Date of Inspection: ______________________________

HAZARDOUS WASTE MANAGEMENT UNITS

1. Drum Handling Unit (Weekly)

Date and time inspected:________________

Inspection Item	Problem Yes No	If, Yes Description
a. Drums:		
• Leaks	___ ___	___
• Corrosion	___ ___	___
• Deterioration	___ ___	___
• Incompatibility with content.	___ ___	___
b. Open containers:		
• Leaks	___ ___	___
• Corrosion	___ ___	___
• Deterioration	___ ___	___
• Incompatibility with content.	___ ___	___
~~• content.~~	~~___ ___~~	~~___~~
• Rows more than 2 drums wide.	___ ___	___
~~• drums wide~~	~~___ ___~~	~~___~~
• Lack of pallets for stacked drums.	___ ___	___
~~• stacked drums~~	~~___ ___~~	~~___~~
• Aisle space less than 2 feet.	___ ___	___
~~• Less than 12' from~~		

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If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____________________

Date of Inspection: ____________________

Inspection Item		Problem Yes No	If, Yes Description
c.	Compatibility group designation not visible on drums.	___ ___	___
b.	Spills or Ponding		
	• On roadways	___ ___	___
	• On access ramps	___ ___	___
	• On loading and Unloading areas	___ ___	___
~~d.~~c.	Presence of liquids or solids in:		
	• Spill containment trenches	___ ___	___
	• Sump System 1	___ ___	___
	• Sump System 2	___ ___	___
	• Sump System 3	___ ___	___
	• Sump System 4	___ ___	___
	• Sump System 5	___ ___	___
	• Sump System 6	___ ___	___
	• Sump System 7	___ ___	___
~~e~~f.	Incompatible waste in same segregation area.	___ ___	___
~~f.~~g.	Unreadable or no signs posting PPE requirements at entry doors.	___ ___	___

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ______________________________

Date of Inspection: ______________________________

h. Does waste contain VO concentrations greater then 500 ppmw? ___ ___ If yes, see inspection forms for Volatile organic waste.

i. No cracks on concrete floor and epoxy coating not damaged. ____________________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____________________

Date of Inspection: ____________________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____

Date of Inspection: ____

1A. DRUM HANDLING UNIT (VOLATILE ORGANIC WASTES) (WEEKLY)

Date and time inspected:__________________

Inspection Item	Problem Yes No	If, Yes Description
a. ~~Determine volume~~Cover and closure devices such as lids, bungs, caps etc. are secure	___ ___	If coverage closure device is not properly secured, then secure, repair or replace. If volume is less then 0.1 m3, no additional inspection required. If volume is between 0.1 m3 and 0.46 m3, then confirm requirements for air monitoring for level 1 containers (40 CFR 264.1086) If volume is greater then 0.46 m3, then confirm requirements for air monitoring for level 1 or level 2 containers, depending on container type (40CFt264.1086)

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____

Date of Inspection: ____

2. Roll-Off Storage Unit – Non-Stabilized (Weekly)

Date and time inspected:__________________

Inspection Item	Problem Yes No	If, Yes Description
a. Containers:		
• Spills	___ ___	____
• Corrosion which affects structural integrity or containment capability	___ ___	____
• Deterioration	___ ___	____
• Incompatibility with contents	___ ___	____
b. Open containers at time of inspection while not involved in sampling	___ ___	____
c. Compatibility group designation not visible on containers	___ ___	____

Inspection Item	Problem Yes No	If, Yes Description
d. Incompatible waste in same segregation area.	___ ___	____

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____

Date of Inspection: ____

e. Spills or Ponding
- On roadways ___ ___ ________________________________
- On access ramps ___ ___ ________________________________
- On loading and Unloading areas ___ ___ ________________________________

f. Presence of liquids in sump. ___ ___ ________________________________

g. Roll-off units within exclusion zone for storm water storage. ___ ___ ________________________________

h. Deterioration or leaks in containment berms. ___ ___ ________________________________

i. Columns less than 4 feet wide, rows less than 2.5 feet wide. ___ ___ ________________________________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ________________________________

Date of Inspection: ________________________________

Roll Off Unit Stabilized (Weekly)

Date and time inspected:__________________

a. Containers:

- Spills ___ ___ ______________________________
- Corrosion which affects structural integrity or containment capability ___ ___ ______________________________
- Deterioration ___ ___ ______________________________
- Incompatibility with contents ___ ___ ______________________________

b. Open containers at time of inspection while not involved in sampling. ___ ___ ______________________________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ______________________________

Date of Inspection: ______________________________

Inspection Item		Problem Yes No	If, Yes Description
c.	Compatibility group designation on containers.	___ ___	______________________________
d.	Incompatible waste in same segregation area.	___ ___	______________________________
e.	Spills or Ponding		
	On roadways	___ ___	______________________________
	On access ramps	___ ___	______________________________
	On loading and Unloading areas	___ ___	______________________________
f.	Presence of liquids in sumps.	___ ___	______________________________
g.	Roll-Off units within exclusion zone for storm water storage.	___ ___	______________________________
h.	Deterioration or leaks in containment berms.	___ ___	______________________________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ______________________________

Date of Inspection: ______________________________

3. Liquid Waste Receiving and Storage Unit (Daily)[1]

Date and time inspected:_______________

Inspection Item	Problem Yes No	If, Yes Description
a. Leaks or spills in area surrounding tanks		
Tank #1	___ ___	________________________________
Tank #2	___ ___	________________________________
b. Evidence of excessive corrosion		
Tank #1	___ ___	________________________________
Tank #2	___ ___	________________________________
c. Leaks in above grade piping, hoses, valves and pumps	___ ___	________________________________
d. Readings compared with operating log		
Tank #1	___ ___	________________________________
Tank #2	___ ___	________________________________
e. Proper operation: of tank vents of level indicators		
Tank #1	___ ___	________________________________
Tank #2	___ ___	________________________________

[1] Leak Test on Ancillary Equipment is Required Annually.

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ________________________________

Date of Inspection: ________________________________

f. Liquids in concrete basin. ___ ___ ____

g. Liquid in secondary containment. ___ ___ ____

h. Spills or Ponding
- On roadways ___ ___ ____
- On access ramps ___ ___ ____
- On loading and Unloading areas ___ ___ ____

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____

Date of Inspection: ______________________________________

4. **Stabilization Unit (Daily)**

Date and time inspected:__________________

Inspection Item		**Problem** **Yes No**	**If, Yes Description**
a.	Presence of unknown materials, fume or gas-producing reactions or excessive dust generation.	___ ___	____
b.	Posted sign to the Stabilized Unit that denotes the protection level are unreadable or missing.	___ ___	____
c.	Spills or ponding on process area floor.	___ ___	____
d.	Treatment Mixing Basin has a freeboard less than 2 feet.	___ ___	____

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____

Date of Inspection: ____

Inspection Item	Problem Yes No	If, Yes Description
e. Dust Suppression System:		
• Worn hoses or pipes	___ ___	______________________
• Loose fitting	___ ___	______________________
• Hydraulic leaks	___ ___	______________________
f. Mechanical Mixing System:		
• Worn hoses or pipes	___ ___	______________________
• Loose fittings	___ ___	______________________
• Hydraulic leaks	___ ___	______________________
• Conveyor belts not operating properly	___ ___	______________________
• Electric cutoff not functioning	___ ___	______________________
g. Steel Bins		
• Cracks or dents	___ ___	______________________
• Punctures	___ ___	______________________
• Excessive wear	___ ___	______________________
h. Fluids in leak detection system	___ ___	______________________
e. Damages to surface within concrete vault. system.	___ ___	______________________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ______________________

Date of Inspection: ______________________

Stabilization Unit (Monthly)

Date and time inspected:___________________

Inspection Item		Problem Yes No	If, Yes Description
a.	Steel bins (when empty)		
	• Cracks	___ ___	___________________________
	• Punctures	___ ___	___________________________
	• Excessive ware	___ ___	___________________________
b.	Concrete frames for bins:		
	• Spills or ponding on floor	___ ___	___________________________
	• Cracks in concrete	___ ___	___________________________

5. Evaporation Pond Unit (Daily)

Date and time inspected:_______________

Average Daily flow rate _________ gallons/day
Daily Liquid Level ______________ ft.

Inspection Item		Problem Yes No	If, Yes Description
a.	Spills, discharges, leaks around perimeter.	___ ___	___________________________
b.	Staff gauge not visible.	___ ___	___________________________
c.	Liquid levels above max fill line.___ ___	___________________________	

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____

Date of Inspection: ____

d. Liquid levels above pumping levels in LDRS. ___ ___ ______________________________

e. Liquids levels above pumping levels in Vadose Zone System. ___ ___ ______________________________

f. Liquids present in secondary containment system. ___ ___ ______________________________

g. Liquid levels above max storage capacity in the pond. ___ ___ ______________________________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ______________________________

Date of Inspection: ______________________________

Evaporation Pond Unit (Weekly and after storms)

Date and time inspected:_______________

Inspection Item	**Problem Yes No**	**If, Yes Description**
a. Seeps around Pond perimeter.	___ ___	________________________
b. Sloughing or Damage to Berms.	___ ___	________________________
c. Damage to exposed liner system.	___ ___	________________________
d. Damage to protective netting.	___ ___	________________________
e. Sudden drop in impoundment contents.	___ ___	________________________
f. Amount of liquid removed from leak detection system.	_______ gallons	

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____

Date of Inspection: ____

6. Truck Wash Facility

Date and time inspected:______________________

Inspection Item		Problem Yes No	If, Yes Description
a.	Spills or leaks in or around surrounding area	___ ___	______________________________
b.	Tank leaking Note which tank ____________	___ ___	______________________________
c.	Ancillary equipment leaking	___ ___	______________________________
d.	Collection trench overflowing	___ ___	______________________________
e.	Obstructions in drainage system	___ ___	______________________________
f.	Liquids above high level point in collection tank	___ ___	______________________________
	Note liquid levels	___ ___	______________________________
g.	Deterioration, leaks or corrosion of the water recycling system	___ ___	______________________________
	Note solid levels	___ ___	______________________________
h.	Recycling System Not Operating Properly	___ ___	______________________________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____

Date of Inspection: ____

7. Landfill (Daily)

Date and Time Inspected:______________________

Item		Problem Yes/No	If, Yes Describe
a.	Ponding or liquids inside cell	___ ___	___________________________
b.	Erosion of protective soil level	___ ___	___________________________
c.	Liquid above pumping level in LCRS	___ ___	___________________________
d.	Liquid above pumping level in LDRS	___ ___	___________________________
e.	Liquid above pumping level in Vadose Zone Monitoring Sump	___ ___	___________________________
f.	Spills, discharge, leaks, around leachate storage tank	___ ___	___________________________
g.	Liquids in secondary containment for leachate storage tank	___ ___	___________________________
h.	Liquid levels above max storage capacity in leachate storage tanks	___ ___	___________________________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ______________________________________

Date of Inspection: ______________________________________

i. Spills or Ponding

- On roadways ___ ___ ________________________________
- On access ramps ___ ___ ________________________________
- On loading and unloading areas ___ ___ ________________________________

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ________________________________

Date of Inspection: ________________________________

Landfill (Weekly)

Date and Time Inspected:______________________

Item		**Problem Yes/No**	**If, Yes Describe**
a.	Spills, discharge leaks, and/or wind blown debris around perimeter	___ ___	____________________
b.	Excess dust generation on haul roads	___ ___	____________________
c.	Blockage or damage to runoff/runon control systems	___ ___	____________________
d.	Amount of liquid removed from the sump	___ ___	____________________
	LCRS System #1	_______gallons	
	LDRS System #2	_______gallons	
	Vadose System #3	_______gallons	
e.	Depth of water in landfill contained water collection basin	______ft	
f.	Depth of water in landfill stormwater collection basin	_______ft	

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____

Date of Inspection: ____

Landfill (Quarterly)

Date and Time Inspected:______________________

Item		**Problem Yes/No**	**If, Yes Describe**
a.	Organic gas present and landfill permit (above background)	___ ___	____

If any of the above items are checked "yes" and are part of an ongoing corrective action, circle the item and write the originating date beside the item.

Inspector's Signature: ____

Date of Inspection: ____

Triassic Park
Part B Permit Application
Tank Certification (40 CFR 264.192)

Proposed Tank Facilities:

- Landfill leachate tanks
- Liquid waste storage tanks
- Stabilization bins

REGULATORY CITATION	REGULATORY REQUIREMENT	DISCUSS OR LOCATION OF INFORMATION IN TEXT
264.192 (a)	Owners or operators of new tank systems or components must obtain and submit to the Regional Administrator, at time of submittal of Part B information, a written assessment, reviewed and certified by an independent, qualified registered professional engineer, in accordance with § 270.11 (d), attesting that the tank system has sufficient structural integrity and is acceptable for the storing and treating of hazardous waste. The assessment must show that the foundation, structural support, seams, connection, and pressure controls (if applicable) are adequately designed and that the tank system has sufficient structural strength, compatibility with the waste(s) to be stored or treated and corrosion protection to ensure that it will not collapse, rupture, or fail. This assessment, which will be used by the Regional Administrator to review and approve or disapprove the acceptability of the tank system design, must include, at a minimum, the following information:	
264.192 (a) (1)	Design standard(s) according to which tank(s) and/or the ancillary equipment are constructed;	Appendix H and Drawing 40 presents that design standards for the plastic leachate storage tanks. This indicates that the tanks are designed according to UBC standards, Structural steel – ASTM A36, Concrete – Compressive strength 2500 psi min. The piping systems into and out of the tanks are designed according to the piping system installation procedures described in American Petroleum Institute (API) Publication 1615 (November 1979), "Installation of Underground Petroleum Storage Systems," or ANSI Standards B31.3, "Petroleum Refinery Piping," and ANSI Standard B31.4 "Liquid Petroleum Transportation Piping System" (Drawing 2). The design calculations for the steel mixing bins are presented in Appendix E33.
264.192 (a) (2)	Hazardous characteristics of the waste(s) to be handled;	The hazardous characteristic of the waste that can be handled in the plastic tanks are presented in Appendix H. The steel mixing bins (stabilization bins) may be subjected to some reaction with the waste, however, steel is the only practical material that can be used to withstand the impact from the mixing equipment. GMI has committed to inspect the bins on daily basis to identify any impacts or damage from the waste being stored in the bins and the mixing equipment (Section 5.2.5). GMI fully realizes that these bins will have to maintained and repaired or replaced based on the results of the inspection.

264.192 (a) (3)	For new tank systems or components in which the external shell of a metal tank or any external metal component of the tank system will be in contact with the soil or with water, a determination by a corrosions expert of: (i) Factors affecting the potential for corrosion, including but not limited to: (A) Soil moisture content; (B) Soil pH; (C) Soil sulfides level; (D) Soil resistively; (E) Structure to soil potential; (F) Influence of nearby underground metal structures (e.g., piping); (G) Existence of stray electric current; (H) Existing corrosion-protection measures (e.g., coating, cathodic protection), and (ii) The type and degree of external corrosion protection that are needed to ensure the integrity of the tank system during the use of the tank system or component, consisting of one or more of the following: (A) Corrosion-resistant materials of construction such as special alloys, fiberglass reinforced plastic, etc.: (B) Corrosion-resistant coating (such as epoxy, fiberglass, etc.) with cathodic protection (e.g., impressed current or sacrificial anodes); and (C) Electrical isolation devices such as insulating joints, flanges, etc. [Note: The practices described in the National Association of Corrosion Engineers (NACE) standard, "Recommended Practice (RP-02-85) – Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems," and the American Petroleum Institute (API) Publication 1632, "Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems," may be used, where applicable, as guidelines in providing corrosion protection for tank systems.]	The liquid waste storage tanks and the leachate tanks will be construction of polyethene and will be located fully above ground. The steel stabilization bins will be located below ground but will not be backfilled with soil. They will be founded on a concrete vault that will allow inspection in and around the tanks. Therefore, the requirement of this section will not apply.
264.192 (a) (4)	For underground tank system components that are likely to be adversely affected by vehicular traffic, a determination of design or operational measures that will protect the tank system against potential damage; and	None of the tank systems proposed for the Triassic park facility will be underground tanks.
264.192 (a) (5)	Design considerations to ensure that: (i) Tank foundations will maintain the load of a full tank (ii) Tank systems will be anchored to prevent floatation or dislodgment where the tank system is placed in a saturated zone, or is located within a seismic fault zone subject to the standards § 264.18(a); and (iii) Tank systems will withstand the effects of frost heave.	(i) The drawings and design information presented in Appendix H indicate that the foundation for the tanks are design for an allowable soil bearing pressure of 1,500 psf. The soil investigation presented in Appendix D indicates that the site soils have an allow bearing capacity of 4,000 psf. (ii) The tanks will not be placed below the groundwater table, therefore, the anchor requirements of this section will not apply. (iii) The information presented in Section 3.2.1 of the permit application indicate that the potential for freezing is very low at the site and therefore, should not impact the tank system.

264.192 (b)	The owner or operator of a new tank system must ensure that proper handling procedures are adhered to in order to prevent damage to the system during installation. Prior to covering, enclosing, or placing a new tank system or component in use, an independent, qualified installation inspector or an independent qualified, registered professional engineer, either of whom is trained and experienced in the proper installation of tank systems or components, must inspect the system for the presence of any of the items indicated in 264.192(b). Inspection as Part of Construction (1) Weld breaks; (2) Punctures; (3) Scrapes of protective coatings Tanks (1) Landfill leachate storage tank (2) Liquid waste storage tanks (3) Stabilization bins (4) Cracks; (5) Corrosion: (6) Other structural damage or inadequate construction/installation All discrepancies must be remedied before the tank system is covered, enclosed, or placed in use.	The CQA Plan (Section XII and XIII) indicate that an independent, qualified installation inspector or an independent, qualified, registered professional engineer, either of whom is trained and experienced in the proper installation of tank systems or components, must inspect the system for the presence of any of the items listed in 264.192 (c).
264.192 (c)	New tank systems or components that are placed underground and that are backfilled must be provided with a backfill material that is a noncorrosive, porous, homogeneous substance and that is installed so that the backfill is placed completely around the tank and compacted to ensure that the tank and piping are fully and uniformly supported.	The tank systems at the Triassic Park facility will not placed underground and backfill. Therefore, the requirements of this section do not apply.
264.192 (d)	All new tanks and ancillary equipment must be tested for tightness prior to being covered, enclosed, or placed in use. If a tank system is found not to be tight, all repairs necessary to remedy the leak(s) in the system must be performed prior to the tank system being covered, enclosed, or placed into use.	The CQA plan (Section XII and XIII) indicate that the tank and ancillary equipment will be tested for tightness and repaired if required.
264.192 (e)	Ancillary equipment must be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction. [Note: The piping system installation procedures described in American Petroleum Institute (API) Publication 1615 (November 1979), “Installation of Underground Petroleum Storage Systems,” or ANSI Standard B31.3, “Petroleum Refinery Piping,” and ANSI Standard B31,4 “Liquid Petroleum Transportation Piping System,’ may be used where applicable, as guidelines for proper installation of piping systems].	The design drawings (Drawing 2) and the Part B permit application (Section 2.3) indicate that the piping systems into and out of the tanks are designed according to the piping system installation procedures described in American Petroleum Institute (API) Publication 1615 (November 1979), “Installation of Underground Petroleum Storage Systems,” or ANSI Standards B31.3, “Petroleum Refinery Piping,” and ANSI Standard B31.4 “Liquid Petroleum Transportation Piping System
264.192 (f)	The owner of operator must provide the type and degree of corrosion protection recommended by an independent corrosion expert, based on the information provided under paragraph (a)(3) of this section, or other corrosion protection if the Regional Administrator believes other corrosion protection is necessary to ensure the integrity of the tank system during use of the tank system. The installation of a corrosion protection system that is field fabricated must be supervised by an independent corrosion expert to ensure proper installation.	The liquid waste storage tanks and the leachate tanks will be construction of polyethene and will be located fully above ground. The steel stabilization bins will be located below ground but will not be backfilled with soil. They will be founded on a concrete vault that will allow inspection in and around the tanks. Therefore, the requirement of this section will not apply.

264.192 (g)	The owner or operator must obtain and keep on file at the facility written statements by those persons required to certify the design of the tank system and supervise the installation of the tank system in accordance with the requirement of paragraphs (b) through (f) of this section, that attest that the tank system was properly designed and installed and that repairs, pursuant to paragraphs (b) and (d) of this section, were performed. These written statements must also include the certification statement as required in § 270.11 (d) of this Chapter.	See below
270.11 (d)	Certification: Any person signing a document under paragraph (a) or (b) of this section shall make the following certification: I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submittal. Based on my inquiry of the person or persons who manage the system, or those person directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.	**Signed by:** ______________________________ **Patrick Corser** **Date:** ______________________ **New Mexico PE Registration Number: 12236**

Prepared for:

~~TRIASSIC PARK WASTE DISPOSAL FACILITY~~
GANDY MARLEY, INC
Post Office Box 827
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ENGINEERING REPORT

TRIASSIC PARK WASTE DISPOSAL FACILITY
CHAVES COUNTY, NEW MEXICO

~~November 1999~~December 1997 (Revised October 2000)

~~Jorge Troncoso~~
~~Senior Engineer~~

Patrick Corser, P.E.
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1.0 GENERAL

1.1 INTRODUCTION

Gandy Marley Inc. (GMI) is submitting a RCRA Part B Permit Application to construct and operate the proposed Triassic Park Waste Disposal Facility (EPA ID NO. NM0001002484) to be located in Chaves County, New Mexico. This engineering report prepared by TerraMatrix/Montgomery Watson (TerraMatrix) presents the detailed design of the Triassic Park Waste Disposal Facility submitted in support of the Triassic Park Waste Disposal Facility RCRA Part B Application.

1.1.1 Background

In 1994, Gandy Marley Inc. contracted the S.M. Stoller Corporation to perform site characterization work and to prepare RCRA Part A and Part B Permit Applications for location of a hazardous waste treatment, storage and disposal facility on a 480 acre parcel of privately owned land located in Chaves County, New Mexico. The proposed site is located in Section 17 and 18 of R31E, T11S which lies approximately 42 miles east of Roswell, New Mexico and 36 miles west of Tatum, New Mexico.

In August 1994, Gandy Marley Inc. contracted with TerraMatrix to prepare preliminary designs for the various site facilities and to assist S.M. Stoller in the preparation of the RCRA Part B Permit submittals. Since that time, S.M. Stoller and TerraMatrix have been working jointly to respond to comments and requests for additional information made by the New Mexico Environmental Department (NMED).

The facility design as presented herein is a product of several design iterations which incorporated additional information and design modifications as suggested by the NMED.

1.1.2 Objective and Scope

The primary objective of this report is to present the detailed design and engineering analyses required under 40 CFR Part 264 and 20 NMAC 4.1 in support of the Triassic Park Waste Disposal Facility RCRA Part B Permit Application. This engineering report presents detailed design drawings, construction specifications, construction quality assurance plan, surface water control plan, and supporting engineering analyses and laboratory studies applicable to the following site features and facilities:

- Site Arrangement
- Landfill
- Evaporation Pond
- Truck Roll-Off Area
- Stabilization Facility
- Drum Handling Facility
- Liquid Waste Storage Facility
- Truck Wash Facility

The report also presents the landfill and evaporation pond action leakage rate and response action plan along with its supporting engineering analyses.

1.1.3 Report Organization

This report is organized into ten sections including this Section 1.0, Introduction. Sections 2.0 through 9.0 describe the design elements and engineering analyses for the general facility arrangement, the landfill, the evaporation pond, the truck roll-off area, the stabilization facility, the drum handling facility, the liquid waste storage facility and the truck wash facility. Section 10.0 presents a list of references used in the report followed by the report appendices. Appendices A through H present, respectively, the detailed design drawings, construction quality assurance plan, construction specifications, laboratory test results, engineering calculations, surface water control plan, and action leakage rate and response action plan.

The drawings in Appendix A present final designs for the RCRA permitted facilities. Details on the non-RCRA components of the facilities may be supplemented during the bidding and construction phase. Gandy Marley will supply the additional details on the non-RCRA components of the design to NMRD for review and approval prior to the start of construction.

1.2 REGULATORY CRITERIA AND GUIDANCE

The following Federal and State regulations, as well as Federal guidance documents were used in the design:

- New Mexico Hazardous Waste Regulations, 20 NMAC 4.1;
- Title 40 -- Code of Federal Regulations (40 CFR), Part 264;
- U.S. Environmental Protection Agency (US EPA), 1984. Permit Applicants Guide Manual for Hazardous Waste Land Treatment Storage and Disposal Facilities
- U.S. Environmental Protection Agency, 1988. Lining of Waste Containment and Other Impoundment Facilities, Part 1 of 2 and Part 2 of 2.
- U.S. Environmental Protection Agency, 1988. Seminar Presentations - Requirements for Hazardous Waste Landfill Design, Construction and Closure.
- U.S. Environmental Protection Agency, 1996. Technical Guidance Document,. Construction Quality Assurance for Hazardous Waste Land Disposal Facilities.
- United States Environmental Protection Agency, July, 1990. Seminars - Design and Construction of RCRA/CERCLA Final Covers, Washington, DC.

Additional supporting reference documents are presented in Section 10.

1.3 REVIEW OF NMED COMMENT RESPONSES

In March 1997 comments on the GMI Triassic Park Waste Disposal Facility RCRA Part B Permit Application were prepared for NMED by A.T. Kearny. In June 1997, Montgomery Watson prepared a response to each comment and indicated how the comment would be addressed with revised information or submittal of additional information. In that submittal, we indicated that it was the intention of GMI to meet all relevant requirements stipulated under 40 CFR 264, 40 CFR 268, 40 CFR 270 and corresponding NMED requirements in 20 NMAC necessary to obtain a RCRA Part B Permit for the Triassic Park Waste Disposal Facility. In addition, GMI would provide the requested supporting technical information for each waste management unit proposed for the facility. Finally, GMI would also provide detailed design drawings, engineering reports, and specifications signed and stamped by a professional engineer registered in the State of New Mexico (Patrick G. Corser, P.E., Registration Number 12236) prior to NMED issuing a Draft RCRA Permit for the Triassic Park Waste Disposal Facility.

1.4 SUMMARY OF GEOLOGIC AND HYDROLOGIC CONDITIONS

Regional and site geologic and hydrologic conditions are discussed in the Triassic Park Waste Disposal Facility Part B Permit Application (45). This site characterization work was performed by the S.M. Stoller Corporation and is based on a series of exploration drilling and test pit programs conducted at the site and review of New Mexico Oil Conservation Division well logs. One of the results of primary importance to this engineering report stemming from the site characterization report is the identification of the "most favorable area" for the location of the landfill. A brief summary of the site geologic and hydrologic conditions based on the Part B Permit application is presented below.

1.4.1 Regional Conditions

The geologic formations present within the region where the Triassic Park Treatment, Storage, and Disposal Facility (TSDF) is situated range from Quaternary through Triassic in age. These include Quaternary alluvium, Tertiary Ogallala Formation, and the Triassic Dockum Group. Permian sediments do not outcrop in this region.

1.4.2 Site Geology

Site stratigraphy generally consists of, from top down, 2 to 20 ft thicknesses of Quaternary alluvial materials; 30 to 100 ft thicknesses of Upper Dockum mudstones, siltstones, and sandy siltstones; and up to 600 ft thicknesses of Lower Dockum mudstones. Permeability testing of mudstones core samples were found to average 2.2 x10^{-7} cm/sec and siltstones averaged 1 x 10^{-4} cm/sec (45).

Based on the Regional Geologic Features, the potential for subsurface subsidence and the occurrence of sinkholes is considered negligible. In addition, there are no identified faults within the project area. The proposed site is located in a geologically stable area with low seismic activity potential. Design ground accelerations of 0.04 g were used in engineering evaluations presented in this report (1).

1.4.3 Site Hydrogeology

Permit Application Section 3.0, Ground Water Protection, provides a detailed discussion of the site geology and supporting investigation activities, as well as, site ground water characteristics and supporting ground water flow modeling. Based on these assessments, the "most favorable" area for the landfill construction was identified (see Figure 3-12 of Section 3.0). The footprint for the proposed landfill generally conforms to the "most favorable" area. Cross sections shown on Drawing No. 7 show the landfill base and geologic foundation intercepts.

1.5 ADDITIONAL FIELD AND LABORATORY STUDIES

In addition to the site characterization drilling and test pitting programs described above, a test pit program to characterize near surface soil conditions and laboratory studies to identify geotechnical properties of the soils and proposed liner components was conducted. Appendix D presents the results of the test pit program, soil index tests, and interface shear tests performed on the soil and geosynthetic liner materials.

1.6 SUMMARY OF CLIMATALOGICAL DATA

Site climatological data was obtained from the National Oceanic and Atmospheric Administration (NOAA) Class A recording station in Roswell, NM. Climate conditions of the area are typical of semi-arid regions characterized by dry, warm winters with minimal snow cover and hot, somewhat moister summers (45).

Moderate temperatures at the Triassic Park Site are typical throughout the year with annual average temperatures near 60°F. Temperatures in December through February show a large diurnal variation, averaging 36°F at Roswell. On approximately 75 percent of the winter mornings, temperatures are below freezing, and afternoon maximum temperatures in the high fifties. Afternoon winter temperatures of 70°F or more are common. Night time lows average near 23°F, occasionally dipping as low as 14°F. There are perhaps two or three winter days when the temperature fails to rise above freezing.

Precipitation is light and unevenly distributed throughout the year, averaging 10 to 13 inches. Winter is the season of least precipitation, averaging less than 0.6-inches of rainfall per month. Snow averages about 5 inches per year at the site and seldom remains on the ground for more than a day at a time because of the typically above freezing temperatures in the afternoon. Approximately half of the annual precipitation comes from frequent thunderstorms in June though September. Rains are usually brief but occasionally intense when moisture from the Gulf of Mexico spreads over the region.

Precipitation for the project area varies greatly from year to year. For example, Roswell's record low annual precipitation is 4.35 inches. The maximum 24 hour rainfall was 5.65 inches in October 1901. The record annual high is 32.92 inches. Most years are either "wet" or "dry"; few are "average". An average precipitation rate for Roswell, for a 107 year period from 1878 to 1982, is 10.61 inches per year.

The prevailing wind direction is from the south with a normal mean wind speed of 9.6 mph at Roswell.

2.0 GENERAL FACILITY DESIGN ELEMENTS

2.1 GENERAL FACILITY DESIGN ELEMENTS

2.1.1 General

General facility design elements include the overall facility layout, traffic plan, and site wide storm water control design. This permit application refers only to Phase 1A. However, potential expansions of the landfill to future phases have been included in the general layout drawings for completeness. This section describes the site layout and provides rationale for the individual facility locations and roadway network. In addition, the site wide storm water control feature system is described.

2.1.2 Facility Layout

Drawing No. 4, Facility Layout, illustrates the proposed locations of all site facilities including the site waste receiving, treatment, disposal, and storage facilities; the site maintenance area; soil stockpiles; surface water control features; water storage basins; and interconnecting access roadways. The location of these facilities is governed by the landfill layout and construction sequencing, existing roads leading to the facility, existing topography and surface water drainage, and operational interactions between the waste storage, treatment, and disposal facilities. Additional rationale for individual facility locations are discussed in the paragraphs below.

Facility entrance and receiving areas including the security gate, administration trailer, truck untarping and sampling stations, chemical laboratory, and truck staging area are located near the facility entrance in the northeast corner of the site. This arrangement facilitates site access security; incoming waste load inspection, sampling, testing, and weighing; and provides vehicle parking, truck staging, and emergency vehicle access.

Waste processing and storage areas including the drum handling facility, stabilization facility, liquid waste storage area, and truck roll-off area are located north of the landfill access. This arrangement will minimize traffic interference between waste processing facility operations, landfill operations, landfill construction activities. The drum handling facility and liquid waste storage area are located closest to the facility entrance because delivery vehicles to these units will not be required to access the landfill or other site facilities. The stabilization facility is located in close proximity to the liquid waste storage area, drum handling facility, truck roll-off area, and landfill entrance to facilitate waste transfer operations between these units.

The evaporation pond and truck wash facility are located to the northwest of the landfill. This arrangement allows trucks leaving the landfill, which need to be cleaned, to pass through the truck wash and exit the facility via the northernmost roadway. The evaporation pond location provides space for future evaporation pond development and is located near the truck wash and the landfill leachate tank locations to reduce leachate haul distances.

The facility maintenance shop area is located next to the truck wash facility because landfill operations equipment is typically cleaned prior to being serviced by the maintenance personnel. As the last facility along the western perimeter haul road, earthmoving and construction equipment will be able to access the maintenance shop from the south thus reducing interference with site operations traffic and minimizing ware to the perimeter road surface. The storm water detention basin is located in the northwest corner of the site because this is a natural low point to which clean run-off from the facility will be directed.

Stockpile and clay processing areas are located along the east side of the facility. These areas provide adequate soil storage space and allow construction equipment to operate separately from other site operations.

The landfill location is governed by subsurface geologic and hydrogeologic characterization discussed in Section 1.4.3.

2.1.3 Facility Traffic Plan

Drawing No. 26, Traffic Plan, illustrates the site roadway locations and grades, traffic flow directions, traffic control features, and emergency vehicle access lanes at the facility entrance. Roadway locations are governed by facility locations and operations requirements. Expected vehicle types and volumes, proposed road types and their intended uses, traffic control features, and individual facility traffic patterns are discussed below. Road design analyses are discussed in Section 2.2.1.

Table 1, Expected Vehicle Types, lists the types of vehicles, their gross vehicle weight, and estimated traffic volume per day which will travel on the site roadways. The traffic volumes shown in Table 1 are estimated based on an assumed waste receipt volume. Actual traffic volumes may vary.

TABLE 1
EXPECTED VEHICLE TYPES

Vehicle Type	Off Highway/On Highway	Gross Vehicle Weight (lb)	Estimated Traffic Volume (units/day)
Waste Haulers			
Roll-off Trucks	On Highway	< 100,000 lb	30-70
End Dump Trucks (Bulk Waste)	On Highway	< 100,000 lb	30-70
Tanker Trucks (Liquid Waste)	On Highway	< 100,000 lb	0-5
Semi Trailer Trucks (Drums)	On Highway	< 100,000 lb	0-5
Other Miscellaneous	On Highway	< 100,000 lb	0-5
Trucks	On Highway	< 100,000 lb	0-5
Site Operations Vehicles			
Vacuum Trucks	On Highway	< 100,000 lb	0-5
Tanker Trucks	On Highway	< 100,000 lb	0-5
Roll-Off Trucks	On Highway	< 100,000 lb	10-30
Flat Bed Trucks	On Highway	< 100,000 lb	0-5
Maintenance Vehicles	On Highway	< 100,000 lb	0-5
LF Waste Compactors	Off Highway	< 100,000 lb	0-2
Excavators	Off Highway	> 100,000 lb	0-2
Backhoes	Off Highway	< 100,000 lb	0-2
LF Scrapers	Off Highway	> 100,000 lb	0-2
Water Trucks	On Highway	< 100,000 lb	0-20
Front End Loader	Off Highway	< 100,000 lb	0-2
Fork Lifts	Off Highway	< 100,000 lb	0-2
Construction Vehicles			
Restricted to construction roads			
End Dump Trucks	Off Highway	< 100,000 lb	NA
Water Trucks	On Highway	< 100,000 lb	NA
Compactors	Off Highway	< 100,000 lb	NA
Graders	Off Highway	< 100,000 lb	NA
Dozers	Off Highway	< 100,000 lb	NA
Excavators	Off Highway	< 100,000 lb	NA
Employee Vehicles	On Highway	< 100,000 lb	30-50

Main Facility Roads

Drawing No. 26, Traffic Plan, identifies the extent of the main facility roadways. These roads include the facility entrance, north access road, south access road, and east and west landfill perimeter roads. Drawing No. 27, Perimeter Road Detail, illustrates the road dimensions, drainage slope, and road surface and subbase material types and thicknesses to be used in construction. The main facility road network will serve the majority of site traffic into and out of the landfill and the waste processing facilities. Construction equipment will typically be restricted to construction haul roads and the cut slope access ramp into the landfill.

Unimproved Access Roads and Temporary Construction Haul Roads

Unimproved access roads and temporary construction haul roads (not shown on the drawings) will be constructed as required by site operations and construction contractors. Access roads to the storm water detention basin, soil stock pile areas, and along the site perimeter fence or along power lines are typical locations for these roads. In general, these roads will be constructed by removing loose materials and vegetation and compacting the underlying soils. No road surface gravels will be placed, however, provisions for surface water drainage, such as culverts and ditches, as well as, erosion control features will be included.

The truck staging area located at the south end of the facility entrance will provide space for waste haul trucks awaiting disposal approval. This area will be surfaced with gravel and will drain to the surface water detention basin. Any localized spills will be cleaned up as required by the contingency plan presented in Volume I.

Parking areas for site personnel vehicles will be designated near the administration trailer, chemical laboratory, drum handling facility, stabilization facility, and maintenance shop area. These areas are also likely be gravel surfaced.

Traffic Control Features

Traffic control features incorporated in the site traffic plan include the main facility entrance gate, stop signs, posted speed limits, and warning and informational signs. Temporary road dividers such as K-rails (also known as California rails) are also often used to separate two-way traffic in high volume areas. Stop sign locations, as shown on Drawing No. 26, Traffic Plan, will serve to control traffic at main roadway intersections and at the various waste processing unit entrances. Speed limits will be posted on all roadways. The main facility road and unimproved access roads will be posted at 15 mph. Temporary construction haul roads will be posted at 35 mph. Additional signage will be posted to identify restricted areas, facility personal protection equipment (PPE) requirements, truck entrance areas, and facility names and access driveways.

Also shown on Drawing No. 26, Traffic Plan, are the emergency vehicle access lanes at the facility entrance. These lanes will remain clear at all times.

Individual Facility Traffic Patterns

The Drum Handling Facility entrance faces the north access road. Incoming trucks will enter the gravel lined apron and will back up to the loading dock areas. Once the truck unloading (or loading) operation is complete, the trucks will exit the facility via the same north access road. Parking areas for site personnel vehicles will be designated near the Drum Handling Facility Office. The gravel apron in front of the facility will not be used to stage waste haul trucks.

The Stabilization Facility has entrances for incoming trucks on both the north and south access roads. These accesses will be used for incoming waste trucks loaded with unstabilized waste for processing. Incoming trucks will enter the gravel lined apron on the north or south side of the facility and back into the stabilization building. Once the load has been dumped into the bin and the truck bed washed out, the truck will exit the facility via the its entrance route. The east and west building entrances will be used by stabilized waste loadout trucks which will cycle between the truck roll-off area or the landfill. The gravel lined areas surrounding the stabilization facility will not be used to stage waste haul trucks. Parking areas for site personnel vehicles will be designated near the stabilization facility office.

Access to the liquid waste storage area is provided on the east, west, and north sides of concrete tank pads. Tanker trucks can use either the north access road or the road to the east of the liquid waste storage area.

The truck roll-off area can be accessed via the north or south access roads.

The landfill design incorporates three access ramps. The two northern ramps will be used by waste haul trucks and landfill operations equipment. These 30 ft wide ramps will accommodate 2-way traffic when necessary, however, in general, the east ramp will be used for incoming traffic and the west ramp for exiting traffic. The third ramp located on the southern cut slope will provide access for earthmoving equipment involved with landfill expansion construction activities. Incoming waste haul trucks will be released from the truck staging area and use the south access road and northeast ramp to enter the landfill. Empty haul trucks will exit the landfill via the northwest ramp, pass through the truck wash facility, if necessary, and exit the site via the north access road.

Evaporation Pond 1A and 1B truck discharge stations are accessible via the north and south access roads, respectively. Pond 1B will be used predominantly for day to day operations for incoming waste. However, the liquid levels in both ponds will be maintained at approximately the same level to maximize evaporation. Tanker trucks will enter Pond 1B discharge station turnout from the west, discharge their load, and can exit the site via the north or south access roads.

2.1.4 Facility Storm Water Control

Facility storm water control is provided in the design by a network of surface water run-on and run-off diversion channels and collection and detention basins. These facilities have been designed to collect and contain the required 25-year, 24-hour storm event. Diversion ditch calculations are presented in Appendix F (Volume VI).

Site Vicinity Drainage Pattern

The proposed site is located on the far eastern flank of the Pecos River Basin. The land surface gently slopes to the west at approximately 40 to 50 feet per mile toward the river. The sloping plain is characterized by low relief hummocky wind-blown deposits, sand ridges, and dunes. The Caprock escarpment (or Mescalero Rim) is one of the most prominent topographic features in southeastern New Mexico. East of the proposed site, the escarpment has approximately 200 feet of relief. Up gradient sources of surface water flow are bounded by the Caprock escarpment. The United States Geologic Survey (USGS) Topographic Maps (7.5 minute series) for Mescalero and Mescaleo N.E. in Appendix F illustrate the topographic features and contributing surface water drainage areas pertinent to the site. The watershed associated with the east diversion channel encompasses an area of approximately 378 acres beginning at the Caprock escarpment and continuing down to the site's east property line.

Surface Water Run-On Diversion Channels

The east diversion channel located on the eastern edge of the landfill property line provides run-on control from the east watershed area. The remaining topography surrounding the site grades away from the site. The discharge location for this channel coincides with existing natural drainages to the north of the site as indicated on Drawing No. 25. The east diversion channel will remain in place after the cover system is constructed.

Surface Water Run-Off Channels

To control the run-off from the facilities area, several collection channels and culverts were designed to divert the peak discharge from the 25-year, 24-hour storm event to a storm water detention basin. The location of the collection channels (Ditch 1 through 6), culverts, and detention pond are shown on Drawing 25 . Channels 1 and 2 are located along the inside of the perimeter road at the toe of the final cover slope. The channels divert run-off from the final cover to channel 5 located at the northwest corner of the landfill. Channels 3 and 4 run along the outside edge of the perimeter road. Channel 3 collects the majority of runoff from the disturbed facilities areas immediately to the east and north of the landfill footprint. Channel 4 collects run-off from the west and south perimeter road. Both channels also discharge to channel 5 at the northwest corner of the landfill. Channel 5 collects the run-off from ditches 1, 2, 3, and 4 and conveys it to the detention pond. Channel 6 collects run-off from the facilities located near the entrance to the site and routes it to the detention pond.

Two ditches, Ditches 7 and 8, are located in the Phase I landfill. These channels are designed to divert runoff from unlined areas of the landfill to the clean water collection basin located in the south end of the landfill.

Two additional ditches (9 and 10) will be located around the evaporation ponds.

Surface Water Detention Basins

There will be three lined detention basins located on the site. The surface water detention basin located in the northwest corner of the site is shown on Drawing No. 25. The clean water collection basin located in the toe of the Phase 1A cut slope and the third basin, which will be located in the lined portion of Phase 1A and will extend from the waste fill slope to the clean water collection basin berm, are shown on Drawings No. 10 and 13.

A berm has been included at the base of the access road to the storm water retention basin of Phase 1A to prevent access road run-off into the contaminated water basin.

Final Cover

The Final Cover Grading Plan is shown on Drawing No. 22. An access road to the top of the landfill is located along the western side of the landfill. The surface water control ditch adjacent to the road will reduce erosion and control surface run-off of the cover. The ditch dimensions and details are shown on Drawings No. 25 and 27.

2.2 GENERAL FACILITY DESIGN ANALYSES

2.2.1 Road Designs

Drawing No. 27, Main Facility Road Detail, illustrates the road dimensions, drainage slope, and road surface and subbase material types and thicknesses to be used in construction. Construction Specification Section 02225, Road Base, provides details regarding road construction materials and placement execution. Calculations presented in Appendix E, evaluates the main facility road design and specification relative to the expected traffic conditions identified in Table 1. As described in the calculation, the main facility bearing capacity of 2,000 psf is suitable for the expected traffic loading.

2.2.2 Facility Surface Water Control Design Analyses

All surface water calculations were conducted utilizing the SEDCAD+ computer model developed by Civil Software Design (63). Channels were sized based on the Mannings equation for open channel flow. The methodology and assumptions used in the design of the surface water control system are presented in Appendix F. Drawing No. 25 presents a layout of the surface water control plan and a schedule of channel and culvert dimensions and installation criteria.

Detention Basin Design Analyses

The surface water detention basin is designed to contain the storm water discharge from the entire active site area given flows from a 25-year, 24-hour storm event. In order to assess the required size of the surface water retention basin, a worst-case storm water volume discharge area was identified. The worst case scenario assumed that the final cover was in place and the run-off from the entire landfill footprint along with the run-off from the surrounding facilities area are all diverted to the basin. The total drainage area is approximately 265.5 acres. Of the 265.5 acres 44 percent is assumed to be reclaimed and revegetated and the remaining 56 percent is considered to be disturbed. The total run-off was computed to be approximately 51.4 ac-ft. Total volume of the detention pond at the invert of the spillway is 66.1 ac-ft.

Erosion Control

Channels with flow velocities less than 5 fps from a 25-year event will not require erosion protection. Channels with peak flow velocities greater than 5 fps from a 25-year event but less than 5 fps from and average storm (2-year event) will also not utilize erosion protection. During average storm events these channels should be stable, however, during major storm events the channels may show signs of erosion in some areas. These areas will be repaired as required following all major storm events. Channels with peak flow velocities greater than 5 fps from an average storm will be lined with gravel or riprap, as required. All channels are designed with 1 foot of freeboard.

To minimize sediment transport to receiving streams the east channel will be lined with gravel. The channel was designed with 1 foot of freeboard. A riprap apron will be constructed at the end of the East channel to dissipate the flow before entering the natural channel to help reduces erosion. The location of the apron is shown on Drawing No. 25. Details of the apron is shown on Drawing No. 25. Design calculation are shown in ~~Appendix F.~~Appendix F. Channels 7 and 8, which direct clean water runoff on the side slope of the landfill into the clean water detention basin, will be lined with a high density polyethylene (HDPE) liner.

2.2.3 Operations and Maintenance

All of the regulated facilities will be constructed in accordance with the Design Drawing, Specification and Construction Quality Assurance Plan presented in Volume II, Appendix O. In general, all maintenance and repairs to the facilities will be completed to meet the requirements of the original Design Drawings and Specifications and will be monitored in compliance with the Construction Quality Assurance manual.

3.0 LANDFILL

3.1 LANDFILL DESIGN

3.1.1 General

Landfill design elements include ultimate and interim landfill layout and phasing; subgrade design; liner system design; and leachate collection system, leak detection system, and vadose monitoring sump design. This section describes each of these design elements. This permit application refers only to Phase 1A. However, potential expansions of the landfill to future phases have been included in the general layout drawings for completeness.

3.1.2 Landfill Layout and Phasing

The proposed landfill footprint illustrated on Drawing No. 4, generally conforms to the most favorable area as previously described. The landfill footprint is divided into three phases (Phase 1, Phase 2, and Phase 3) with each phase having a separate leachate collection, leak detection, and vadose detection system. These phases will be further subdivided based on development sequencing and landfill waste receipt rates. The limits of Phase 1A , the first area of the landfill to be developed, is shown on Drawing Numbers 8, 9, and 10. Details of the ultimate landfill configuration and the Phase 1A configuration are discussed below.

Ultimate Landfill Configuration

Drawing Nos. 6, 7, and 22, illustrate the ultimate configuration of the landfill for Phases I, II and III. The landfill footprint defined by the crest line encompasses approximately 101 acres. The final cover area, which will extends 20 ft beyond the crest line, is approximately 107 acres. The final cover area for Phase 1A is approximately as shown in Drawing No. 22~~3~~, no waste will be placed outside of the crest line of the landfill and leachate percolating vertically through the waste mass will be contained by the slope and floor liner systems.

The subsurface, or basal, portion of the landfill will be excavated to a depth of approximately 100 ft. At this depth, the floor and sumps of the landfill will be located in the Lower Dockum Unit (Drawing No. 7). All side slope angles are 3 horizontal: 1 vertical (3H:1V) and the base in each landfill phase grades approximately 3 percent with a minimum of 2 percent towards its respective sump area. The basal liner system anchor trench is located approximately 4 ft beyond the crest of the landfill (Drawing No. 12). Sumps are located at convenient locations in each phase to allow for subphase landfill development, to provide space for access ramps, and to maintain leachate collection system flow lengths capable of detecting a leak in a timely manner.

As shown on Drawing Nos. ~~6,~~ 7~~,~~ and 22, the final cover system will reach a maximum elevation of approximately 4,205 ft. The cover system will crest at the mid-point of the landfill and will slope at 6 percent outwards. Slopes around the perimeter of the landfill will be 4H:1V.

Phase 1A Landfill Configuration

Phase 1A landfill development is illustrated on Drawing Nos. 8, 9, 10, and 11. The basal liner system will cover the entire north 3H:1V slope, the slopes below the access ramps, and most of the Phase 1A floor. Waste placement will occur only on lined areas as shown on Drawing No. 10.

Landfill access ramps located on the east and west sides of Phase 1A grade at 10 percent from the crest to the floor surface. The 30 ft wide ramps can facilitate two way traffic. Drawing No. 14, illustrates the access ramp cross sections when waste placement takes place below the ramps and when waste placement takes place above the ramps.

Drawing No. 13, shows slope run-off diversion ditches located along the access ramps that discharge into a collection basin positioned at the toe of the cut slope. This temporary storm water control feature will collect run-off from unlined slope areas above the access ramp and from the cut slope area during Phase 1A waste filling. Clean water collected in the basin may be used for dust control within the landfill or may be pumped out of the basin and discharged into the site surface water control system.

3.1.3 Subgrade Excavation, Liner System, LCRS, LDRS, and Vadose Sump Design

Subgrade Excavation

Drawing No. 6 shows the landfill excavation and structural fill contours. The crest of the landfill generally follows the site's surface topography which grades from the southeast to the northwest. Fill areas along the south and west sides of the landfill combined with cut areas along the landfill's north side provide sufficient grade differences for perimeter drainage ditches to move storm water run-off to the detention basin located in the northwest corner of the site. Drawing No. 5 indicates the initial cut and fill areas that would be required for the initial site development. This would require grading around the perimeter of the landfill and in the waste processing areas.

Specification Section No. 02110, Site Preparation and Earthwork, describes site preparation, excavated soil classification and stockpiling, subgrade surface preparation and inspection, structural fill placement and compaction requirements, survey and quality control, and erosion control features.

Liner System

Drawing No. 12 shows the landfill basal liner components intended for the floor, slopes, and anchor trench areas. The landfill liner system is a double lined system consisting of (from bottom up) a prepared subgrade, a composite (geosynthetic clay liner and geomembrane) secondary liner, a geocomposite leak detection drainage layer, a primary geomembrane liner, a geocomposite leachate collection drainage layer, and a protective soil layer. Details of each liner component are discussed below:

- *6-inch thickness of prepared subgrade*

  The prepared subgrade component will provide a smooth stable surface suitable for placement of overlying geosynthetic materials. Specification Section 02119, Prepared Subgrade, presents subgrade material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements.

- *16-foot ~~wide~~ compacted clay liner (CCL) around landfill perimeter*

  During excavation, Quaternary Sands will be exposed around the perimeter of the landfill to depths ranging from 2 to 10 feet. As shown on Drawing No. 23, ~~a~~ 16 f~~oo~~eet of horizontal thickness of this sand material will be removed and replaced with a compacted CCL component. The purpose of the CCL is to provide the liner with enhanced water barrier qualities in the Quaternary Sand areas. The CCL will be extended into the Upper

Dockum Unit to a depth of at least 2 feet. The CCL ($k \leq 1 \times 10^{-7}$ cm/sec) in combination with the overlying GCL described below will serve as a low permeability barrier layer to restrict infiltration of leachate into the subgrade. The CCL will consist of clay material (CL or CH) obtained during excavation of the landfill and surface impoundment. Specification Section 02221, Clay Liner, describes clay material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements. Soil liner leachate compatibility tests (~~20A 9090~~ASTM D5084) will be conducted prior to construction. In addition, a test fill will be constructed, as per the procedures outlined in the CQA plan. The results of the permeability testing performed in compacted samples are shown in the appendices.

- *Geosynthetic Clay Liner (GCL)*

  The GCL will serve as a low permeability ($k \leq 5 \times 10^{-9}$ cm/sec) barrier layer to restrict infiltration of leachate into the subgrade. The GCL type used will consist of bentonite granules sandwiched between two layers of geotextile. The upper geotextile will be a non-woven 6 oz. material and the lower geotextile will be a woven 4 oz. material. Specification Section 02780, Geosynthetic Clay Liners, describes minimum GCL properties required, subgrade preparation and inspection, material transportation and handling procedures, deployment and seaming requirements, and material construction quality assurance.

  Site specific compatibility tests (ASTM D5084) will be conducted prior to operations. Manufacturer published information on the compatibility of the GCL with typical leachate materials is provided in Appendix H-5.

- *60-mil thick high density polyethylene (HDPE) geomembrane liner (textured on both sides)*

  The 60-mil HDPE liner placed on top of the GCL is the second component of the composite secondary liner. Together, the GCL and HDPE liner form a highly efficient barrier layer to restrict percolation of leachate into the subgrade (see Section 3.2.7, HELP Modeling). HDPE texturing increases the friction angle between the geomembrane and the underlying and overlying geotextile liner elements. Specification Section 02775, Geomembrane Liners, describes minimum geomembrane properties required, subgrade preparation and inspection, material transportation and handling procedures, deployment and seaming requirements, and material construction quality assurance. Section 3.2.1, discusses slope stability analyses for the landfill liner system.

  Site specific compatibility tests will be conducted on a synthetic leachate and the proposed liner prior to operation of the facility. Manufactures' Published Information on the compatibility of the HDPE with typical leachate materials is provided in Appendix H-4.

- *Geocomposite leak detection drainage layer (transmissivity $\geq 2.2 \times 10^{-4}$ m²/sec as tested under actual field conditions) consisting of*:

  * A 7 oz. geotextile (non-woven)
  * A geonet
  * A 7 oz. geotextile (non-woven)

The high transmissivity geocomposite leak detection drainage layer provides a means to transmit and remove leachate percolating through any leaks in the primary geomembrane layer above. The upper and lower geotextiles serve to filter sediments from the leachate and cushion the geomembranes, respectively. Flow calculations discussed in Section 3.2.8 and presented in Appendix G indicate that the geocomposite, in combination with the centrally located 8 inch diameter drain pipe, are capable of removing leachate in a timely manner such that head on the underlying geomembrane will remain less than 1 foot. Specification Section 02710, Geocomposite, describes minimum geocomposite properties required, material transportation and handling procedures, deployment and seaming requirements, and material construction quality assurance (CQA).

The arrangement for the 8 inch diameter drain pipes and surrounding drainage gravel and filtration geotextile, which are located in the floor of the leak detection layer and the leachate collection layer, are illustrated on Drawing No. 12. Specification Section 02714, Filter or Cushion Geotextile, describes minimum geotextile properties required, material transportation and handling procedures, deployment and seaming requirements, and material CQA.

Calculations demonstrating the leak detection system performance capabilities are presented in Section 3.2.7, HELP Modeling and Section 3.2.8, Leachate Collection and Removal Leak Detection and Removal, and Vadose Monitoring System Hydraulic Analyses.

- *60-mil thick HDPE geomembrane liner (textured on both sides)*

This HDPE geomembrane serves as the primary barrier layer of the double liner system. Specification Section 02775, Geomembrane Liners, discussed above also applies to this geomembrane layer.

Site specific compatibility tests will be conducted on a synthetic leachate and the proposed liner prior to operation of the facility. Manufactures' published information on the compatibility of the HDPE with typical leachate materials is provided in Appendix H-4.

- *Geocomposite leachate collection and removal drainage layer (transmissivity $\geq 2.2 \times 10^{-4}$ m²/sec as tested under actual field conditions) consisting of :*

  * A 7 oz. geotextile (non-woven)
  * A geonet
  * A 7 oz. geotextile (non-woven)

This geocomposite layer serves as the primary leachate collection and removal system. Leachate percolating through the overlying waste fill will drain through the geocomposite to the central drain pipe and then flow to the leachate collection sump where it will be removed via the slope riser pipes. This material is the same used in secondary leak detection layer. The floor drain pipe arrangement is also the same.

Primary geocomposite flow calculations are presented in Appendices E and G, and the performance demonstrations are provided in the HELP Modeling discussed in Section 3.2.7.

- *2-foot thick protective soil layer*

  A 2-foot thick protective soil layer will be placed above the primary leachate collection geocomposite. The protective soil layer will extend over all lined floor and side slope areas. The purpose of the soil layer is to protect the underlying geosynthetics from damage due to vehicle traffic or from waste debris settlement. Specification Section 02716, Protective Soil Layer, describes material requirements including particle size, placement requirements, and survey and field quality control requirements. This soil layer will be placed during construction of the liner system.

Leachate Collection and Removal, Leak Detection and Removal, and Vadose Monitoring Sump Systems

The leachate collection and removal (LCRS), leak detection and removal (LDRS), and vadose monitoring systems each have a separate sump from which fluids can be collected and removed. The liner systems on the landfill floor continue into the sumps, however, in order to provide adequate volume to efficiently operate removal pumps, gravel thicknesses are incorporated into the drainage systems. Also, because liquids may be present, clay soil liner components have been added below the primary geomembrane liner and below the secondary GCL liner. These clay soil liner elements are not required by the regulations but are added to enhance the barrier qualities of the liner elements in the sump. Drawings describing the sump arrangements in Phase 1A include Drawing Nos. 15, 16, 17, and, 18. As shown on the drawings, the sumps are square pyramidal shapes which lie concentrically above one another. The slope riser pipes enter their respective sumps at the sump base and are horizontally offset to provide adequate space for slope riser trenches. The slope riser trench arrangement enables the vadose and leak detection slope riser pipes to penetrate overlying geosynthetic liner elements at the crest of the landfill rather than in the sump area. The leachate collection riser pipe lies on top of the primary geomembrane and therefore no liner penetration is required. Table 2, Landfill Sump Arrangement Summary, below lists the dimensions, volumes, flow capacity, slope riser pipe dimensions, pump type and capacity, and fluid level instrumentation included in each of the sumps. Performing curves for the proposed pumps are shown in Appendix H-1.

TABLE 2
LANDFILL SUMP ARRANGEMENT SUMMARY

	LCRS	LDRS	VADOSE
Fluid Capacity[(1)] (gallons)	102,900	16,840	1,965
Pipe Dimensions (length/diameter)	30 ft/18 in	15 ft/18 in	10 ft/12 in
Flow Capacity[(2)] (gallons per day)	618,480	135,400	For Detection
Pump Type/Capacity[(3)] (gallons per minute (gpm))	Grundfos/50 gpm	Grundfos/50gpm	Grundfos/25 gpm
Fluid Level Instrumentation	Yes	Yes	Yes

Notes:
(1) 0.3 x net volume accounts for gravel space
(2) Determined from Dupuit-Forcheimer equation for flow from the sump gravel to collection pipe
(3) Expected pump type and flow capacity for side slope riser.

<u>LCRS Vertical Riser</u>

In addition to its side slope riser, the LCRS sump also has a vertical riser which will extend from the LCRS through the waste fill and final cover system to the surface. The vertical riser is redundant design feature which provides an additional access to the LCRS sump whereby a second pump can be added to rapidly increase leachate removal rates. As shown on Drawing Nos. 17 and 20, the vertical riser arrangement consists of three pipes and three vertical riser pipe pads. The innermost pipe is a 18 inch diameter stainless steel pipe which rests on an HDPE flatstock and extends from the bottom of the LCRS sump through an opening in the concrete vertical riser pad above. Because this pipe is not attached to the concrete pad, any settlement that the concrete pad incurs will not be transferred to the pipe. The concrete vertical riser pad rests on the LCRS gravel and provides support for the second pipe which will extend through the waste fill to the surface. This pipe is wrapped with a double layer of HDPE. This arrangement isolates the pipes from the surrounding soils which reduces down drag forces resulting from waste settlement. Calculations which evaluate the down drag forces and structural design of the concrete vertical riser pad are included in Appendix E.

Crest Riser Pad Arrangement

Drawing No. 19, illustrates the slope riser piping and valving , the double lined 9,000 gallon polyethylene tank (poly tank) system for leachate storage, and the concrete containment pad. Also indicated are high and low level tank cutoff switches, flexible piping connections between the inner and outer poly tanks, the fluid level sight gauge, 50 gpm leachate discharge pump and control panel locations.

The double lined poly tank consists of two tanks, one inside of the other. The inner tank will have a capacity of 9,000 gallons and the outer tank will have a minimum capacity of 15,500 gallons. Liquids containing solvents such as MEK, toluene, zylene, diesel, or gasoline in concentrations greater than 15 percent will not be placed in the tanks. Tank tie down details have been provided by the manufacturer and are included in Appendix H-2. A chemical resistance chart for the tanks is provided in Appendix H-3.

The concrete containment pad will slope towards the landfill crest. A concrete pad will be placed in the loading/unloading areas for the tanker trucks. This pad will be sloped providing drainage toward the sump areas. Calculations on the bearing capacity of the concrete pad are detailed in Appendix E-35. Should a catastrophic failure of the tank or piping system occur, leachate will flow back into the landfill leachate collection system rather than be released to unlined areas. The landfill liner system anchor trench will completely encompass the pad so that any leakage through the pad will also drain back into the landfill leachate collection system. Construction details for the concrete containment pad are called out in Specification Section 03100, Concrete Formwork, Section 03200, Reinforcement Steel, Section 03290, Joints in Concrete, and Section 03300, Cast-in-Place Concrete.

3.1.4 Waste Filling Sequence

As mentioned previously in Section 3.1.2, landfill development will begin in Phase 1A, proceed southward into Phase 2, and then finish in Phase 3. The extent of landfill subphases will be based on waste receipt rates.

Liner installation in Phase 1A will take place in two stages: the slope and floor area below the access ramps and the slope area above the access ramps. The initial stage of the Phase 1A liner installation will consist of liner placement below the access ramps and is the only portion relevant to this permit application. The approximate area that will be lined during the Phase 1A construction is 14.9 acres which is delineated on Drawing No. 10.

-Detailed planning for Phase 1B, Phase 2 and Phase 3 liner installation, access ramp location, and waste fill sequencing will be determined and permitted in the future, however, the ultimate landfill configuration will be developed as follows. Once the waste fill approaches the Phase 1A limits defined in Drawing No. 10, the cut slope will be advanced southward into Phase 2 and the remaining floor and slope areas of Phase 1 will be lined. At this time, the stormwater collection basin in the landfill will be removed from Phase 1 ~~The collection basin in the base of Phase 1 will also be removed~~ and re-established in Phase 2. Waste filling in Phase 1 will continue during this liner expansion. As the waste fill extends beyond and above the access ramps, a ramp will be established in the south waste fill slope to provide access to the newly lined floor areas of Phase 1. ~~Detailed planning for Phase 2 and Phase 3 liner installation, access ramp location, and waste fill sequencing will be determined in the future, however, the ultimate landfill configuration will be maintained.~~

Waste filling will take place in 5 to 10 foot thick horizontal lifts. Waste will be covered with daily cover soil as soon as practicable following waste placement (and minimally at the end of each operating shift). Daily cover soil thicknesses will ~~range~~ be at least 0.5 ft.

3.1.5 ~~Interim and~~ Final Covers

~~Because landfill development and waste filling will take place in stages depending on waste receipt rates, ultimate waste fill heights may not be achieved early in the life of the landfill. For example, in order to achieve maximum fill heights in Phase 1, Phase 2 below grade filling will necessarily have to be substantially complete. A similar situation will occur between Phase 2 and Phase 3 in order to reach maximum fill heights in Phase 2. To reduce storm water infiltration and promote clean water run-off from inactive fill areas within the landfill, interim cover over the waste will be established. Interim cover will consist of a 1.5 foot thickness of cover soil.~~

~~The interim soil cover will be inspected following rain events for rills or other erosion features and will be regraded if necessary. Run-off from interim cover areas will drain to the landfill's perimeter drainage ditch system and flow to the site stormwater detention basin. Alternatively, if deemed necessary by the owner, a geosynthetic cover consisting of a light weight sacrificial HDPE geomembrane could also be placed on top of the soil cover to shed rain water. When waste placement commences in the interim cover area, the geosynthetic cover can be used in a new location or disposed of the landfill. Excess interim soil cover which has not come in contact with waste material can be used as daily cover during the new waste placement operation.~~

Drawing Nos. 21, 22, and 23 illustrate the landfill's ultimate waste fill configuration and final cover design. The final cover system is a composite cover consisting of (from top down) a vegetative cover, a geocomposite drainage layer, a geomembrane layer, a geosynthetic clay layer, a prepared subgrade layer, and a cover soil layer. Details of each component of this 4.5 foot thick cover system are discussed below.

- *2.5-foot thick vegetative cover*

  The vegetative cover will provide a substrate for plant growth on the cover surface and protect the underlying geosynthetics from frost and sun exposure damage. Establishment of plant growth will enhance evapotranspiration of precipitation that soaks into the vegetative cover and will reduce soil erosion due to rainwater runoff. Specification Section 02227, Vegetative Cover, discusses vegetative cover material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements. Specification Section 02900, Vegetation and Seeding, identifies seed mixtures, site preparation, and planting requirements for cover vegetation.

- *Geocomposite drainage layer (transmissivity $\geq 2 \times 10^{-4}$ m^2/sec consisting of :*

  * A 7 oz. geotextile (non-woven)
  * A geonet
  * A 7 oz. geotextile (non-woven)

  The high transmissivity geocomposite drainage layer provides a means to transmit and remove precipitation percolating through the vegetative cover above. The upper and lower geotextiles serve to filter sediments from the rain water and cushion the geomembrane below. Flow calculations discussed in Section 3.27 and presented in Appendix E indicate that the geocomposite, in combination with the vegetative cover above, is capable of removing 99 percent of the precipitation falling on the cover. Specification Section 02710, Geocomposite, describes minimum geocomposite properties required, material transportation and handling procedures, deployment and seaming requirements, and material CQA.

- *60-mil thick HDPE geomembrane (textured on both sides)*

  The 60-mil HDPE liner placed below the geocomposite drainage layer and on top of the GCL is the primary barrier layer of the cover system. Together with the underlying GCL, the HDPE geomembrane forms a highly efficient barrier layer to restrict percolation of rain water into the waste fill (see Section 3.2.7, HELP Modeling). HDPE texturing serves to increase the geocomposite/geomembrane/GCL friction angles to enhance slope stability. Specification Section 02775, Geomembrane Liners, describes minimum geomembrane properties required, subgrade preparation and inspection, material transportation and handling procedures, deployment and seaming requirements, and material CQA.

  Site specific compatibility tests will be conducted on a synthetic leachate and the proposed liner prior to operation of the facility. Manufacturers published information on the compatibility of the HDPE is presented in Appendix H.

- *Geosynthetic clay liner (GCL)*

  In conjunction with the overlying HDPE geomembrane, the GCL will serve as a low permeability ($k \leq 5 \times 10^{-9}$ cm/sec) barrier layer to restrict infiltration of precipitation runoff into the waste fill. The GCL type used will consist of bentonite granules sandwiched between two layers of geotextile. The upper geotextile will be a non-woven 6 oz. material and the lower geotextile will be a woven 4 oz. material. Specification Section 02780, Geosynthetic Clay Liners, describes the minimum GLC properties required, subgrade preparation and inspection, material transportation and handling procedures, deployment and seaming requirements, material construction quality assurance.

  Manufacture published information on the compatibility of the GCL with typical leachate materials is provided in Appendix H-5.

- *6-inch thick prepared subgrade layer*

  The prepared subgrade component will provide a smooth stable surface suitable for placement of overlying geosynthetic materials. Specification Section 02119, Prepared Subgrade, presents subgrade material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements.

- *2-foot thick cover soil layer*

  The cover soil layer placed on the surface of the waste fill serves to isolate the waste and any near surface debris from the overlying cover elements and also provides a base for the prepared subgrade layer. Specification Section 02226, Cover Soil, presents material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements.

As shown on Drawing No. 23 the final cover system will extend 24 ft outside the crest of the landfill. In addition, the waste fill terminates inboard of the crest line. Rain water that percolates through the vegetative cover will flow in the cover system's geocomposite layer to the drainage pipe located in the cover anchor trench. The water will then be discharged to the landfill perimeter drainage ditch system. Rain water that percolates through the cover system and comes in contact with the waste will flow vertically downward and be captured in the LCRS.

Prior to closure of the landfill, an assessment will be made of the landfill waste gas generating potential. If it is concluded that gas generation may result in gas build-ups beneath the barrier layer of the cover or releases following closure exceeding regulator air quality standards, then provisions will be made to collect and monitor gas generation and release during the post-closure period. If this occurs, the latest technology available will be implemented into the construction of the cover system.

Drawing No. 22 indicates the location of the cover access road and surface water diversion ditches. Traffic on the cover access road will be limited to light vehicles such as pick up trucks. Surface water drainage ditches on the cover are included to reduce runoff flow lengths and thereby reduce surface soil erosion. Sections 3.2.10 and 3.2.11 discuss ditch sizing and cover soil erosion, respectively.

Waste settlement impacts on the 6 percent and 4H:1V cover slopes are discussed in Section 3.2.2.

3.1.6 Landfill Storm Water Control Features

Drawing Nos. 13, 14, 22 and 25 illustrate the landfill's storm water control features designed to contain and control rain water run-off and run-on for the required 25 year, 24 hour storm event. These features include the landfill's collection basin and slope run off drainage ditches, cover system drainage ditches, perimeter drainage ditch, and the culverts and drainage ditches leading to the storm water detention pond.

During the Phase 1A waste filling, runoff from the slope areas above the access ramps and from the cut slope area will be diverted to the ~~HDPE lined~~ HDPE lined collection basin located near the toe of the cut slope on the floor of the landfill. HDPE lined diversion ditches located on the side of the access ramps will carry slope run-off to the stormwater collection basin. The landfill perimeter ditches located on either side of the perimeter road will intercept run-off from areas outside of the landfill and divert this water to the storm~~urface~~ water detention basin. . Runoff from active waste filling area will drain to the contaminated water basin at the south end of the landfill. The contaminated water basin is not its own separate entity, but is a part of the Phase 1A landfill that will not initially receive waste. The layout of the contaminated water basin is shown on Drawing Nos.: 10, 11~~, 12~~, 13, and 24. Since the contaminated water basin is only a portion of the landfill set aside to store stormwater, it will not be removed as the landfill is expanded to the south. Rather waste will be placed over the top of the contaminated water basin.

~~Once waste filling reaches elevations above the landfill crest, interim soil cover (and/or interim geomembrane cover) will be placed on outer fill slopes. Rain water run-off from the clean slope cover will flow into the perimeter ditch system and flow to the storm water detention basin.~~

During the operational period, when the final cover system is partially installed in some areas and waste filling continues to take place in other areas, run-off from the final cover will be diverted to the surface water detention basin. Following the post closure period, after the effectiveness of the landfill cover has been demonstrated, the surface water detention basin will be removed from service and the area will be regraded to its approximate predisturbance state. Run-off from the landfill cover will be allowed to flow into the natural drainages which existed prior to construction.

Section 4.2.8 summarizes surface water calculations performed to size the landfill's stormwater control features. The calculations are presented in Appendix F.

3.2 LANDFILL DESIGN ANALYSES

3.2.1 Slope Stability

Cut Slope Stability

Prior to filling, unsupported cut slopes will exist on all sides of the landfill. These slopes were analyzed for static and dynamic stability using the Janbu Simplified Method. A computerized slope stability program (XSTABL) was used to analyze the cut slopes (44). Strength parameters used for soil and rock materials were estimated using design overburden pressures and plasticity index data gathered from laboratory testing of site soil materials correlated to published data (46). The material properties used in the analyses are summarized in Calculation No. E-1, presented in Appendix E.

The site grading plans (Drawing Nos. 5 and 6) indicate that the maximum cut slopes will be 3H:1V and maximum height will be approximately 100 feet. Results for the critical 3H:1V slope indicate a static factor of safety of 1.4 for the critical short term (undrained) condition. Stability during seismic loading was estimated by applying a pseudo-static earthquake force in the Janbu analysis. Results based on the 0.04 g design acceleration indicate a dynamic factor of safety of 1.2 for the short term (undrained) condition.

The stability of the outward slopes was also evaluated. Results indicate a static factor of safety of 1.3 and a dynamic factor of safety of 1.1. These slopes were analyzed using Bishop's Method (Appendix E-34).

The temporary cut slope along the south side of Phase 1A was analyzed using Bishop's Method giving a static factor of safety of 1.1 (Appendix E-37).

Waste Fill Stability

Waste fill stability was considered for both the Phase 1A and ultimate landfill configurations. In both cases a face failure through the waste and along the lining system, and a basal failure along the lining system was considered. The analysis assumed a 4H:1V waste fill slope and floor at design base grades. The Sarma analysis method was used to calculate factor of safety and acceleration coefficient (Kc). Kc is the net acceleration that would have to be applied to a slide mass to initiate movement.

Phase 1A Waste Fill Stability

Critical inputs for the Phase 1A stability analysis were as follows:

- *GCL, saturated undrained condition: friction angle = 2° and C=440 psf*

  Based on testing performed by Geosyntec Inc. using actual site soils and a needle punched GCL, the critical failure interface under saturated conditions occurs in bentonite layer between the geotextile components of the GCL. It should be noted that this value is highly conservative since the GCL is most likely to remain in an unsaturated state during the life of the landfill. Additionally, the type of GCL tested was the needle punched variety. Other types of GCLs with stitching between the geotextile components offer substantially greater interface shear strengths.

- *Design ground acceleration = 0.04 g*

- *Waste friction angle ϕ = 29° (29)*

- *Design fill configuration shown on Drawing No. 10*

Results of the Phase 1A analyses presented in Calculation No. E-3, Phase 1A Filling Plan Stability, indicated a static factor of safety of 1.5 and a dynamic factor of safety of 1.0. These factors of safety are considered acceptable for the interim fill configuration of Phase 1A.

Ultimate Landfill Configuration Waste Fill Stability

The ultimate landfill configuration analyses used same liner interface strength inputs as the Phase 1A evaluation and the final waste configuration shown on Drawing No. 22. Results of the ultimate configuration waste fill stability analyses presented in Calculation No. E-4, Ultimate Filling Plan Waste Stability, indicated a static factor of safety of 3.7 and a dynamic factor of safety of 1.5. These factors of safety are considered acceptable for the ultimate waste fill configuration.

Protective Soil Layer Stability

An infinite slope model approach was used to evaluate the stability of the protective soil layer on the 3H:1V landfill slopes which considered the loading scenario of the protective soil layer only, and a loading scenario with a D6 dozer (9.8 psi track loading [16]) on top of the protective soil. The analysis considered saturated and undrained soil conditions. The soil/geotextile interface shear strength was based on a friction angle of 31° and an adhesion of 15 psf obtained from interface shear tests. Results of the analyses indicated a static factor of safety of 2.0 for the soil only case and a static factor of safety of 1.8 for the case with the dozer loading. Both factors of safety are considered acceptable. Calculation No. E-2, Protective Soil Layer Stability, is presented in Appendix E.

Cover Stability

The cover system stability analysis focused on two potential failure mechanisms: a deep block failure through the waste and along the basal liner system, and an infinite slope failure within the cover system. Both stability analyses were conducted for static and dynamic conditions assuming undrained soil conditions. The block failure analysis assumed a zero head condition on the liner system while the infinite slope failure analyses considered a zero head condition and a head condition of 2.5 ft in the cover. As with other stability analyses, a design ground acceleration of 0.04g, waste friction angle of 29°, and liner interface strength of $\phi = 2°$ and c = 440 psf was assumed.

Results of the analyses indicated a static factor of safety of 2.8 and dynamic factor of safety of 1.5 for the deep block failure. The infinite slope analyses indicated a static factor of safety of 10.9 and dynamic factor of safety of 6.5 for the zero head condition and a static factor of safety of 5.2 and dynamic factor of safety of 3.1 for the 2.5 ft. head condition. All of these factors of safety are considered acceptable. Calculation No. E-5, Cover Stability, is presented in Appendix E.

3.2.2 Settlement

Subgrade Settlement

Total settlement of the landfill base due to settlement of the subgrade and prepared subgrade layers was calculated to ensure that the base liner grades did not fall below EPA's recommended minimum of 2 percent.

Subgrade settlement was modeled assuming the subgrade behaves as an elastic medium (30). This assumption implies that any settlement occurs during placement of a given load. Therefore, settlement in the subgrade should occur during the operating life of the landfill and post-closure settlement should be negligibly small. The most important parameter used in this analysis is the elastic modulus of the subgrade. The elastic modulus used was 72,000 ksf which was obtained from conservative estimates for unweathered mudstone (32). The maximum calculated settlements near the center of the landfill are expected to be on the order of 5 inches. Settlement should progressively decrease towards the toe of the sideslopes. These settlements are not expected to result in any excessive stress in the liner system. Details of the subgrade settlement analysis are presented in Calculation No. E-9, in Appendix E.

Final Cover Grades Due to Waste Settlement

As previously mentioned, waste placed at the Facility will consist of hazardous waste which contains no free liquids. All drummed solid material and lab packs will be stacked horizontally in rows within the landfill and the voids between drums filled with compacted bulk wastes. Bulk waste filling will take place in 5 to 10 foot thick horizontal lifts. Waste will be covered with daily cover soil as soon as practicable following waste placement (and minimally at the end of each operating shift). Daily cover soil thicknesses will range from 0.2 to 0.5 ft.

EPA guidelines (54 and 55) suggest a minimum of 3 percent for final cover grades on hazardous waste landfills. The proposed 6 percent initial design cover grade was analyzed to determine the maximum settlement factor to main the final 3 percent grade. The calculated maximum settlement factor was 7 percent. The analysis assumed that the waste settlement is uniform. Calculation No. E-11, Waste Settlement, presents waste settlement computations in Appendix E.

EPA estimates, based on finite element modeling, indicate that settlement factors of 11.5 percent are appropriate for hazardous waste landfills (38). This model considered that the most significant portion of the waste would be solidified material buried in steel drums, with the drums having a maximum allowable void space of ten percent. This model may not be applicable to the Triassic Park Facility because there should be less void space in the waste than that assumed for the model.

In order to mitigate this potential discrepancy between the suggested 11.5 percent and 7 percent, the post-closure waste settlement of Phase 1 should be monitored. The monitoring results will be compared to the estimated settlement factor of 7 percent. If settlement is greater than 7 percent, cover grades of subsequent phases will be steepened to accommodate the settlement and maintain the minimum 3 percent final grade.

3.2.3 Geosynthetics Strength and Performance Analyses

3.2.3.1 Geomembranes

Settlement Induced Stress

The maximum settlement will occur at the base of the cell slopes where the waste load is highest. The subgrade settlement is estimated to be approximately 0.5 feet. This settlement will vary from this calculated maximum at the slope toe to zero at the slope crest. Resulting stresses of 65 psi in the geomembrane are much lower than the 2200 psi geomembrane yield stress. Differential settlement is therefore not expected to damage the liner (34). Details of the liner stress analysis are presented in Calculation No. E-12, Settlement Induced Stress.

Thermal Induced Stress

Due to the 2-foot thick protective soil layer above the liner, the 60-mil HDPE geomembrane liner will not be subject to extended periods of contraction and expansion from daily temperature differentials. Temperature restrictions for installation of geomembrane are discussed in Specification Section 02775.

Tear and Puncture

All geomembranes in the landfill liner and cover system are overlain by at least one layer of geotextile. Review of the puncture resistance of the geotextiles indicates a worst case factor of safety of 3.5 (see Calculation No. E-17, Geomembrane Puncture Resistance in Landfill and Calculation No. E-21, Puncture Resistance of Geotextile/Geocomposite [33]). Therefore, the proposed 60-mil HDPE is adequate to resist puncture stresses.

3.2.3.2 Geocomposites

The geocomposite is intended to act as a lateral drainage layer in both the LCRS and the LDRS. The geonet in the core of the geocomposite is the drainage media and the overlying and underlying geotextile act as filters. The primary design criteria of the geocomposite is the transmissivity. As part of the design process the typical transmissivity values reported in the literature and by manufactures have been reduced to account for clogging of the geotextile, penetration of the geotextile in to the geonet and creep of the geonet.

In order to confirm the actual transmissivity of the material that arrives on the site, the specifications require that the material be tested as part of the conformance testing program. The specific test methods, including backing materials, normal loads, seating times, gradients, and test durations are detailed in the specifications and meet actual design conditions (55).

3.2.3.3 Geotextiles

Geotextile Filtration

Geotextiles are used in a number of locations in both the liner and cover sections for filtration. Specifically, the geotextiles act as filters between the clay liners and drainage layers or between the granular leachate collection material, protective soil cover or general fill and a drainage layer. All of the soil materials expected to be used for either the liners, covers, protective soil cover or general fill are conservatively expected to be fine grained with more than 50 percent of the material passing the Number 200 sieve.

The design criteria outlined by Task Force 25 (31) indicated that for soil material with more than 50 percent passing the #200 sieve, the apparent opening size (AOS) of the geotextile should be less than 0.297 mm. The current geotextile specifications require that the AOS is less than 0.212 mm. Therefore, the geotextile should adequately retain any of the onsite soils. Calculation E-20, Geotextile/Geocomposite filtration, compares specified material AOS values to site soil analyses results.

Geotextile Cushion

The puncture resistance during installation of the proposed geotextile materials was analyzed. The analysis, which used standard design equations (33), was based on the maximum ground pressure exerted by construction equipment, the largest average aggregate size that will be in contact with the geotextile, and the minimum puncture strength properties specified in the General Specifications. Based on these parameters the calculated safety factor for puncture is 3.6, which is acceptable (see Calculation No. E-21, Puncture Resistance of Geotextile/Geocomposite).

3.2.3.4 Geosynthetic Clay Liner

No specific design analyses were conducted on the GCL other than determining the interface friction angle of the material in the liner and cover section. The GCL has a specified permeability of $5x10^{-9}$ cm/sec which exceeds EPA's criteria of $1x10^{-7}$ cm/sec. Detailed specifications for the GCL are presented in the specifications. The critical parameters for the GCL will be confirmed through a conformance testing program on the material that is delivered to the site.

3.2.3.5 Geosynthetics Leachate Compatibility

Specific leachate compatibility tests have not been conducted on the soil or geosynthetic liner components for the Triassic Park facility. These tests have not been conducted at this time, because the specific manufacture of the liner components has not been selected and there is not a representative leachate available for testing. EPA (55) recommends that compatibility testing be done on the specific (manufacture and resin type) liner materials selected for use in a facility and a representative leachate for the facility. Therefore, it is proposed that testing be completed prior to construction once the geosynthetic materials have been selected. Since the facility will not be in operation, a representative leachate will not be available. However, as recommended by EPA (55), market studies can be used to characterize expected waste streams and a synthetic leachate can be developed for use in compatibility testing.

Although compatibility has not been completed, it is expected that the geosynthetic materials selected for the liner and leachate collection system for the Triassic Park Facility have a long track record of successful use at a variety of waste disposal facilities (both municipal waste and hazardous waste) across the US. Therefore, it is not expected that there will be any compatibility issues that would impact the current design. However, as mentioned above, site specific testing will be completed and the results submitted to NMED for approval prior to construction. Supporting information on the compatibility of the HDPE and GCL components of the lining system with various leachates is presented in Appendix H.

3.2.4 Sump Compacted Clay Liner

In the sump base a compacted clay liner will be placed in addition to a GCL layer. The compacted clay liner (CCL) will provide an added thickness to the liner in the area of the sump where leachate is expected to have the longest resident time and the largest head. The specifications for processing, placement, and compaction are detailed in the specifications. The placement criteria in terms of moisture content and dry density is defined by a window with limits defined by the zero air voids curve, a percent saturation line, a minimum dry density and a minimum moisture content. A graph indicating these specific limits is presented in the specifications which were based on actual laboratory testing conducted as part of this study (Appendix D). This method of specifying a compaction window for a CCL is recommended by EPA and is detailed in a series of articles by Prof. Craig Benson (12).

As part of the CQA program samples of the material to be used as the compacted clay liner will be obtained and tested to confirm the permeability criteria ($1x10^{-7}$ cm/sec) can be met. In addition, samples will be taken from the in-place liner to confirm the permeability.

3.2.5 Anchor Trench Design

The pullout capacity of the primary and secondary geosynthetics from the landfill anchor trench was determined. It was assumed the geosynthetics will pull out of the trench with single-sided shear. Single-sided shear is believed to occur rather than double-sided shear because there is less shearing resistance for single-sided shear. Assumed interface friction angles were based on previous laboratory testing for similar materials at low normal stresses. Based on the trench geometry, critical HDPE geomembrane properties, and assumed interface friction angles, both the secondary and primary liners will pull out prior to tearing. Stability calculations for both the secondary and primary liner systems indicate that there are no net downslope forces on the anchor trench because the liner systems are held in place by friction (see Calculation No. E-15, Anchor Trench Pullout Capacity).

3.2.6 Access Ramp Design

Calculation No. E-24, Wheel Loading on Access Ramp, presented in Appendix E, evaluated the puncture resistance of the geomembrane on the landfill access ramps. The ramps grade at 10 percent from the crest of the landfill to the floor. Drawing No. 14, shows the access ramp configuration during initial Phase 1A filling below the ramps and the final configuration after the slope areas above the ramp are lined.

The ramp section consists of the following components(from top down):

- 1 ft thickness of roadbase material
- 12 oz cushion geotextile (enveloping the top and sides of the underlying subbase)
- 2 ft thickness of subbase material
- Basal liner geosynthetics (geocomposite/60 mil THDPE/geocomposite/60 mil THDPE/ GCL/prepared subgrade)

The calculation considered a Caterpillar 631 scraper which weighs approximately 168,000 lbs when fully loaded (16). A factor of safety of 4.6 against puncture of the HDPE is considered acceptable for this loading condition.

An assessment of the stability of the Ramp Liner System under breaking forces from a loaded scraper was also analyzed (34). This analysis utilized the strength parameters from the interface shear testing program. The results presented in Appendix E-6 indicate a factor of safety of 4.3 against sliding on the ramp.

3.2.7 HELP Modeling

Hydrologic Evaluation of Landfill Performance (HELP) (41) modeling was performed to demonstrate equivalency of the proposed Triassic Park landfill liner and cover system with EPA's Minimum Technology Requirement (MTR) systems. This demonstration was submitted to NMED for review and was subsequently approved by NMED on March 11, 1996 and EPA on March 14, 1996. The report entitled, *Triassic Park Hazardous Waste Landfill Alternative Liner System Analyses (Revision 1),* dated March 1996 presents the HELP modeling performed and is reproduced in Appendix E.

The HELP modeling approach used to evaluate the hydrologic performance of the proposed landfill liner and cover alternative follows the NMED's Draft Guidance Document for Performance Demonstration for an Alternative Liner Design Using the HELP Modeling Program Under the New Mexico Solid Waste Management Regulations (20 NMAC 9.1). This approach was selected because it allows a direct comparison between MTR liner system and an alternative liner system,. The results can be used to demonstrate performance equivalency required under 40 CFR 264.301(d).

The conclusions of the HELP modeling as stated in the report are as follows:

- There is little difference between the proposed alternative and MTR in terms of percolation rates through the bottom liner over the life of the facility. The differences that exist in Years 0 through 10 are insignificantly small. The proposed alternate liner performance can therefore be considered equivalent to the MTR liner performance.

- Hydraulic pressure on the primary and secondary liners of both the MTR and proposed alternate liner system is well below the regulatory maximum of 12 inches.

- The cover system leakage is less than or equal to the leakage of the liner system. It effectively reduces precipitation infiltration which will allow the waste to drain once the cover is in place.

3.2.8 Leachate Collection and Removal, Leak Detection and Removal, and Vadose Monitoring System Hydraulic Analyses

Analyses performed to evaluated the effectiveness of the LCRS, LDRS, and Vadose Monitoring Systems are discussed below. Also discussed are slope and vertical riser pipe strength evaluations and the concrete crest riser pad structural analyses.

Leachate Collection and Removal System Analyses

Based on HELP modeling data presented in *Triassic Park Hazardous Waste Landfill Alternative Liner System Analyses (Revision 1),* dated March 1996, maximum LCRS flow rates of 116.8 gallons per acre per day (gpad) for slope areas and 50.9 gpad for floor areas occur during year 11 of the simulated facility life. For Phase 1A, which has a slope surface area of 7.9 acres and floor surface area of approximately

3.4 acres, this totals to approximately 1,100 gpd. Calculation No. E-31, LCRS Pumping Capacity, estimates the flow capacity of the LCRS sump design to be approximately 618,000 gpd (based on Dupuit-Forchniemer Equation [11]).

The flow capacity of the LCRS sump far exceeds the flow rates delivered from the LCRS as determined from the HELP modeling. A Grundfos 50 gpm pump which has the capacity to remove 72,000 gpd is recommended for the LCRS sump. In addition, should flow rates into the LCRS increase beyond those predicted by the HELP modeling or the capacity of the 50- gpm pump, a second leachate removal pump can quickly be added via the vertical riser system, thus increasing the leachate removal rates.

Leak Detection and Removal System Analyses

Adequacy of the leak detection and removal system for Phase 1A is addressed in the Landfill Action Leakage Rate calculation presented in Action Leakage Rate and Response Action Plan (see Appendix G). In this calculation, leakage rates into the LDRS, as determined by EPA's recommended method (60), were compared to flow capacities of the LDRS geocomposite drainage layer and the LRDS sump. Based on these calculations, the flow capacity of the LDRS sump exceeds the flow capacity of the LDRS geocomposite drainage layer and the flow capacity of the LDRS geocomposite drainage layer exceeds the leakage rate into the LDRS. A Grundfos 50 gpm pump which has the capacity to remove 72,000 gpd is recommended for the LDRS system sump.

Vadose Monitoring System Analyses

The vadose monitoring sump serves as a detection system for leakage of the secondary LDRS system. A Grundfos 25 gpm pump is recommended for vadose monitoring sump. In the unlikely event that a leak develops in the LDRS sump, leachate will flow to the vadose monitoring sump where it can be collected and removed.

Evaluation of Slope Riser Pipe and Vertical Riser Pipe Strengths

Calculation No. E-26, Pipe Crushing, presented in Appendix E, considers the stresses and deflections to the slope riser pipes. Based on this calculation, the 18 inch diameter HDPE SDR 11 slope riser pipe ring deflection at maximum burial depths of 160 ft is 0.4 percent. This is less than the manufacturer's recommended ring deflection limit of 2.7 percent (39).

The downdrag loads on the vertical riser pipe were evaluated in Calculation No. G-30 to determine if the vertical riser pipe could damage the liner. The vertical downdrag loads are developed as a result of waste settlement around the vertical pipe. In order to limit the downdrag loads acting on the liner, the lower portion of the vertical riser was de-coupled from the upper portion. The upper portion was founded on a large concrete pad that is located on top of the sump gravel. In addition, a friction break consisting of a double wrap of HDPE was included around the steel vertical riser pipe.

3.2.9 Action Leakage Rate and Response Action Plan

Because of the similar liner components used in the landfill and the evaporation pond a single Action Leakage Rate and Response Action Plan (RAP) was developed which includes both facilities. This plan and its supporting calculations are presented in its entirety in Appendix G . The results are summarized below.

An Action Leakage Rate (ALR) and RAP for the proposed Triassic Park Waste Disposal Facility landfill is required under 40 CFR Parts 302. The ALR, as defined in the final rule published in January 29, 1992, is the maximum design flow rate that the LDRS may remove without the fluid head on the bottom liner exceeding one foot (60). The RAP describes the steps to be taken in the event the ALR is exceeded in landfill . The RAP specifies the initial notifications, steps to be taken in response to the leakage rate being exceeded, and follow-up reports.

The EPA recommended method for determining the landfill ALR presented in Federal Register Vol. 57, No. 19 and in reference No. 59 were used to calculate the ALR for the landfill facility. Using the flow equation for geonets and applying field representative geocomposite transmissivities and appropriate factors of safety for geonet creep and sediment clogging, the recommended ALR for the landfill was determined to be 900 gpad.

The ALR value of 900 gpad is above the EPA recommended value of 100 gpad. The primary reason for this difference is that the EPA value is based on a sand drainage layer with a permeability of 1 x 10^{-2} cm/sec compared to the geocomposite drainage layer transmissivity of $2.2x10^{-4}$ m^2/sec proposed for the Triassic Park Landfill.

Additional computations to check the LDRS sump capacity and LDRS drain pipe capacity are also presented in the Appendix G.

Response Action Plan steps outlined in the Action Leakage Rate and Response Action Plan closely follow the recommended actions presented in Federal Register Volume 57, No. 19.

3.2.10 Surface Water Drainage Analyses

Design parameters for HDPE lined Channels 7 and 8 located above the landfill access ramps are presented on Drawing No. 25 (Sheet 2 of 2). The methodology, assumptions, and run-off calculations for these channels and the collection basins discussed below and are presented in Appendix F.

The clean stormwater collection basin located at the toe of the 2H:1V cut slope in the south end of landfill will contain the run-off from the 15 acres of unlined area of ~~the~~ Phase 1A (above the access ramps). The total run-off from the 25-year, 24-hour event is approximately 4.5 ac-ft. Total volume of the detention pond assuming 1 foot of freeboard is 5.2 ac-ft.

The contaminated water basin ~~collection area~~ at the toe of the Phase 1A waste fill slope is designed to contain the run-off from the entire 15.6 acre fill area of ~~the~~ Phase 1A. The total run-off from the 25-year, 24-hour event is approximately 4.3 ac-ft. The contaminated water basin is approximately 560 feet by 200 feet and can store approximately 10.4 ac-ft assuming 1 foot of freeboard. The contaminated water basin will be constructed at the same time as the rest of the Phase 1A landfill so it can accommodate runoff from waste placed in Phase 1A.
~~Total volume of this collection area, assuming 1 foot of freeboard, is approximately 10.4 ac-ft.~~

3.2.11 Soil Erosion Analyses

Due to the temporary nature of the 2H:1V cut slope and the 3H:1V subgrade slopes above the access ramps, severe soil erosion of these slope areas is not anticipated. The 2H:1V cut slope will be excavated during future landfill construction and the 3H:1V subgrade areas above the access roads will be conditioned prior to liner placement as required in the specifications.

Erosional features such as rills and localized slumping in exposed areas of the protective soils layer on the 3H:1V slope areas will be repaired following rain events.

3.2.12 Frost Protection

The maximum frost depths in the Roswell area, indicates that frost may reach 23 inches during the winter months. In addition, site-specific frost penetration modeling for the site indicated a maximum design freezing depth of 2.3 feet for this cover. Recent studies by Kraus (36) evaluating the effects of frost on geosynthetic clay liners indicate that there is little change in the permeability of the GCLs due to frost. Since the landfill utilizes GCLs in combination with HDPE as barrier elements for both the liner system and the cover system, frost damage to these layers is not expected. However, the 2.5-foot thick vegetative layer on the cover system will also provide frost protection for underlying geosynthetics and soil components in the cover section, two feet protective soil is specified on the side slopes of the landfill. Due to the relatively short time period that the side slopes will be exposed without waste placement, the 2-foot cover thickness is considered adequate.

3.2.13 Earthwork Volumetrics

Table 3 lists the material quantities for subgrade excavation, structural fill, cover and liner soil components, and the net waste airspace available for Phase 1A development. Table 3 also lists material quantities for the final landfill configuration.

TABLE 3
LANDFILL PHASE 1A MATERIAL BALANCE
AND ULTIMATE LANDFILL MATERIAL BALANCE

Material Balance Phase 1A		
	LOOSE OR COMPACTED CUBIC YARDS	**BANK CUBIC YARDS**
Design Capacity		
Total Airspace		691,540 bcy
Liner Area		14.5 acres
Cover Area (Top of Waste)		11.9 acres
Volume of cover (NOT included in airspace)		0 bcy
Volume of Liner (NOT included in airspace)		0 bcy
Remaining Airspace		691,540 bcy
Volume of Daily Cover (20% of total)		138,308 bcy
Total Waste Capacity		**553,232 bcy**
Total Soil Requirements		
Volume of Daily Cover (20% of total)	170,119 lcy	138,308 bcy
Volume of Liner Material (0.5 foot)	92,194 ccy	83,813 bcy
Volume of Cover (4 feet)	718,385 ccy	653,077 bcy
Total Volume of Soil Required		875,198 bcy
Total Cut Volume		2,797,921 bcy
Cut/Fill Balance Difference		**1,922,723 bcy**
Material Balance Ultimate Landfill		
Design Capacity		
Total Airspace		13,997,654 bcy
Liner Area		103.9 acres
Cover Area (Top of Waste)		101.2 acres
Volume of cover (NOT included in airspace)		0 bcy
Volume of Liner (NOT included in airspace)		419,063 bcy
Remaining Airspace		13,578,591 bcy
Volume of Daily Cover (20% of total)		2,715,718 bcy
Total Waste Capacity		**10,862,873 bcy**
Total Soil Requirements		
Volume of Daily Cover (20% of total)	3,340,333 lcy	2,715,718 bcy
Volume of Liner Material (0.5 foot)	92,194 ccy	88,813 bcy
Volume of Cover (4 feet)	718,385 ccy	653,077 bcy
Total Volume of Soil Required		3,452,608 bcy
Total Cut Volume		10,281,466 bcy
Cut/Fill Balance Difference		**6,828,858 bcy**

TABLE 3 LANDFILL PHASE 1A MATERIAL BALANCE AND ULTIMATE LANDFILL MATERIAL BALANCE	
Notes:	1) lcy = 1.23 bcy 2) ccy = 1.1 bcy

4.0 EVAPORATION POND

4.1 EVAPORATION POND DESIGN

4.1.1 General

The purpose of the evaporation pond is to treat liquid wastes which meet land ban restrictions. The majority of these liquid wastes will be leachates collected from the landfill LCRS or other containment sump systems on site. The pond may receive leachates from other off-site sources. This unit will not be used to manage wastes containing volatile organic concentrations greater than 500 parts per million by weight (ppmw).

The volume of liquids in the pond will be dependent on the waste market. Net evaporation (total evaporation minus rainfall) for the site is in the range of 80 inches per year.

Evaporation pond design elements include pond layouts and phasing; subgrade design; liner system design; and leak detection system , and vadose monitoring sump design. This section describes each of these design elements.

4.1.2 Evaporation Pond Layout and Phasing

The proposed evaporation pond area layout and phasing is illustrated on Drawing No. 28. Pond 1 will be constructed initially and will service site operations during waste filling of landfill Phase 1A. A future Pond 2 would be located east of Pond 1 and would provide additional pond treatment capacity as the landfill expands into Phases 2 and 3. Space has been allocated in the site layout to the east of Future Pond 2 should demand for pond storage capacity increase beyond that currently provided in the design.

Ponds 1 and 2 are each divided into two separate ponds, A and B. This arrangement provides separate pond units which can be placed into service independently. For example, in the event of a major rain event or should the Pond 1A primary liner begin to leak, additional pond storage capacity available in Pond 1B could immediately be brought on line. Each pond unit is equipped with its own discharge station. An inter-pond transfer pump will be located on separation berm between the A and B pond units. Provisions to curtail placement of liquid wastes into an impoundment that has exceeded its ALR are discussed in Appendix G.

Pond units 1A and 1B are each 135-ft wide by 290-ft long by 12-ft deep and each will contain approximately 2.62 million gallons. Side slope angles are 3H:1V except for the inter pond berms which have 2H:1V sideslopes. Leak detection and vadose monitoring sumps are located centrally on the long side of the pond units. Pond floor grades are a minimum 2 percent towards the sumps.

Pond overtopping will be controlled manually through the use of liquid elevation indicators placed in the pond. These indicators will be graduated vertical rods fixed to a stable base. The rods will be placed such that graduated markings can be easily read from the discharge station. The rods will be surveyed when placed and checked by survey periodically to ensure accuracy. Correlation charts between elevation and pond volume will be maintained at the discharge station of each pond. Pond discharge pipes will also be equipped with flow meters so that liquid volumes placed in the pond can be continuously tracked and documented. Filling of the ponds above the 2-foot freeboard limit will not be permitted. Site personnel will be present during all fluid discharge and transfer operations to ensure that pond overtopping does not occur in the event of equipment malfunction or other human error.

Due to the small aerial extent of the evaporation ponds and limited fetch distance, wave action developed in the pond fluid surface will also be limited. The 2-ft freeboard distance will accommodate minimal wave action without overtopping. At closure, the pond will be backfilled to surrounding ground and revegetation.

4.1.3 Subgrade Excavation, Liner System, LDS Sump Design and Vadose Monitoring Sump Design

Subgrade Excavation

Drawing No. 28 shows the evaporation pond excavation contours. The crest of the evaporation pond is essentially flat. Fill areas around the perimeter of the ponds along with site grading outside of the pond area provide sufficient grade differences for storm water run-off to flow to the perimeter road ditches and ultimately to the storm water detention basin located in the northwest corner of the site.

Specification Section No. 02110, Site Preparation and Earthwork, describes site preparation, excavated soil classification and stockpiling, subgrade surface preparation and inspection, structural fill placement and compaction requirements, survey and quality control, and erosion control features.

Liner System

Drawing Nos. 30, 31 and 32 show the evaporation pond liner components ~~on~~covering the floor and~~,~~ slopes, and extending into the anchor trench areas. The liner system will be continuous over the berm between the A and B units. The evaporation pond liner system is a double lined system consisting of (from bottom up) a composite (compacted clay and geomembrane) secondary liner, a geonet leak detection drainage layer, and a primary geomembrane liner. Details of each liner component are discussed below:

- *3-foot thick compacted clay liner (CCL)*

  The CCL ($k \leq 1x10^{-7}$ cm/sec) in combination with the overlying HDPE geomembrane will serve as a low permeability barrier layer to restrict infiltration of leachate into the subgrade. The CCL will consist of clay material (CL, CH) obtained during excavation of the landfill and surface impoundment. Specification Section 02221, Clay Liner, describes clay material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements. Soil under leachate compatibility tests ~~(EPA 9090)~~(two stage permeability testing using ASTM D 5084) will be conducted prior to construction. In addition, a test fill will be constructed, as per the procedures outlined in the CQA plan. The results of the permeability testing performed compacted samples are shown in the appendices.

  Soil liner compatibility is normally not a problem unless the leachate contains high concentrations o~~r~~f organics (Eklund, 1985; Peterson and Gee, 1985; Mitchell and Madsen, 1987; Finno and Schubert, 1986). Additional supporting information on the compatibility of the CGL with various leachate is presented in Appendix E-40.

- *60-mil thick high density polyethylene (HDPE) geomembrane liner (smooth)*

  The 60-mil HDPE liner placed on top of the CCL is the second component of the composite secondary liner. Together, the CCL and HDPE liner form a highly efficient barrier layer to restrict percolation of leachate into the subgrade (see Section 3.2.7, HELP

Modeling). Specification Section 02775, Geomembrane Liners, describes minimum geomembrane properties required, subgrade preparation and inspection, material transportation and handling procedures, deployment and seaming requirements, and material CQA.

Site specific compatibility tests will be conducted on a synthetic leachate and the proposed liner prior to operation of the facility.

- *Geonet leak detection drainage layer (transmissivity $\geq 5x10^{-3}$ m^2/sec as tested under actual field conditions)*

  The high transmissivity geonet leak detection drainage layer provides a means to transmit and remove leachate percolating through any leaks in the primary geomembrane layer above. Flow calculations discussed in Section 4.2.7 and presented in Appendix G indicate that the geonet is capable of removing leachate in a timely manner such that head on the underlying geomembrane will remain less than 1 foot. Specification Section 02712, Geonet, describes minimum geonet properties required, material transportation and handling procedures, deployment and seaming requirements, and material construction quality assurance.

- *60-mil thick high density polyethylene (HDPE) geomembrane liner (smooth)*

  This HDPE geomembrane serves as the liner systems primary barrier layer of the double liner system. Specification Section 02775, Geomembrane Liners, discussed above also applies to this geomembrane layer.

  Site specific compatibility tests will be conducted on a synthetic leachate and the proposed liner prior to operation of the facility.

Since portions of this liner component will be permanently exposed to sunlight and UV radiation, it may be necessary to replace it prior to the end of the facility life. The lifetime of exposed geomembrane liners varies, however, it is generally limited to the warranty period of the product which may be as long as 20 years (33). The staged approach to pond development will help alleviate this concern, as will maintaining fluid levels near capacity in the primary use pond unit. Periodically alternating pond units for primary use will also reduce exposure time.

Leak Detection and Removal and Vadose Monitoring Sump Systems

The leak detection and vadose monitoring systems each have a separate sump from which fluids can be collected and removed. The liner systems on the ~~landfill~~ evaporation pond floor continue into the sumps, however, in order to provide adequate volume to efficiently operate removal pumps, gravel thicknesses are incorporated into the drainage systems. Drawing No. 32 illustrates the sump layout and cross section. As shown on the drawings, the sumps are square pyramidal shapes which lie concentrically above one another. The slope riser pipe trenches enter their respective sumps at the sump base. The slope riser trench arrangement enables the vadose and leak detection slope riser pipes to penetrate overlying geosynthetic liner elements at the crest of the ~~landfill~~ evaporation pond rather than in the sump area. The leak detection sump has a total fluid capacity of 1,790 gallons (after accounting for gravel). Similar to the landfill leak detection sump, the evaporation pond sump will be equipped with fluid level instrumentation and a 50 gpm fluid removal pump. The vadose monitoring sump has a total fluid capacity of 95 gallons (after accounting for gravel).

4.1.4 Evaporation Pond Discharge Pad Arrangement

Drawing No. 31 illustrates the slope riser piping and valving, the discharge pipe arrangement, and the layout for the concrete containment pad. Tanker trucks will pull up next to the concrete pad and hook up to the desired piping system. Hose connections at the pipes are located within the concrete pad area to contain any leakage. A concrete pad will be placed in the loading/unloading area for the tanker trucks. This pad will be sloped providing drainage toward the sump area. The concrete containment pad slopes towards the evaporation pond crest. Should a catastrophic failure of the piping system occur, leachate will flow back into the evaporation pond rather than be released to unlined areas. The evaporation pond liner system anchor trench will completely encompass the pad so that any leakage through the pad will also drain back into the evaporation pond. Construction details for the concrete containment pad are called out in Specification Section 03100, Concrete Formwork, Section 03200, Reinforcement Steel, Section 03290, Joints in Concrete, and Section 03300, Cast-in-Place Concrete.

Storm Water Control Features

Drawing No. 5 depicts the surface grades around the perimeter of the pond area. Surface water run off from these areas will flow to the roadway ditch system and ultimately to the surface water detention pond.

4.2 EVAPORATION POND DESIGN ANALYSES

4.2.1 Slope Stability

Cut Slope Stability

Prior to filling, unsupported cut slopes will exist on all sides of the evaporation pond. These slopes were analyzed for static and dynamic stability using the Bishop method of slices. A computerized slope stability program (XSTABL) (44) was used to analyze the cut slopes. Strength parameters used for soil and rock materials were estimated using pocket penetrometer data gathered during test pitting of the ~~of~~ site soil materials. The material properties used in the analyses are summarized in Appendix E.

The site grading plans (Drawing Nos. 28 and 29) indicate that the maximum cut slopes will be 3H:1V and 2H:1V and maximum height will be approximately 12 feet. Results for the critical 2H:1V slope as presented in Calculation E-7, indicate a static factor of safety of 19.8 for the critical short term (undrained) condition. Stability during seismic loading was estimated by applying a pseudo-static earthquake force in the Bishop analysis. Results based on the 0.04 g design acceleration indicate a dynamic factor of safety of 15.7 for the short term (undrained) condition.

Slope stability was not considered for the filled evaporation pond configurations. Filling the pond with fluid does not place any stresses on the liner system which could cause instability.

4.2.2 Settlement

The evaporation pond will experience relatively low overburden pressures due to its shallow depth and liquid fill density in comparison to pressures previously imparted to the clay during placement compaction. Clay liner consolidation will therefore be negligible.

4.2.3 Geosynthetics Strength and Performance Analyses

As discussed in Sections 4.2.1 and 4.2.2 above geosynthetics components of the evaporation pond will not experience significant stresses related to slope stability or settlement. Settlement induced stresses to evaporation pond geosynthetics were, therefore, not considered.

4.2.3.1 Geomembranes

The general use of geomembranes in the evaporation pond is similar to that described for the landfill. Thermal induced stress and tear and puncture evaluations are discussed below.

Thermal Induced Stress

The 60-mil HDPE geomembrane liner will be subject to contraction and expansion from daily temperature differentials. The contraction/expansion potential of the HDPE liner was determined, and the maximum induced stress was determined. Calculation No. E-27, Thermal Induced Stress in Evaporation Pond Liner, indicates the maximum induced thermal stress in the liner would be 560 psi. This value is far below the 2200 psi minimum yield strength of liner, which yields a design safety factor of 3.9.

Tear and Puncture

The evaluation of geomembrane tear and puncture in the landfill liner system was presented in Section 3.2.1.2 . The results of that analyses indicated that the 60-mil HDPE geomembranes were adequate for loading conditions which were much more severe than those expected for the evaporation pond. Since similar HDPE products will be used in the evaporation pond and the same subgrade surface preparation methods are required by the specifications, separate calculations for evaporation pond geomembrane tear and puncture are not necessary.

4.2.3.2 Geonets

The geonet is intended to act as a lateral drainage layer in the evaporation pond LDRS. The primary design criteria of the geonet is the transmissivity. Calculations presented in Appendix G-2 evaluate the typical transmissivity values reported in the literature and by manufactures. These values have been reduced to account for clogging of the geotextile, penetration of the geotextile in to the geonet and creep of the geonet.

In order to confirm the actual transmissivity of the material that arrives on the site, the specifications require that the geonet be tested as part of the conformance testing program. The specific test methods, including backing materials, normal loads, seating times, gradients, and test durations are detailed in the specifications.

4.2.3.3 Geotextiles

Geotextile Filtration

Geotextiles are used in a number of locations in both the liner and sump sections for filtration. Specifically, the geotextiles act as filters between the pipe bedding material or between the granular leachate collection material. Similar to the landfill evaluation, if these soil materials are conservatively estimated to be fine grained with more than 50 percent of the material passing the Number 200 sieve, then the specified geotextile with a AOS of less than 0.212 mm should adequately retain these soils.

Geotextile Cushion

The puncture resistance during installation of the proposed geotextile materials was analyzed for more severe conditions in the landfill design. Therefore, these calculations are not repeated for the evaporation pond application.

4.2.4 Compacted Clay Liner

As previously discussed for the sump CCL, the criteria for the CCL materials characteristics and the placement and compaction criteria are presented in the specifications.

4.2.5 Anchor Trench Design

The pullout capacity of the primary and secondary geosynthetics from the evaporation pond anchor trench was determined. It was assumed the geosynthetics will pull out of the trench with single-sided shear. Single-sided shear is believed to occur rather than double-sided shear because there is less shearing resistance for single-sided shear. Assumed interface friction angles were based on previous laboratory testing for similar materials at low normal stresses. Based on the trench geometry, critical HDPE geomembrane properties, and assumed interface friction angles, pullout resistance calculations for both the secondary and primary liner anchor trenches indicate that the HDPE geomembranes will pull out prior to tearing (see Calculation No. E-15).

4.2.6 Leak Detection and Vadose System Hydraulic Analyses

The leak detection system design and performance is very similar to the landfill system. Therefore, design analyses for the following criteria are not discussed. Rather the reader is referred to Appendix E for the detail of the calculations.

Adequacy of the leak detection and removal system for the evaporation pond is addressed in the Action Leakage Rate calculation presented in Action Leakage Rate and Response Action Plan (see Section 4.2.7 below and Appendix G). In this calculation, leakage rates into the LDRS, as determined by EPA's recommended method, were compared to flow capacities of the LDRS geonet drainage layer and the LRDS sump. Based on these calculations, the flow capacity of the LDRS sump exceeds the flow capacity of the LDRS geonet drainage layer and the estimated leakage rate into the LDRS. A Grundfos 50 gpm pump which has the capacity to remove 72,000 gpd is recommended for the LDRS system sump.

Vadose Monitoring System Analyses

The vadose monitoring sump serves as a detection system for leakage of the secondary LDRS system. A Grundfos 25 gpm pump is recommended for vadose monitoring sump. In the unlikely event that a leak develops in the LDRS sump, leachate will flow to the vadose monitoring sump where it can be detected and removed.

4.2.7 Action Leak Rate and Response Action Plan

Because of the similar liner components used in the landfill and the evaporation pond a single ALR and RAP was developed which includes both facilities. This plan and its supporting calculations are presented in its entirety in Appendix G. The results are summarized below.

An ALR and RAP for the proposed Triassic Park Waste Disposal Facility evaporation pond is required under 40 CFR Parts 302. The ALR, as defined in the final rule published in January 29, 1992, is the maximum design flow rate that the LDRS may remove without the fluid head on the bottom liner exceeding one foot. The RAP describes the steps to be taken in the event the ALR is exceeded in the evaporation pond. The RAP specifies the initial notifications, steps to be taken in response to the leakage rate being exceeded, and follow-up reports.

The EPA recommended method for determining the landfill ALR was used to calculate the ALR for the evaporation pond. Using the flow equation for geonets and applying field representative geonet transmissivities and appropriate factors of safety for geonet creep and sediment clogging, the recommended ALR for the evaporation pond was determined to be 1000 gpad.

Although computations indicated a much higher ALR value could be justified, the ALR value of 1000 gpad, which is equal to the maximum EPA recommended value of 1000 gpad, was selected because this value adequately represented a "large and rapid" leak considering the small size of the evaporation ponds.

Additional computations to check the LDRS sump capacity and LDRS drain pipe capacity are also presented in the Appendix G.

Response Action Plan steps outlined in the ALR and RAP closely follow the recommended actions presented in the Federal Regulations.

4.2.8 Frost Protection

Based on the landfill design, the design depth of frost at the site could be in the range of 2.3 feet (see Calculation No. E-25, Frost Penetration). Review of the evaporation pond design indicates that portions of the clay liner above the pond fluid level may be exposed to frost action. The following paragraph discusses resulting effects this may have on leakage to the environment.

Unlike the landfill, the evaporation pond is a temporary facility to be removed from service during the facility's post closure period. Increased permeability of the clay liner and any resulting leakage is therefore, not as critical as with a permanent landfill installation. Further, due to the insulating ~~a~~effects of the pond liquids, only portions of the clay liner above the fluid level in the pond will reach freezing temperatures. Finally, the evaporation pond design incorporates a vadose detection system and a leak detection system. Any leakage detected will be removed and if large enough, based on the action leakage rate, will cause remedial steps to be taken to locate and repair damage to the geomembrane, thus limiting exposure of fluids to the clay liner. Therefore, in our judgment, any increase in permeability of the clay liner due to potential damaging effects of frost will not result in significant increases of liquids released to the environment.

4.2.9 Earthwork and Pond Volumetrics

Approximately 62,500 cy of soil materials will be excavated to construct evaporation Pond 1. Clay liner construction will require placement of 22,150 cy of compacted clay liner material. The resulting pond volume available for liquid evaporation (not including 2 ft of freeboard) is approximately 5.2 million gallons.

5.0 TRUCK ROLL-OFF AREA

5.1 TRUCK ROLL-OFF AREA DESIGN

5.1.1 General

It should be noted that the incoming trucks containing unstabilized waste will be Department of Transportation (DOT) approved roll off vehicles (17). These trucks are required by DOT to be covered. Additionally, the roll-off bin must be free of leaks and the waste must be contained with a plastic bed liner. Together, the roll-off bin and the plastic bed liner are considered a double lined system. This containment system will remain in place the entire period the roll-off bin is staged in the truck roll-off area. The liner system incorporated in the ~~unstabilized~~ waste roll-off area is included as a precautionary measure.

It should also be noted that some roll-off containers staged in the area will contain stabilized waste which has met the paint filter tests for free liquids. Additionally, these roll-off bins will be lined using a plastic bed liner and will be covered in a manner similar to DOT approved roll-off containers.

The purpose of the truck roll-off area is to provide a staging area for incoming roll-off bins containing unstabilized waste destined for the stabilization facility and a second staging area for roll-off bins containing post treatment stabilized waste awaiting landfill disposal approval.

The truck roll-off area is surrounded by a berm with a minimum height of 2.0 feet (see Drawing 41). This berm will divert run-on surface water around the perimeter of the truck roll-off area. Culverts are proposed under each of the access ramps to allow surface water flow to the west towards the run-off detention basin. The interior depth of the berms is also a minimum of 2.0 feet. The 25-year, 24-hour storm for the site is 4.3 inches. This is expected to result in ponding inside the roll-off area to a depth of approximately 2 feet in the sump area and in the range of 1-foot or less in the central area. Incoming waste roll-off containers are not expected to contain free liquids. The sumps will be pumped to remove any accumulated water after any rainfall event.

Truck roll-off area design elements include truck roll-off area layout, subgrade design; liner design; and drainage sump design. This section describes each of these design elements.

5.1.2 Truck Roll-Off Area Layout

Drawing Nos. 41 and 42 illustrate the layout of the Truck Roll-Off Facility. Each is approximately ~~290~~310 ft long by 1~~7~~80 ft wide roll-off cell can stage approximately 66 roll-off bins. The floor of each cell grades at 2 percent towards its respective sump and the surrounding soil berms have side slopes of 1.5H:1V and range in elevation from 4~~6~~ ft to 8~~10~~ ft. Cell access is provided by four ramps which grade at 10 percent.

The west cell will be used for unstabilized waste, and the east cell will be used for stabilized waste

5.1.3 Subgrade Excavation, Liner System, Drainage Sump Design, and Leak Detection System Design

Subgrade Excavation

Drawing No. 41 shows the truck roll-off area excavation and fill contours. Cut areas in the central portion of the facility are made to achieve the required floor grades. The berms and fill areas around the perimeter of the truck roll-off area and surrounding site grading provide sufficient grade differences for storm water run-off to flow to the perimeter road ditches and ultimately to the storm water detention basin.

Specification Section No. 02110, Site Preparation and Earthwork, describes site preparation, excavated soil classification and stockpiling, subgrade surface preparation and inspection, structural fill placement and compaction requirements, survey and quality control, and erosion control features.

Liner System

Drawing No. 43 shows the liner components on the floor, berm, and anchor trench areas. The truck roll-off area for roll-off bins is a single lined system consisting of (from bottom up) a prepared subgrade, a geomembrane underliner, a geonet drainage layer, a geotextile filter layer, a soil subbase layer, and a surface gravel layer. This design should accommodate the limited truck traffic that will be required to load and unload the roll-off boxes. Details of each liner component are discussed below.

- *6-inch thickness of prepared subgrade*

  The prepared subgrade component will provide a smooth stable surface suitable for placement of overlying geosynthetic materials. Specification Section 02119, Prepared Subgrade, presents subgrade material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements.

- *60-mil thick high density polyethylene (HDPE) geomembrane underliner (smooth)*

  The 60-mil HDPE liner placed on top of the prepared subgrade liner form a highly efficient barrier layer to restrict percolation of rain water into the subgrade. Specification Section 02775, Geomembrane Liners, describes minimum geomembrane properties required, subgrade preparation and inspection, material transportation and handling procedures, deployment and seaming requirements, and material construction quality assurance.

  Site specific compatibility tests will be conducted on a synthetic leachate and the proposed liner prior to operation of the facility.

- *Geocomposite leak detection drainage layer (transmissivity $\geq 2.2 \times 10^{-4}$ m^2/sec) as tested under actual field conditions*

  The high transmissivity geocomposite drainage layer provides a means to transmit and remove rainwater falling within the unstabilized waste roll-off bin area. Flow calculations discussed in Appendix E indicate that the geocomposite is capable of removing rainwater so that ponding can be minimized and trafficability of the upper gravel surface can be maintained. Specification Section 02710, Geocomposite, describes minimum geocomposite properties required, material transportation and handling procedures, deployment and seaming requirements, and material CQA.

- *18-inch thickness of soil subbase layer*

  The soil subbase will consist of free draining soils classified as SM, SW, GM, of GW.

Specification Section 02230, Subbase, presents material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements.

- *6-inch thick road base gravel surface*

  The road base gravel surface will allow storm water to drain from the surface while providing sufficient bearing capacity for truck traffic. Any disturbance of the road base surface as a result of loading and unloading the roll-off trailers will be observed during the weekly inspections of the unit and repaired by placement of new material or re-grading of the raising material. In the case of severe rutting (greater than 6 inches) the area will be excavated and the geosynthetic materials will be inspected for damage. Repairs will be made if required. Specification Section 02225, Road Base, presents material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements.

  Potential leakages from the containers would be very limited and are not expected to react with the road-base aggregate.

Drainage Sump System

The drainage sump will collect storm water run off from the floor of the truck roll-off area. The liner systems on the truck roll-off area continue into the sump, however, in order to provide adequate volume to efficiently operate the removal pump, a gravel thickness has been incorporated into the drainage systems. Drawing No. 43 illustrates the sump layout and cross section. As shown on the drawings, the sump is a triangular pyramidal shape. The slope riser pipe enters the sump at the sump base. The slope riser trench arrangement enables the leak detection slope riser pipe to penetrate the overlying geomembrane liner elements at the crest of the truck roll-off area berm rather than in the sump area. The sump has a total fluid capacity of 1,406 gallons (after accounting for gravel). The truck roll-off area drainage sump will be monitored visually to determine whether pumping is required. Fluid removal will be performed by a vacuum truck.

5.2 TRUCK ROLL-OFF AREA DESIGN ANALYSES

5.2.1 Geosynthetics Strength and Performance Analyses

5.2.1.1 Geomembranes

The evaluation of geomembrane puncture in the truck roll-off liner system is presented in Calculation No. 18, Geomembrane Puncture Resistance. The results of the calculation indicate that the 6-inch road base and 18 inch subbase materials will adequately dissipate truck wheel loads and, in conjunction with the subgrade preparation specifications, which call for a 1 inch maximum particle size, will adequately protect the geomembrane from puncture. A calculated factor of safety of 60 to 1 against puncture was computed.

5.2.1.2 Geocomposite

Low overburden pressures due to the overlying roadbase and subbase are not high enough to adversely affect transmissivity of the geocomposite. Review of the texnet transmissivity charts presented in Calculation No. G-1, Landfill Action Leakage Rate support this.

5.2.1.3 Geotextiles

Geotextile filtration and puncture resistance are evaluated in Calculation No. E-20, Geotextile/Geocomposite Filtration, and Calculation No. E-21, Puncture Resistance of Geotextile/Geocomposites, respectively. Based on these calculations, the geotextiles specified for the truck roll-off area will adequately filter the sites fine grained materials and resist puncture.

5.2.2 Anchor Trench Design

The purpose of the truck roll-off facility anchor trench is to hold the geosynthetic liner components in place during placement of the overlying subbase and roadbase materials. Pull out considerations due to settlement are not a relevant concern for this facility.

5.2.3 Storm Water Collection Sump and Leak Detection Sump Containment Hydraulic Analyses

Calculation No. E-32, Truck Roll-Off LDRS Pumping Capacity, evaluates the capacity of the storm water collection sump in the lined portion of the truck roll-off facility to remove water from the geonet drainage layer. Based on this calculation, the geonet flow capacity is estimated to be 161,000 gpd and the sump capacity is estimated to be 199,000 gpd. The sump will, therefore, provide adequate water removal capabilities.

6.0 STABILIZATION FACILITY

6.1 STABILIZATION FACILITY DESIGN

6.1.1 General

The purpose of the stabilization facility is to treat waste streams using a chemical stabilization process which will chemically alter hazardous waste constituents such that their leachability is reduced to levels allowing landfill disposal. The stabilization treatment process involves combining chemical reagents with waste materials according to a specific treatment recipe and mixing until the waste/reagent reactions are complete. The –batch stabilization mixing method to be used in the Triassic Park Stabilization Facility requires a backhoe excavator to mix waste with reagents in a large double lined steel bin. The materials treated will be in the bins for a limited amount of time, therefore only concentrated acids will not be allowed in the bins.

Stabilization facility design elements presented here include stabilization facility layout; stabilization bin, bin vault, and floor design; and stabilization process design. This section describes each of these design elements. It should be noted that certain components of the stabilization building, process control and delivery systems, ventilation systems and steel bins will be completed under future design/build contracts.

6.1.2 Facility Layout

Drawing No. 3 illustrates the layout of the stabilization building and the surrounding area. As previously discussed, the Stabilization Facility has entrances for incoming trucks on both the north and south access roads. These accesses will be used for incoming waste trucks loaded with unstabilized waste for processing in the bins. Incoming trucks will enter the gravel lined apron on the north or south side of the facility and back into the stabilization building. Once the load has been dumped into the bin and the truck bed washed out, the truck will exit the facility via the entrance route. The east and west building entrances will be used by stabilized waste loadout trucks which will cycle between the truck roll-off area or the landfill. The gravel lined areas surrounding the stabilization facility will not be used to stage waste hauler trucks. Parking areas for site personnel vehicles will be designated near the stabilization facility control room.

The control room is positioned centrally along the ~~west~~ east wall of the stabilization building. From this vantage point operations personnel will be able to monitor all activities taking place inside the building. Reagent storage tanks and silos are also located on the ~~east~~ eastside of the building which permits operations personnel to view reagent delivery activities.

The stabilization building's internal arrangement is centered around the four waste mixing bins. The mixing bins are orientated such that delivery, mixing and loadout operations can take place from either the north or the south sides of the building. Stabilization unit operations are depicted on Drawing No. 34. The 25 ft long by 10 ft wide by 10 ft deep bins can hold a maximum of approximately 100 cy of waste and reagent material. The double lined steel bins are located within a 38 ft wide by 79 ft long by 12 ft deep concrete vault which has a total volume of 1,330 cy. The bin and vault arrangement provides three levels of waste containment with the inner bin liner serving as primary containment, the outer bin as secondary containment, and the vault as final or tertiary containment.

The 118 ft wide by 123 ft long concrete floor is sized to accommodate the backhoe mixer and load out truck operations with adequate clearances. Section 6.2.3 discusses working point distance and clearance radius requirements for this operation.

The vertical dimensions for the stabilization building will be established during the building design/build phase when locations and sizing of the reagent delivery system and ventilation system are finalized.

6.1.3 Bin Liner, Bin Vault, and Floor Design

The stabilization bin arrangement is a double lined system consisting of two concentric steel bins separated by a network of wire rope isolators. The bins must be able to withstand the impacts from mixing with a backhoe bucket and also be relatively compatible with the waste that will be placed in the bins. Since the bins are concentric, the outer bin (secondary containment) can hold 100% of the volume of the inner bin. The wire rope isolators act as shock absorbers to dissipate impact loading to the bins by the mixing action of the backhoe. The wire rope isolators also serve to reduce impact loading transferred to the concrete vault floor and walls. Drawing No. 35 illustrates the inner and outer bin arrangements, bin dimensions, plate thicknesses, reinforcing rib arrangements, and locations of the wire rope isolators. The inner bin is not attached to the outer bin and therefore, can be removed for repair or replacement. The space between the bins provides access for leak detection instrumentation and fluid removal piping. Should a leak in the inner bin occur such that fluids escape into the inter-bin space, the leak detection instrumentation will trigger alarms in the control room immediately notifying the operators. The bin can then be taken out of service, inter-bin fluids removed, bin walls inspected, and repairs made if necessary. The outer bin is attached to the floor of the concrete vault. Drawing No. 33~~5~~ shows the location of the leak detection and fluid removal piping. Liquid in the leak detection and fluid removal pipes may be monitored using a probe and removed by pumping, if necessary. The design of the bin has been based on a rational assumption of the design mixing and has selected a design thickness based on a reasonable curve of risk for damage. It is fully realized that if a worst case loading condition arose and the bins were cracked or otherwise damaged to the point of not providing containment than the bin would be taken out of service and repaired or replaced. Outline Specification for Proposed Hazardous Waste Mixing Bins at the Triassic Park Facility, presented in Appendix E, describes the steel plate, reinforcing members, and energy absorbing devices intended for the stabilization bin system.

The ~~-~~1,330 cy concrete vault which will contain the stabilization bins has the capacity to easily contain ~~100 percent of~~ the volume of ~~one~~all 4 100 cy bins (~~i.e., after removing~~ 400 cy total capacity)~~ for each bin~~. As mentioned above, the vault serves as a tertiary containment feature should a catastrophic bin failure occur. In addition, the vault also provides access to the bins for inspection purposes and for ancillary reagent delivery piping and ventilation ducts. Construction details will be prepared for the concrete containment vault similar to those provided in Specification Section 03100, Concrete Formwork, Section 03200, Reinforcement Steel, Section 03290, Joints in Concrete, and Section 03300, Cast-in-Place Concrete.

The concrete floor will be steel reinforced cast-in-place concrete. All joints in the concrete floor will be constructed with chemical resistant water stops and caulking sealer. Drawing No. 44 shows the rebar types and concrete details for the floor. Construction details for the floor will be prepared similar to those provided in Specification Section 03100, Concrete Formwork, Section 03200, Reinforcement Steel, Section 03290, Joints in Concrete, and Section 03300, Cast-in-Place Concrete. Specification Section 07970, Sealants and Caulking describes the concrete epoxy coating requirements.

6.1.4 Stabilization Process Design

Drawing No. 34 summarizes the major waste processing unit operations and illustrates typical waste and reagent stream flows. Also shown are reagent tank and silo capacities, delivery piping, and control valve and flow meter locations.

Waste processing unit operations include waste receiving, reagent addition, stabilization mixing, and stabilized waste loadout. Waste receiving involves positioning loaded waste hauler at the end of the bin, dumping the waste load, and washing out any residue left in the truck bed into the bin. Reagent addition involves placing a cover on top of the bin, connecting ventilation and dry reagent delivery ducts, and injecting reagents into the bin. Reagent delivery to the bins will be controlled by a process controller (computer) system which will automatically sequence and deliver the necessary quantities of reagent based on a predetermined waste processing recipe. The bin cover will then be removed and a backhoe type excavator will mix the reagents with the waste. Following mixing, the waste will be sampled and a paint filter test will be conducted to ensure that no free liquids are present. Also, if necessary, samples will be gathered for toxicity characteristic leachate procedure (TCLP) testing. If the paint filter test is passed, the backhoe will load the stabilized waste into a waste hauler (roll-off truck) and the truck's roll-off cover will be positioned over the waste. The truck will either proceed to the landfill for disposal or will stage the roll-off bin in the Truck Roll-Off Area. The stabilized waste will need to be stored temporarily at the roll-off unit while tests are completed to determine how and if the material can be disposed of in the landfill.

Reagent usage will vary with the waste type and the prescribed stabilization recipe~~, however, for design purposes a typical waste recipe, presented in the table on Drawing No. 24 was used as a basis to size the various reagent storage and delivery systems~~. It should be noted that both waste receipt rates and stabilization recipes will vary considerably. Stabilization process flows are discussed further in Section 6.2.4.

Reagent storage and delivery systems for two types of dry reagent and three types of liquid reagent (one being water) are incorporated into the design. Dry reagents including cement and fly will be stored in 25,000 and 50,000 cft silos, respectively, and delivered to the bins by a pneumatic delivery system. Liquid reagents including calcium polysulfate and ferrous sulfide will be batch mixed in individual 10,000 gal reagent tanks and pumped into the bins. Water will also be pumped to the stabilization bins.

For design purposes, a CAT 213B LC type excavator was selected as the backhoe mixer, however, other equipment manufacturer's offer excavators with similar reach, power, and weight characteristics.

In order to ensure no visible fugitive dust emissions during stabilization processing, the bins and the stabilization building will be equipped with an exhausting ventilation system which will maintain a negative pressure inside the building. Slotted ducts located around the perimeter of each bin will provide supply and return air in a push-pull arrangement to remove dust during the waste receiving, mixing, and loadout operations. During reagent delivery operations, the bin cover, which will also be connected to the exhaust system, will control dust. Dust will be removed from the exhaust air in the bag house located on the west side of the building. Collected dust will be processed in the stabilization facility.

Wastes containing VOCs greater than 500 parts per million per weight (ppmw) will not be accepted for stabilization processing.

6.2 STABILIZATION FACILITY DESIGN ANALYSES

6.2.1 Stabilization Bin Structural Analyses

Basic engineering principles in conjunction with finite plate analyses were used to address the preliminary structural design of the steel stabilization bins. Principles of impulse - momentum and

conservation of energy were used to establish the mass, velocity and displacement relationships. Then plated stresses were approximated through the use of Sap 90. Finally force and displacement results were scaled up/down to limiting displacements (controlled by the wire rope isolators) and stresses (controlled by the grade of steel).
The fundamental design inputs for the bin analysis are the forces generated by the backhoe mixing action. For the purposes of this design a CAT 213B LC type backhoe was assumed. Critical velocities of the backhoe movements to prevent damage to the bins were determined as a percentage of maximum velocities achievable by the backhoe. These limiting velocities will be implemented in the actual backhoe unit by adjusting the hydraulic system flows. Calculations are presented in Appendix E and summarized in the overview below.

Overview Structural Analysis

1. ~~Initial c~~Calculations establish the structural capacity required to support the static loads from hazardous waste material plus the stabilizing materials. The worst case scenario for the static load case is 80 cubic yards of material weighing 110 lbs/cubic foot.

2. ~~Preliminary d~~Dynamic analyses for vertical impact loads due to the material dropping into the bin indicate that this is not a significant problem. However, impact from the bucket dropping freely due to a total and instantaneous hydraulic failure from a height of 15 feet would cause stresses in a 1 inch thick inner liner which would far exceed the yield stress of the steel and cause a permanent "dent" in the steel. It does not appear cost effective to design the inner liner for this possibility.

3. ~~Preliminary d~~Dynamic analyses established a side impact load from the backhoe bucket with contributions from the stick and boom based upon their relative velocity and percent of load transferred to the bucket when it impacts the sidewall of the mixing bin.

    a. Static loads were applied to the wall of the inner liner to establish the relative deflections of points surrounding the point of impact. Then the effectiveness of the inner liner which would act to reduce the momentum of the bucket was established and the conservation of momentum principle was used to determine the reduction in velocity immediately after impact.

    b. After impact the moving bucket plus the effective plate mass has a kinetic energy equal to one half of the total mass times the square of the velocity. That kinetic energy is "gradually" transferred into potential energy from force times displacement (or bending moment times angle change) in the inner liner, the energy absorbing springs and the outer plate support system. When the bucket has been stopped all of the energy has been transferred from the kinetic state to the potential state. It appears that 80 to 90 percent of the energy absorption occurs in the springs.

    c. Through a trial and error process, approximate relationships between initial velocity, displacements and stresses in the structural systems were established. It appears that the controlling factor in the system is the stress in the inner liner when subjected to impact loads.

    d. The impact loads from the weight of the bucket plus contributions from the stick and boom totaling approximately 3,290 pounds results in a kinetic energy in excess of 800,000 lb-inches for the condition where a swing angle of 180 degrees can occur in 3 seconds (approximately 440 inches per second at the outer end of the bin).

e. In order to limit the stresses in the high strength inner liner plate to an acceptable allowable value, it will be necessary to reduce the side to side velocity of the bucket to 15 percent of the present velocity with a ¾ inch thick plate, 19 percent for a 7/8 inch plate and 23 percent for a 1 inch plate.

4. Preliminary analysis of the dominantly in and out impact loads caused by movement of the boom, stick and bucket were also made. Combinations of circular velocities (Boom + Stick + Bucket) could easily result in velocities and resulting impact loads greater than the capacity of the inner plate to resist. Some of these velocities will probably need to be reduced to limit damage to the inner liner but this will require significantly more detailed calculations. Note that the effective mass at impact varies with each of these elements and the addition of these circular velocities and tributary masses in any particular direction and at any particular point is far from linear. The maximum reduction in velocity for any of these elements appears to be in the order of 50 percent.

Bin steel plate thickness is dependent on the grade of steel selected. The final bin design will determine the optimal steel plate to be used.

Corrosion protection for the bins will be provided by installing grounded cathodes to the inner and outer bins.

6.2.2 Facility Stabilization Concrete Vault

The Stabilization Facility concrete vault is not a secondary containment feature, therefore, regulations pertaining to secondary containment do not apply, however, all joints in the concrete vault of the stabilization building will be constructed with chemical resistant water stops. In addition, a chemical resistant epoxy coating will be placed on the surface of the vault floor and walls to further restrict potential liquid penetration into the concrete.

The concrete vault area will be inspected monthly. If liquids are found, then will be removed with a portable pump and transported to the liquid waste storage unit.

6.2.3 Stabilization Facility Concrete Floor

Waste entering the stabilization building will be contained ~~either~~ in the DOT approved waste trucks~~, or in double walled piping coming from the liquid waste storage area , or in the double walled stabilization bins~~. Stabilized waste, having undergone treatment, will either be contained in roll-off trucks fashioned with DOT approved truck bed liners or, if treatment standards are met, according to approved testing protocols, the stabilized waste will be transferred directly to the landfill. The floor of the stabilization building will not be exposed to untreated waste material and is not required to serve as a containment system. However, all joints in the concrete floor of the stabilization building will be constructed with chemical resistant water stops. In addition, a chemical resistant epoxy coating will be placed on the surface of the floor to further restrict potential liquid penetration into the concrete.

As shown on Drawing No. 33, stabilization bins are located on 19 ft centers in the middle of the stabilization building. The bins are situated such that adjacent bins alternate mixing and receiving ends allowing for reagent addition operations to take place simultaneously with mixing or loadout operations in two adjacent bins.

During mixing and loadout operations, the center point (rotational axis) of the backhoe unit will be located 8 to 9 ft from the mixing end of the bin. Load out trucks, which can access the building through one of four doorways, will be positioned between 15 to 20 ft from the backhoe center point within the 20 ft wide load out truck lane. A 6.5 ft clearance is provided between the load out truck lane and the north and south building walls. A 27 ft clearance is provided between the outer bins and the east and west building walls. At this distance the backhoe unit will be able to make a full 180° swing angle in the direction of the wall with minimal reach adjustments.

The backhoe unit will be equipped with synthetic rubber track pads covering the steel track ribs. The track pads will allow the backhoe unit to move over the concrete floor without damaging the floor surface.

6.2.4 Stabilization Process Analyses

~~The table presented on Drawing No. 34 summarizes the stabilization process reagent flows based on a typical stabilization recipe and typical liquid and solid waste processing requirements.~~ Solid waste throughputs in the order of 400 tons per day and liquid waste throughputs in the order of 1000 gpd were assumed based on experience at similar operating facilities. Similarly, a typical waste recipe for stabilization of solid and liquid waste was developed.

The 25,000 and 50,000 cft dry reagent storage silos and 10,000 gal tank capacities are based on providing sufficient reagent quantities for one week of normal stabilization operations. Reagent delivery piping sizes shown on Drawing No. 34 are preliminary and will be finalized when selection of the pumps and dry reagent pneumatic system are determined, however, these piping sizes are capable of meeting the daily reagent delivery requirements.

Ventilation system requirements will be determined in conjunction with the final design of the stabilization building. As previously mentioned, the building will be maintained under negative pressure during processing operations to ensure no visible dust is emitted. Additionally, each bin will have its own push-pull ventilation system to control dust inside the building during waste receiving, mixing, and loadout operations.

6.2.5 Compatibility

The steel bins of the stabilization unit will not be completely compatible with all possible wastes. However, steel bins are considered to be the best material to withstand the impacts of the mixing operations. In addition, the bins are accessible and can be inspected for corrosion that could impact their containment capabilities. If excessive corrosion or wear is noted during the inspections the tanks could be prepared or replaced.

7.0 DRUM HANDLING FACILITY

7.1 DRUM HANDLING FACILITY DESIGN

7.1.1 General

The purpose of the drum handling facility is to provide storage capacity for drummed waste streams which will either be processed in the stabilization facility, placed in the landfill, or shipped to other waste processing centers such as incinerators or solvent recovery plants.

Drum handling facility design elements include drum facility layout, subgrade design; liner design; concrete floor design, and drainage sump design. This section describes each of these design elements.

7.1.2 Facility Layout

Drawing No. 37 shows the layout of the drum handling facility floor and surrounding area. Additional details for the floor and floor drains are illustrated on Drawing No. 38.

As previously discussed, the drum handling facility entrance faces the north access road. Incoming trucks will enter the gravel lined apron and will back up to the loading dock areas. Once the truck unloading (or loading) operation is complete, the trucks will exit the facility via the same north access road. Parking areas for site personnel vehicles will be designated near the Drum Handling Facility Office. The gravel apron in front of the facility will not be used to stage waste haul trucks.

The drum handling building will be an open walled building with a roof which extends over the entire floor and truck docking areas. The roof structure will eliminate rain water from entering the drum handling area. The open walls will provide ample ventilation inside the building, however, personnel involved with drum sampling and decanting activities will still be required to use supplied air respiratory systems. As discussed in Section 1.6, during winter months the site will experience temperatures as low as 14°F, with average daily temperatures of 36°F. Under the most severe conditions, freezing of liquids in the drums may be possible. Therefore, during periods of extended low temperatures, drums will be monitored for any sign of leakage or damage due to freezing. Damaged drums will be immediately placed in over pack units to ensure containment.

The 49,265 sf total floor area is divided into 7 drum storage cells with each cell having a separate drain, collection sump, and leak detection sump. Each 63-ft long by 52-ft wide cell is capable of storing 160 drums. Two of the cells are designated as TSCA-PCB cells and as such are required to be isolated from other drum storage cells. The 6-inch high by 41 inch wide berm walkway which surrounds the TSCA –PCB cell provides the necessary isolation. The remaining five cells are also separated by berm walkways. As shown on Drawing No. 38, drums will be placed in four rows, two drums deep. Two 12-ft wide aisles will provide access for the forklift to place and remove drums. Any drum spills or leakage will flow to the deep drain located along the center line of the cell. The drain bottom slopes at 2 percent to the sumps located on the south side (rear) of the building. The berms in combination with the sloping floors to the sumps for each cell will provide separation of the incompatible wastes. Any fluids in the sump will be removed though the sump riser pipes using a vacuum truck which can access the pipes from the rear of the building.

The perimeter of the drum storage unit will be graded to drain away from the facility foundation.

7.1.3 Subgrade Excavation, Liner System, Leachate Collection Sump, and Leak Detection Sump Design

Subgrade Excavation

The subgrade surface will be compacted to provide a suitable foundation for overlying drainage soils, geosynthetics, and the concrete floor and building foundation. Soft areas will be over excavated and replaced with compacted structural fill. Specification Section No. 02110, Site Preparation and Earthwork, describes site preparation, excavated soil classification and stockpiling, subgrade surface preparation and inspection, structural fill placement and compaction requirements, survey and quality control, and erosion control features.

Liner System

Drawing No. 37 indicates the area extent of the liner system and the basal liner components intended for the floor, drainage trenches and sumps, and anchor trench areas. In the floor area of the drum handling facility, the liner system is a double lined system consisting of (from bottom up), a prepared subgrade, a geomembrane secondary liner, a composite geotextile and sand leachate collection drainage layer, and the epoxy coated concrete floor which serves as the primary containment element. In the drainage trench areas, the liner system is a double lined system consisting of (from bottom up), a prepared subgrade, a secondary geomembrane liner, a geonet leak detection and removal layer, and a primary geomembrane liner. Details of each liner component of the floor and drainage trench areas (from bottom up) are discussed below.

Floor Liner System

- *6-inch thickness of prepared subgrade*

  The prepared subgrade component will provide a smooth stable surface suitable for placement of overlying geosynthetic materials. Specification Section 02119, Prepared Subgrade, presents subgrade material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements.

- *60-mil thick high density polyethylene (HDPE) geomembrane liner (smooth)*

  The 60-mil HDPE liner placed on top of the prepared subgrade is the secondary liner component. The HDPE liner is a highly efficient barrier layer to restrict percolation of leachate into the subgrade. Specification Section 02775, Geomembrane Liners, describes minimum geomembrane properties required, subgrade preparation and inspection, material transportation and handling procedures, deployment and seaming requirements, and material CQA.

  Site specific compatibility tests will be conducted on a synthetic leachate and the proposed liner prior to operation of the facility.

- *12-oz non-woven cushion geotextle*

  The 12-oz non-woven geotextile layer placed on top of the geomembrane will provide cushion, as well as filtration qualities to protect the geomembrane from puncture and allow liquids percolating through the concrete floor and select subbase to drain to the sump area. Specification Section 02714, Filter or Cushion Geotextile, describes minimum geotextile properties required, material transportation and handling procedures, deployment and seaming requirements, and material CQA.

- *one-foot thick select subbase*

The select subbase will provide a stable foundation for the overlying concrete floor while allowing liquids for the overlying concrete floor while allowing liquids percolating through the concrete to drain to the sump area. Specification Section 02229, Select Subbase, presents material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements.

- *6-inch thick epoxy coated concrete floor*

The concrete drum handling facility concrete floor slopes towards one of the seven drainage trenches located within each cell. The drum handling facility secondary liner system completely encompass the floor so that any leakage through the pad will also drain back into one of the drainage trenches. The concrete floor will be steel reinforced cast-in-place concrete. All joints in the concrete floor will be constructed with chemical resistant water stops and caulking sealer. Drawing No. 454 shows the rebar types and concrete details for the floor. Construction details for the floor are also called out in Specification Section 03100, Concrete Formwork, Section 03200, Reinforcement Steel, Section 03290, Joints in Concrete, and Section 03300, Cast-in-Place Concrete. Specification Section 07920, Sealants and Caulking, describes the concrete epoxy coating requirements.

Drainage Trench Liner System

- *6-inch thickness of prepared subgrade*

The prepared subgrade component will provide a smooth stable surface suitable for placement of overlying geosynthetic materials. Specification Section 02119, Prepared Subgrade, presents subgrade material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements.

- *60-mil thick high density polyethylene (HDPE) secondary geomembrane liner (smooth)*

The 60-mil HDPE liner placed on top of the prepared subgrade is the secondary liner component. The HDPE liner is a highly efficient barrier layer to restrict percolation of leachate into the subgrade. Specification Section 02775, Geomembrane Liners, describes minimum geomembrane properties required, subgrade preparation and inspection, material transportation and handling procedures, deployment and seaming requirements, and material and CQA.

Site specific compatibility tests will be conducted on a synthetic leachate and the proposed liner prior to operation of the facility.

- *Geonet leak detection drainage layer (transmissivity $\geq 5x10^{-3}$ m^2/sec)*

The high transmissivity geonet drainage layer provides a means to transmit and remove fluids percolating through the primary geomembrane layer. Flow calculations discussed in Section 7.2.1 and presented in Appendix E indicate that the geonet is capable of removing fluids such that ponding on the secondary liner can be avoided. Specification Section 02712, Geonet, describes minimum geonet properties required, material transportation and handling procedures, deployment and seaming requirements, and material and construction quality assurance.

- *60-mil thick high density polyethylene (HDPE) primary geomembrane liner (smooth)*

The 60-mil HDPE liner placed on top of the geonet layer serves as the primary liner component in the drainage trench area. The HDPE liner is a highly efficient barrier layer to restrict percolation of fluids from entering the into the geosynthetic layers below. Specification Section 02775, Geomembrane Liners, describes minimum geomembrane properties required, subgrade preparation and inspection, material transportation and handling procedures, deployment and seaming requirements, and material and CQA.

Site specific compatibility tests will be conducted on a synthetic leachate and the proposed liner prior to operation of the facility.

Leachate Collection Sump and Leak Detection Sump Design

The leachate collection system and leak detection system each have a separate sump from which fluids can be collected and removed. The liner components in the drainage trench system continue into the sumps, however, in order to provide adequate volume to efficiently operate removal pumps, gravel thicknesses are incorporated in the sumps. Drawing No. 39 illustrates the sump layout and cross-sections and the geosynthetic component arrangements. As shown on the drawings, the sumps are rectangular pyramidal shapes which lie concentrically above one another. The slope riser pipes enter their respective sumps at the sump base and are in the same vertical plane. The slope riser trench arrangement enables the leachate collection and leak detection slope riser pipes to penetrate overlying geosynthetic liner elements at the crest of the sump rather than at its base. The leachate collection sump and drain has a total fluid capacity of 2,110 gallons (after accounting for gravel). Ten percent of the cell water volume is 880 gallons based on a storage capacity of 160 55-gallon drums. The leak detection sump and drain has a total fluid capacity of 41 gallons (after accounting for gravel). Because theses sumps are close to the surface and any fluids in the sump can be observed by looking down the riser pipes, fluid level instrumentation is not required.

7.2 DRUM HANDLING FACILITY DESIGN ANALYSES

7.2.1 Geosynthetics Strength and Performance Analyses

7.2.1.1 Geomembranes

The 60 mil geomembrane located beneath the concrete floor area of the drum handling building is protected by a an overlying geotextile and fine grained foundation sand. Below this geomembrane is a 6-inch thickness of prepared subbgrade. Specification No. 02119, Prepared Subgrade, requires this subgrade material to have a maximum particle size of 1 inch. Specification No. 02775, Geomembrane Liners, requires that the surface of the prepared subgrade be smooth drum compacted and free of any foreign objects which might damage the overlying geomembrane. Considering that the loading conditions of the geomembrane in this arrangement due to the overlying sand, concrete floor, drums, and forklift wheeling loading do not approach the loading conditions evaluated in Calculation No. E-

18, Geomembrane Puncture Resistance, the geomembrane will be adequately protected against puncture.

The geomembranes located in the drain areas and the drain sumps will not be subjected to significant overburden pressures. Gravel in the sump will not be compacted.

7.2.1.2 Geonet

The geonet layer in the drain areas and the drain sumps will not be subjected to significant overburden pressures which might reduce flow capacity. Additionally, the 2 percent slope of the drain system provides adequate relief to cause fluid flow to the sumps.

7.2.1.3 Geotextiles

Calculation No. E-20, Geotextile/Geocomposite Filtration, evaluates the AOS of several available geotextile products with respect to the silty sands and Upper Dockum materials found at the site. Based on this calculation, the 7 oz non woven geotextile called for in the specifications will adequately filter fines from the foundation sand material (SM) .

7.2.1.4 Anchor Trench Design

The purpose of the anchor trench in the drum handling facility is to restrict movement of the geosynthetics during installation of the sand and concrete layers. Pullout capacity due to settlement is not a relevant concern for this facility.

7.2.2 Drum Handling Facility Concrete Floor

The floor of the drum handling building may be exposed to untreated waste material and is required to serve as the primary containment system. All joints in the concrete floor of the stabilization building will be constructed with chemical resistant water stops. In addition, a chemical resistant epoxy coating will be placed on the surface of the floor to further restrict potential liquid penetration into the concrete.

Drawing No. 45 shows the rebar types and concrete details for the floor. Construction details for the floor are also called out in Specification Section 03100, Concrete Formwork, Section 03200, Reinforcement Steel, Section 03290, Joints in Concrete, and Section 03300, Cast-in-Place Concrete. Specification Section 07920, Sealants and Caulking, describes the concrete epoxy coating requirements.

8.0 LIQUID WASTE STORAGE FACILITY

8.1 LIQUID STORAGE FACILITY DESIGN

8.1.1 General

The purpose of the liquid waste storage facility is to provide storage capacity for bulk liquid wastes which will either be processed in the stabilization facility or ~~to~~be placed in the evaporation pond. The tanks will not be used to manage wastes containing volatile organic concentrations greater than 500 parts per million by weight (ppmw).

Liquid waste storage facility design elements include liquid storage facility layout, storage tank leak containment design; piping and pumping design; and concrete tank pad. This section describes each of these design elements.

8.1.2 Facility Layout

Drawing No. 40~~1~~ shows the arrangement of the liquid waste storage tanks, piping , and tank containment pad and surrounding area. The four double lined HDPE poly tanks (9,000 gallon capacity) will each have its own concrete pad area, discharge and intake pump, and piping and control system.

As previously discussed, access to the liquid waste storage area is provided on the east, west, and north sides of concrete tank pads. Tanker trucks can use either the north access road or the road to the east of the liquid waste storage area.

The concrete pad is included ~~as secondary containers~~ to prevent the spread of fluid should leaks or spills occur at discharge piping connections and pumps located within the pad.

A concrete pad will be placed in the loading/unloading areas for the tanker trucks. This pad will be sloped providing drainage toward the sump areas.

8.1.3 Tank Leakage Containment Design

Drawing No. 40 illustrates the double walled poly tank system. The outer tank will be covered to prevent the precipitation infiltration. The inner tank will not be covered. The tanks will be equipped with flexible connections at pipe penetrations between the inner and outer tanks and drainage ports in the outer tank. Chemical resistant gaskets will be used at all tank flanges. Liquids containing solvents such as MEK, toluene, zylene, diesel, or gasoline in concentrations greater than 15% will not be placed in the tanks. Tank tie down details will be developed from manufacturer's shop drawings when the tank is purchased.

The 15,500 gallon outer tank will contain the total volume of the 9,000 gallon inner tank should a leak in the inner tank occur. Each tank system will be equipped with graduated sight gauges allowing visual determination of fluid volume in the inner tank. In addition, to prevent tank overfilling or unnecessary pumping, high level and low level cutoff switches are included.

The tanks will be vented to the atmosphere to prevent internal pressure buildup. Protected ladders running up the outside of the outer tank will provide access to openings in the top tank.

Specification Section 13205, Polyethylene Tank (see Volume IV, Appendix C for Construction

Specifications), discusses the tank material and installation requirements. Construction details for the concrete tank pad are called out in Specification Section 03100, Concrete Formwork, Section 03200, Reinforcement Steel, Section 03290, Joints in Concrete, and Section 03300, Cast-in-Place Concrete.

8.2 LIQUID WASTE STORAGE FACILITY DESIGN ANALYSES

8.2.1 Tank Design, Testing, and Quality Control Standards

The liquid waste storage facility poly tanks will be manufactured by Central California Container Inc. Performance tests, material property tests, and design standards provided by the manufacturer include the following:

- **Performance Requirement Tests**
  Low Temperature Dart Impact Test (ASTM D-1998)
  O-xylene-Insoluble Faction (Gel Test) (ASTM D-1998)
  Ultrasonic Gauge Wall Thickness Test (ASTM D-1998)
  Hydrostatic Pressure Test (ASTM D1998)

- **Material Properties Tests**
  Environmental Stress Crack Resistance (ASTM D-1693)
  Elongation @ Break, Tensil Strength (ASTM D-638)
  Uv Stabilizer Compounded into Resin (ASTM D-1998)

- **Design Standards**
  Wall Thickness Calculations (ASTM D01998)
  Seismic & Wind Restrain (UBC)
  Finite Element Analysis (ADE-92)

The tank manufacturer has provided recommended tank tie down details. The details should be reviewed and approved by a registered professional engineer prior to tank installation.

The manufacturer information on the tank compatibility is provided in Appendix H-3. This assessment indicates that the tanks are compatible with a wide variety of waste liquids.

8.2.2 Pumping and Piping

Drawing No. 40 illustrates the pumping, piping, and control feature arrangement for the liquid waste ~~d~~receiving and storage area. High and low level cutoffs will prevent tank overfilling and pump burnout. The flow meter will record fluid volumes pumped into and out of the tank.

The Piping system will be installed according to API publication 1625 (November 1979) or ANSI standard B31.2 and ANSI standard B31.4.

All piping installed at the liquid waste storage facility will be double walled.

8.2.3 Tank Concrete ~~Tank~~ Pad

The concrete pad will provide secondary containment for the ancillary facilities.

Drawing Nos. 404 and 45 show~~s~~ the rebar types and concrete details for the floor. Construction details for the floor are also called out in Specification Section 03100, Concrete Formwork, Section

03200, Reinforcement Steel, Section 03290, Joints in Concrete, and Section 03300, Cast-in-Place Concrete. Specification Section 07920, Sealants and Caulking, describes the concrete epoxy coating requirements.

9.0 TRUCK WASH FACILITY

9.1 TRUCK WASH FACILITY DESIGN

9.1.1 General

DOT approved roll-off trucks delivering bulk solid waste for landfill disposal will have plastic bed liners which will isolate the waste from the roll-off bin interior. As waste loads are dumped, these bed liners can become damaged exposing the roll-off bin to the waste material. If this material cannot be removed from the roll-off bin at the landfill waste placement face, then the truck will be required to proceed to the truck wash facility, where the bin will be washed out. Also, during rainy periods, mud from access roads or daily cover soil can collect on the wheels and undercarriages of waste haul trucks exiting the landfill. Similarly, if this material cannot be removed from the truck while in the landfill, then the truck will be required to proceed to the truck wash facility for cleanup prior to exiting the site. Landfill operations equipment such as waste compactors, scrapers, water trucks, and other vehicles may also require similar cleanup upon exiting the landfill. Because potentially contaminated materials may be washed from the roll-off bin or from undercarriage recesses while at the truck wash facility, a double liner containment system has been designed to contain wash water and wash residues.

The truck wash facility design elements presented here include the facility layout, liner system, and sump and leak detection system.

9.1.2 Facility Layout

Drawing No. 44 illustrates the truck wash facility layout. As previously discussed, access to the truck wash facility is from the west landfill perimeter road. Exiting traffic will proceed to the north access road. The facility is designed with two wash bays: a heavy equipment bay and a roll-off truck bay; and a water storage area. Both wash bays drain to a common sump area which will collect wash water and residue. Poly tanks and pumps, located in the water storage area provide storage and pumping capacity for clean and used wash water.

The truck wash sump drains to a collection point at its north end where water will be pumped from the sump into a clarifier. The sump and sediment bins will be inspected weekly for the accumulation of sediment and liquids and will be removed to the wash water storage tanks. Residues remaining in the sump can be removed using a front-end-loader which has access from the heavy equipment wash bay. Oils, grease, and fine sediments will be removed from the wash water in the clarifier before being pumped to a double lined poly tank. Wash water and residues will be chemically analyzed and handled in an appropriate manner.

The entire extent of the truck wash facility concrete, which acts as primary containment, is designed with a geosynthetic secondary liner and leak detection system. The concrete will be coated with epoxy similar to the drum handling facility.

The roll-off truck bay is equipped with a truck barrier, tail gate lift, moveable wash platforms, and three high pressure hose reel and nozzle assemblies. The high pressure pump and delivery system can either be a single fixed installation or be made up of several portable units. Roll-off trucks will back into the bay to the truck barrier and lift the truck bed as if to dump. The trail gate lift will be attached and the tail gate raised to expose the inside of the roll-off bin. Truck wash personnel will then wash out the inside of the bin using the high pressure wash system. Wash water and residue will then be washed from the concrete floor into the sump area. If necessary, moveable platforms can be positioned next to the truck and the truck bed can be washed from openings in its top surface.

The heavy equipment wash bay will be constructed with steel rail or I-beams incorporated into the concrete floor of this bay to resist damage by heavy equipment tracks. Wash water and residue will flow to the sump area and will be removed as discussed above.

A concrete pad will be placed in the loading/unloading areas for the tanker trucks. This pad will be sloped, providing drainage towards the sump areas.

9.1.3 Subgrade Excavation, Liner System, Sump and Leak Detection System Design

- *Subgrade Excavation*

  The subgrade surface will be compacted to provide a suitable foundation for overlying drainage soils, geosynthetics, and the concrete floor and building foundation. Soft areas will be overexcavated and replaced with compacted structural fill. Specification Section No. 02110, Site Preparation and Earthwork, describes site preparation, excavated soil classification and stockpiling, subgrade surface preparation and inspection, structural fill placement and compaction requirements, survey and quality control, and erosion control features.

- *Liner System*

  Drawing No. 44 indicates the aerial extent of the liners system and the basal liner components intended for the floor, drainage trenches and sumps, and anchor trench areas. In the floor areas, the liner system consists of (from bottom up), a prepared subgrade, a geomembrane secondary liner, a geocomposite drainage layer, a foundation sand layer, and the epoxy coated concrete floor which serves as the primary containment element. Details of each liner component are discussed below.

Floor Liner System

- *6-inch thickness of prepared subgrade*

  The prepared subgrade component will provide a smooth stable surface suitable for placement of overlying geosynthetic materials. Specification Section 02119, Prepared Subgrade, presents subgrade material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements.

- *60-mil thick high density polyethylene (HDPE) geomembrane liner (textured)*

  The 60-mil HDPE liner placed on top of the prepared subgrade is the secondary liner component. The HDPE liner is a highly efficient barrier layer to restrict percolation of leachate into the subgrade. Specification Section 02775, Geomembrane Liners, describes minimum geomembrane properties required, subgrade preparation and inspection, material transportation and handling procedures, deployment and seaming requirements, and material construction quality assurance.

  Site specific compatibility tests will be conducted on a synthetic leachate and the proposed liner prior to operation of the facility.

- *Geocomposite*

  * A geocomposite drainage layer (transvissivity ≥ 2.2 x 10^{-4} m^2/sec) consisting of:
    - ◊ A7 oz. geotextile (non-woven)
    - ◊ A geonet
    - ◊ A 7 oz. geoxtile (non-woven)

  The high transmissivity geocomposite drainage layer provides a means to transmit and remove fluids percolating through the epoxy coated concrete floor. Flow calculations discussed in Section 3.2.8 and presented in Appendix E indicate that the geocomposite is capable of removing fluids such that ponding on the geomembrane liner can be avoided. Specification Section 02712, Geocomposites, describes minimum geonet properties required, material transportation and handling procedures, deployment and seaming requirements, and material and construction quality assurance.

- *A 12-inch thick foundation sand layer*

  Specification Section 02231, Foundation Sand, presents foundation sand material requirements including particle size and moisture content, placement and compaction requirements, and survey and field quality control requirements.

- *One foot thick epoxy coated concrete floor*

  The truck wash facility floor slopes towards sump located between the two bay areas. The truck wash facility secondary liner system completely encompass the floor so that any leakage through the floor will be captured in the leak detection system. The concrete floor will be steel reinforced cast-in-place concrete. All joints in the concrete floor will be constructed with chemical resistant water stops and caulking sealer. Construction details for the floor will be provided similar to those presented in Specification Section 03100, Concrete Formwork, Section 03200, Reinforcement Steel, Section 03290, Joints in Concrete, and Section 03300, Cast-in-Place Concrete. Specification Section 07920, Sealants and Caulking describes the concrete epoxy coating requirements.

Leak Detection Sump (LDRS) Design

The leak detection system geocomposite drains to a separate sump from which fluids can be detected and removed. In order to provide adequate volume to efficiently operate removal pumps, a gravel thickness has been incorporated in the sump. Drawing No. 44 illustrates the sump layout and cross sections and the geosynthetic component arrangements. A vertical riser pipe is located in the center of the sump and provides space for the fluid removal pump. The leak detection sump has a total fluid capacity of 72 gallons (after accounting for gravel). Because this sump is close to the surface and any fluids in the sump can be observed by looking down the riser pipe, fluid level instrumentation is not required. Fluids in the sump will be removed by pumping into the clarified or by vacuum truck.

9.2 TRUCK WASH FACILITY DESIGN ANALYSES

9.2.1 Geosynthetics Strength and Performance

Geomembrane, geocomposite, and geotextile material installation in the truck wash facility is similar to the installations in the drum pad facility. Rationale and computations pertaining to geomembrane puncture and tearing, geocomposite flow capability, and geotextile cushioning and filtration performed for the drum pad, which are applicable to the truck wash facility, are not repeated.

9.2.2 Tank Design, Testing, and Quality Control Standards

Tanks and piping intended to store and convey potentially contaminated wash water will be double lined installations similar to the liquid waste storage area tanks. Section 8.2 presents a discussion of this equipment which also applies to the truck wash facility. Control features for this system are identified on Drawing No. 44.

Piping system will be installed according to API publication 1615 (November 1979) or ANSI B31.2 and ANSI standard B31.4.

The clean water supply tank and piping will be single walled installations.

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MONTGOMERY WATSON WEEKLY FIELD SUMMARY REPORT
TRIASSIC PARK WASTE DISPOSAL FACILITY
CONSTRUCTION QUALITY ASSURANCE
WEEK #1

Introduction

In accordance with the CQA Implementation Plan for cover construction at the Triassic Park Waste Disposal project, Montgomery Watson is providing a weekly summary of construction and CQA activities for the construction related to the earthworks geosynthetics. Copies of Daily Reports and associated field book notes have been submitted previously. The following table presents a summary of construction conditions and activities for the week.

	Date	Date	Date	Date	Date	Date	Date		Cumulative
	Su	M	T	W	Th	F	Sa	Week Total	Total to Date
1. Staff On-site:									
Name									
Name									
Name									
Name									
Name									
Name									
Name									
Name									
Total On-site Hours									
2. Weather Conditions									
Temperature									
Precipitation									
Site Closure									
3. Contractor Activity									
Earth Works									
Type D subgrade preparation									
Sand placement									
Type B placement over geonet									
Type E placement over geotextile									
Other									
Geosynthetics									
Geosynthetics deployment									
Geosynthetics detail work									

MONTGOMERY WATSON WEEKLY FIELD SUMMARY REPORT
TRIASSIC PARK WASTE DISPOSAL FACILITY
CONSTRUCTION QUALITY ASSURANCE
WEEK #1 (Continued)

	6/13	6/14	6/15	6/16	6/17	6/18	6/19		
	Su	M	T	W	Th	F	Sa	Week Total	
4. Geosynthetics Activity									
Material Inventory (see attached material quantities summary)									
Geomembrane									
Geonet									
Geotextile									
Material Deployment (based on total deployed lengths of panels, including overlaps and prior to trimming)									
Geomembrane (square feet)									
Geonet (square feet)									
Geotextile (square feet)									
Geomembrane Field Seaming									
Fusion welding footage									
Fusion destructive tests									
Extrusion welding footage									
Extrusion destructive tests									
5. QA Soil Testing									
Field Testing									
Laboratory Testing									

NEW MEXICO ENVIRONMENTAL DEPARTMENT
RCRA PART B PERMIT APPLICATION

SPECIFICATIONS FOR LANDFILL, SURFACE IMPOUNDMENT AND ASSOCIATED FACILITIES LINER AND COVER SYSTEM CONSTRUCTION

FINAL

TRIASSIC PARK HAZARDOUS WASTE FACILITY
CHAVES COUNTY, NEW MEXICO

EPA IDENTIFICATION NUMBER NM0001002484

~~December 1997~~December 1997
(Revised October 2000)

Patrick Corser, P.E., New Mexico Registration 12236

NOTE: This document contains construction specifications for various elements of the Triassic Park Hazardous Waste Facility landfill, landfill cover, surface impoundment, and Associated Facilities. Modifications to the plan may be required prior to construction. Any revisions required will be submitted to NMED for approval prior to construction.

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SECTION 01010
GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary to construct the landfill or surface impoundment liner or cover systems at the Triassic Park hazardous waste treatment, storage, and disposal facility (TSDF) in Chaves County, New Mexico.

B. The work shall include those items identified in the Contract Documents which may include site preparation and earthwork, clay liner construction, geosynthetic clay liner installation, geomembrane liner/cover installation, drainage layer and drainage pipe installation, protective soil layer placement, quality control, surveying, and related work.

1.02 DEFINITIONS

A. The following list of definitions is provided for reference.

1. *Atterberg Limits*: The liquid limit, plastic limit, and shrinkage limit for soils as defined by (ASTM D 4318).

2. *NMED*: New Mexico Environmental Department (NMED)

3. *NMED and RCRA Part B Permit (Part B Permit):* New Mexico Environmental Department and Resource Conservation and Recovery Act (RCRA) Part B Permit for the Triassic Park Facility.

4. *Compaction*: The process of increasing the unit weight of soil by rolling, tamping, vibrating, or other mechanical means. As a result of compaction, the hydraulic conductivity of the soil may be decreased.

5. *Construction Drawings*: Design plans used to construct a facility; the plans must be signed and sealed by a Professional Engineer registered in the State of New Mexico.

6. *Construction Quality Assurance (CQA)*: A planned and systematic pattern of all means and actions designed to provide adequate confidence that items or services meet contractual and regulatory requirements.

7. *CQA Engineer*: The individual, firm or corporation, independent from the Owner, Contractor, Supplier, or Manufacturer, that is responsible for observing, testing, and documenting construction activities under the terms of the contract. Provided that the Design Engineer and the Owner are not the same party, the CQA Engineer may be the same as the Design Engineer. The CQA Engineer will provide a Construction Quality Assurance Resident

Engineer (CQA Resident Engineer). The CQA Engineer is responsible for certification of landfill construction according to the specifications contained herein and will be a Professional Engineer registered in the State of New Mexico.

8. *CQA Plan*: Site-specific document which addresses the following: (i) CQA personnel responsibilities, authorities, and qualifications; (ii) inspection, monitoring, and testing activities necessary to ensure that the facility is constructed to meet or exceed design criteria, plans, and specifications; and (iii) CQA documentation requirements.

9. *Contract Documents*: The contract documents for construction of the landfill or surface impoundment including the General Specifications, the Construction Drawings, the CQA Plan, any supplemental requirements, and the General Agreement.

10. *Contractor*: The individual, firm, or corporation undertaking the execution of the work under the terms of the contract.

11. *Design Engineer*: The individual, firm or corporation having direct responsibility for the design of the landfill or surface impoundment structure. The Design Engineer must provide a Professional Engineer registered in the State of New Mexico. The Design Engineer may be the same as the Owner.

12. *Dewatering:* Process of lowering ground water level(s) or removing storm water to permit construction activities to be made "in the dry" (not drying of fill material).

13. *General Specifications*: Specifications written which apply to the construction of all landfills and surface impoundments.

14. *Geocomposite:* A planar, polymeric drainage material consisting of a polyethylene geonet core and geotextile filter layers that have been heat-bonded to the top and bottom surfaces of the geonet.

15. *Geomembrane:* A nonporous polymeric membrane liner or barrier used in civil engineering projects.

16. *Geonet*: A net consisting of two sets of transverse polymeric strands which create high in-plane flow capacity; used as a drainage medium in civil engineering projects.

17. *Geosynthetics*: Polymeric materials used to perform various functions in construction projects (i.e., geomembranes, geonets, geocomposites, geotextiles, etc.).

18. *Geosynthetic Clay Liner (GCL)*: A factory manufactured, hydraulic barrier typically consisting of bentonite clay or other very low permeability material, supported by geotextiles and/or geomembranes which are held together by needling, stitching, or chemical adhesives.

19. *Geotextile:* A permeable textile material used with foundation, soil, rock, earth, or any other geotechnical engineering-related material that is an integral part of a man-made project, structure, or system.

20. *Gandy-Marley, Inc.*: owner and operator of the hazardous waste treatment, storage, and disposal facility under construction; referred to as the Owner.

21. *Hydraulic Conductivity*: The rate at which a fluid flows through a porous medium. It is a function of the physical characteristics of both the porous medium and the fluid.

22. *In-situ*: "As is", or as it exists in place naturally.

23. *Laboratory:* The individual, firm, or corporation, independent from the Owner, Manufacturer, Supplier, or Contractor, responsible for conducting tests on construction materials to assure conformance with the General Specifications.

24. *Leachate Collection System*: The drainage layer above the primary composite liner of the landfill and associated piping, risers, etc. that enable collection and removal of leachate from the landfill.

25. *Leak Detection System*: The drainage layer sandwiched between the primary and secondary liners of the landfill or surface impoundment and associated piping, risers, etc., that enable detection, collection, and removal of leachate, if any, that leaks through the primary liner.

26. *Liner System*: The system of natural and synthetic liners and drainage layers beneath the landfill or surface impoundment, used to contain leachate while allowing its collection and removal.

27. *Manufacturer*: The individual, firm, or corporation responsible for manufacturing a specific component (e.g., a geomembrane liner) used in surface impoundment or landfill construction.

28. *Moisture Content*: Ratio of quantity of water in the soil (by weight) to the weight of the soil solids (dry soil), expressed in percentage; also referred to as water content.

29. *Optimum Moisture Content (OMC)*: Moisture content corresponding to maximum dry unit weight as determined in the standard Proctor or modified Proctor compaction test (i.e., ASTM D 698 or D 1557).

30. *Owner:* The party known as Gandy-Marley, Inc., a New Mexico Corporation, and the operator of the hazardous waste treatment storage and disposal facility under construction. The Owner shall hire the Contractor(s) to execute the work under the terms of the General Agreement. The activities of the Owner in the General Specifications, any supplemental requirements, and CQA Plan may be performed by the Owner or other party representing

the Owner such as, but not limited to, a representative of Triassic Park Hazardous Waste Facility, the Design Engineer, or CQA Engineer.

31. *Particle-Size Distribution*: Distribution of particle sizes within a soil; determined using ASTM D 422.

32. *Permanent Sump*: The drainage layer beneath the sump area of the secondary liner of the landfill that enables the detection, collection, and removal of leachate if any, that leaks through the secondary liner in that area.

33. *Permeability*: Ability of pore fluid to travel through a soil mass via interconnected voids. "High" permeability indicates relatively rapid flow, and vice versa. Rates of permeability are generally reported in centimeters per second.

34. *Plasticity*: Ability of soil mass to flow or be remolded without raveling or breaking apart. Generally that range of soil water content between the liquid and plastic limit.

35. *Primary Composite Liner*: Top composite liner in a double-liner system consisting of two or more low-permeability components of different materials in contact with each other.

36. *Primary Geomembrane Liner*: Top geomembrane liner in a double-liner system.

37. *Primary Soil Liner*: Top soil liner in a double-liner system.

38. *RCRA*: Resource Conservation and Recovery Act; Federal hazardous waste regulations.

39. *Secondary Composite Liner*: Bottom composite liner in a double-liner system consisting of two or more low-permeability components of different materials in contact with each other.

40. *Secondary Geomembrane Liner*: Bottom geomembrane liner in a double-liner system.

41. *Secondary Soil Liner*: Bottom soil liner in a double-liner system.

42. *Secondary Structure*: The macrostructure of a geologic stratum. Structural features in a soil or rock deposit which can be seen with little or no magnification, to include, but not be limited to, pockets, lenses, layers, seams, or partings of varying soil types, slickensided fissures, laminated structure, bedding planes, and/or mineral concretions or staining.

43. *Landfill Phase*: A discrete landfill cell designed and constructed to store industrial and/or hazardous wastes in an environmentally safe manner and in accordance with Federal, State, and local regulations.

44. *Sieve (200 Mesh)*: Refers to the soil particle size that passes (smaller than or equal to) the U.S. Sieve No. 200 (ASTM Specification E-11) which has a 75 micrometer (0.00295 inch) opening.

45. *Specifications*: Detailed descriptions of requirements, dimensions, materials, construction methods, etc., necessary for the construction of a landfill or surface impoundment.

46. *Subcontractor:* The individual, firm, or corporation that contracts to perform some service or provide some material necessary for the performance of another's contract.

47. *Supplier:* The individual, firm, or corporation responsible for supplying a contractor or a manufacturer with a specific material (e.g., gravel, granular material, resin, etc.) required for construction of a manufactured product or for the construction of the landfill or surface impoundment.

48. *Surface Impoundment:* A discrete impoundment designed and constructed to hold an accumulation of potentially contaminated rainwater and runoff from processing, hauling, or waste handling operations or designed and operated to contain hazardous waste during treatment of the waste.

49. *TSDF*: treatment, storage, and disposal facility.

50. *Unified Soil Classification System*: Soil classification system in accordance with ASTM D 2487.

51. *Unit Weight*: Weight of soil per unit volume; usually reported in pounds per cubic foot.

52. *"Walking Out"*: Continually rising effect experienced by a sheepsfoot roller during compaction of soil; an indication that the soil is approaching the proper degree of compaction.

PART 2: CONTRACT DOCUMENTS

2.01 INCLUDED DOCUMENTS

A. The Contract Documents for construction of the landfill or surface impoundment shall include, as applicable: (i) General Specifications, (ii) Supplemental Specifications; (iii) CQA Plan; (iv) Construction Drawings; and (v) General Agreement.

2.02 GENERAL SPECIFICATIONS

A. The landfill or surface impoundment shall be constructed in accordance with these General Specifications and other applicable Contract Documents.

2.03 SUPPLEMENTAL SPECIFICATION

A. The supplemental specifications provide additional requirements for construction of a specific landfill liner or cover or surface impoundment that relate to construction contractual considerations, and are not permit-related.

2.04 CQA PLAN

A. The materials, procedures, and test methods and frequencies used in the construction quality assurance of the landfill or surface impoundment construction shall conform to the requirements of the CQA Plan.

2.05 CONSTRUCTION DRAWINGS

A. The landfill or surface impoundment shall be constructed not only in accordance with the General Specifications but also in accordance with the Construction Drawings for the specific structure.

2.06 GENERAL AGREEMENT

A. The contractual agreement, and all terms and conditions thereof, between the Owner and the Contractor.

PART 3: PROJECT ORGANIZATION AND CONTROL

3.01 ORGANIZATION CHART

A. The project organization chart for the parties involved in construction of the landfill and surface impoundment is provided in Figure 01010-1.

3.02 RESPONSIBILITIES OF PARTIES

A. *Owner:* The Owner is the facility manager, responsible for facility administration, regulatory oversight, health and safety, accounting, purchasing, etc. The Owner has direct authority over the Contractor, CQA Engineer, and Design Engineer and coordinates activities by these parties.

B. *Contractor:* The Contractor is responsible for constructing various elements of the facility in accordance with the General Specifications, other applicable contract documents, Construction Drawings and CQA Plan. The Contractor may be responsible for earthwork, geosynthetics, and other components of landfill or surface impoundment construction. The contracting and administration of contract requirements for landfill or surface impoundment construction shall be the responsibility of the Owner. Different contractors may be used to construct different components of the landfill or surface impoundment.

C. *CQA Engineer*: The CQA Engineer is responsible for monitoring construction activities on-site and certifying that the facility is constructed in accordance with the plans and specifications. The CQA Engineer provides information, reports, test results, and observations to the Owner. The CQA Engineer may communicate directly with the Contractor and Design Engineer to coordinate activities and receive information. The CQA Engineer provides an on-site CQA Resident Engineer.

D. *Design Engineer:* The Design Engineer is responsible for the design of the landfill or surface impoundment. The Design Engineer reports to the Owner. The Design Engineer may communicate directly with the Contractor and CQA Engineer.

PART 4: SEQUENCE OF CONSTRUCTION

4.01 OVERALL SEQUENCE

A. The overall sequence of construction for a specific facility element shall be as described in the Construction Drawings for the specific structure and in accordance with the Contract Documents.

PART 5: REFERENCE STANDARDS

5.01 APPLICABLE ORGANIZATIONS

A. Organizations whose standards are referenced herein are as follows:

1. ASTM - American Society for Testing and Materials
2. New Mexico State Highway and Transportation Department (Standard Specifications for Highway and Bridge Construction)
3. GRI - Geosynthetics Research Institute
4. OSHA - Occupational Safety and Health Administration
5. USEPA - United States Environmental Protection Agency

5.02 APPLICABLE STANDARDS

A. Any reference to standards of any society, institute, association, or government agency shall be the edition in effect as of the date of the contract, unless stated otherwise.

5.03 SPECIFIC STANDARDS

A. Specific test standards cited in the General Specifications are given in Table 01010-1.

PART 6: GENERAL REQUIREMENTS

A. *Reference Points*: Construction reference monuments and benchmarks have been established by the Owner for use in controlling the construction work. All work shall be constructed based on and in relation to these reference points. The Contractor shall be responsible for re-establishing any reference points disturbed during construction. Disturbed or destroyed points shall be re-established at the Contractor's expense, as directed by the Owner.

B. *Soils Investigation*: Site soil investigations will be performed by the Owner. Soil investigation reports will be available for the Contractor's use. The Contractor shall not assume that information within these reports accurately reflects the soil conditions at all locations within the project area, but that they only depict soil conditions at specific points where samples were taken.

Figure 01010-1 Organization Chart

C. *Surveying:* The Contractor shall perform all surveying required to lay out and control the work. Surveying shall be conducted such that all applicable standards required by the State of New Mexico are followed. Required Record Drawings shall be as specified in these General Specifications. All surveying shall be performed under the direction of a surveyor licensed to perform such work in the State of New Mexico. All Record Drawings shall be signed and sealed by the licensed surveyor who directed the survey work. Record drawings shall be at a scale not smaller than 1 inch = 50 feet. The required surveying of liner system elevations shall be carried out on a grid; approximately 50-foot square on slopes of 25 percent or less and 100-foot square on slopes greater than 25 percent. The survey locations shall be close enough to define the following features in the landfill or surface impoundment: toe of slope, crest of slope, anchor trench, leachate collection sump, leak detection sump, permanent sump, and perimeter drainage ditch. All surveys shall be referenced to the Owner's site coordinate grid system.

D. *Construction Tolerances:* Unless otherwise stated herein and where practical, construction tolerances shall be " 0.2 feet horizontally, and, provided that minimum thickness requirements are met, " 0.1 feet vertically. All surfaces shall be reasonably free from irregularities with slopes or grades within " 10 percent of their nominal values. All liner and cover surfaces shall be free-draining with no standing water except at low points designated on the Construction Drawings.

E. *Permits:* The Contractor shall not be required to obtain any environmental or general construction permits applying to the general design of the facility. The Contractor shall be required to obtain permits, such as over-size haul permits, related to specific construction equipment or techniques he intends to employ to accomplish the work.

F. *Sedimentation, Erosion Control, and Dewatering*: Contractor shall comply with all requirements of the New Mexico State Highway and Transportation Department Standard Specifications for Highway and Bridge Construction for controlling erosion, water pollution, and dust emissions resulting from construction activities; the Contractor shall be responsible for any fines imposed due to noncompliance. Within the disturbed areas in which the Contractor is working, the Contractor shall seal-roll disturbed surfaces when required and maintain temporary grades and ditches to promote water drainage and prevent infiltration. The Contractor shall provide all equipment necessary to dewater excavations within 12 hours after a storm event.

G. *Work Limits*: All clearing, stripping, excavation, backfill and surfacing shall be done to the lines, grades, and dimensions called for on the Construction Drawings and General Specifications unless directed otherwise by the Owner. All work done beyond designated limits without prior approval shall be corrected to the Owner's satisfaction, at no additional cost to the Owner.

H. *Protection of Existing Services and Wells*: The Contractor shall exercise care to avoid disturbing or damaging existing monitor wells, electrical poles and lines, permanent below-ground utilities, permanent drainage structures, temporary utilities and structures, or items which the Owner has marked with red flagging. If the Contractor encounters any unexpected underground utilities during the course of the work, the Contractor shall immediately inform the Owner who will determine whether or not the utility is active. When the work requires the Contractor to be near or cross known utilities, the Contractor shall carefully uncover, support and protect these utilities and shall not cut, damage, or otherwise disturb them without prior authorization from the Owner. All utilities, wells, or other items damaged by the Contractor shall be immediately repaired or replaced by the Contractor to the satisfaction of the Owner at no additional cost to the Owner.

I. *Explosives*: The use of explosives for demolition or excavation is not expected to be required and will not be permitted without prior written approval of the Owner.

J. *Burning*: The use of open fires on site for any reason is prohibited.

K. *Temporary Roads*: The Contractor shall be responsible for constructing and maintaining all temporary roads and laydown areas which the Contractor may require in the execution of his work.

L. *Construction Water*: The quality of construction water used to accomplish construction work is crucial due to the nature of the facilities being constructed. The Owner will provide water for construction and dust control and will specify the source and periodically obtain water quality samples. The Contractor shall not add substances to construction water without the express written consent of the Owner. The Contractor shall utilize measuring devices that allow him to measure and record the volume of water used. Such usage records shall be maintained by the Contractor and provided to the Owner.

M. *Cooperation*: The Contractor shall cooperate with all other parties engaged in project-related activities to the greatest extent possible. Disputes or problems shall be referred to the Owner for resolution.

N. *Familiarization*: The Contractor is responsible for becoming familiar with all aspects of work prior to performing the work.

O. *Safeguards*: The Contractor shall provide and use all personnel safety equipment, barricades, guardrails, signs, lights, flares, and flagmen as required by OSHA, state, or local codes and ordinances. No excavations deeper than 4 feet with side slopes steeper than 2:1 (horizontal:vertical) shall be made without the prior approval of the Owner. When shoring is required, the design and inspection of such shoring shall be the Contractor's responsibility and subject to the review of the Owner prior to use. No personnel shall work within or next to an excavation requiring shoring until such shoring has been installed, inspected, and approved by an Engineer registered in the State of New Mexico provided by the Contractor. The Contractor shall be responsible for any fines imposed due to violation of any laws and regulations relating to the safety of the Contractor's personnel.

P *Construction Access Plan*: Prior to mobilization to the site, the Contractor shall submit a plan to the Owner showing where he intends to place staging areas, stockpile areas, temporary on-site access roads, temporary erosion control structures, etc. This plan must be approved by the Owner prior to mobilization.

Q. *Clean-up*: The Contractor shall be responsible for general house-keeping during construction. Upon completion of work, the Contractor shall remove all of his equipment, facilities, construction materials, and trash. All disturbed areas shall be revegetated or otherwise put into a condition satisfactory to the Owner. Revegetation shall be carried out in accordance with the requirements in Section 02900.

R. *Security*: The Contractor is responsible for the safety and condition of all of his tools and equipment. The Owner will not be responsible for lost or stolen materials or equipment.

S. *Acceptance of Work*: Except as otherwise provided within the General Conditions, the Contractor shall retain ownership and responsibility for all work until accepted by Owner. The Owner will accept ownership and responsibility for the liner system: (i) when all work is completed; (ii) after the Contractor has submitted all required documentation, including manufacturing quality control documentation, manufacturing certifications, and Record Drawings signed and sealed by a Professional Land Surveyor licensed in the State of New Mexico (if required by Owner); and (iii) after the CQA Engineer has submitted the Final CQA Report which certifies that the liner has been constructed in accordance with the Construction Drawings and these Specifications and Record Drawings signed and sealed by a Professional Engineer registered in the State of New Mexico.

T. *Health and Safety Training*: The Contractor shall provide necessary health and safety training for all of the Contractor's on-site personnel in accordance with the Site Health and Safety Plan. The Owner may require evidence of health and safety training at any time for any of the Contractor's personnel working on site.

U. *Exclusion Areas*: The Contractor's personnel shall not enter any areas on-site identified with signs as exclusion areas without approval of the Owner, and without proper personal protective equipment. The Contractor shall confine activities to the work limits shown on the Construction Drawings.

V. *Hazardous Waste Management Operations*: The Contractor shall not enter areas where active hazardous waste management operations are being performed.

W. *CQA Activities*: The Owner will utilize an independent CQA Engineer to perform CQA activities. The Contractor shall be aware of all CQA activities and shall allow sufficient time in his construction schedule to accommodate CQA activities. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of CQA activities.

X. All quality control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

TABLE 01010-1 TEST METHODS CITED IN GENERAL SPECIFICATIONS AND CQA PLAN	
AMERICAN SOCIETY OF TESTING AND MATERIALS	
1. ASTM A 307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
2. ASTM A 726	Standard Specification for Cold-Rolled Carbon Steel Sheet, Magnetic Laminated Quality, Types 1, 2, and 2S.
3. ASTM C 88	Soundness of Aggregate by use of Sodium Sulfate or Magnesium Sulfate
4. ASTM C 131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
5. ASTM C 535	Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
6. ASTM D 422	Standard Method for Particle-Size Analysis of Soils.
7. ASTM D 570	Standard Test Method for Water Absorption of Plastics.
8. ASTM D 638	Standard Test Method for Tensile Properties of Plastics.
9. ASTM D 698	Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop.
10. ASTM D 746	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
11. ASTM D 751	Standard Methods of Testing Coated Fabrics.
12. ASTM D 792	Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
13. ASTM D 882	Standard Test Methods for Tensile Properties of Thin Plastic Sheeting.
14. ASTM D 1004	Standard Test Method of Initial Tear Resistance of Plastic Film and Sheeting.
15. ASTM D 1204	Standard Plastics Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
16. ASTM D 1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
17. ASTM D 1248	Standard Specification for Polyethylene Plastic Molding and Extrusion Metals.
18. ASTM D 1505	Standard Test Methods for Density of Plastics by Density-Gradient Technique.
19. ASTM D 1556	Standard Test Method for Density of Soil In Place by the Sand-Cone Method.
20. ASTM D 1593	Standard Specification for Nonrigid Vinyl Chloride Plastic Sheeting.
21. ASTM D 1603	Standard Test Method for Carbon Black in Olefin Plastics.
22. ASTM D 2167	Standard Test Method for Density and Unit Weight of Soils in Place by the Rubber Balloon Method.
23. ASTM D 2216 or D 4643	Standard Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
24. ASTM D 2434	Standard Test Method for Permeability of Granular Soils (Constant Head).
25. ASTM D 2487	Standard Test Method for Classification of Soils for Engineering Purposes.
26. ASTM D 2657	Standard Practice for Heat-Joining for Polyolefin Pipe and Fittings.
27. ASTM D 2663	Carbon-Black Dispersion in Rubber.
28. ASTM D 2837	Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
29. ASTM D 2922	Standard Test Method for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth).
30. ASTM D 3015	Recommended Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds.
31. ASTM D 3017	Standard Test Method for Moisture Content of Soil and Rock In Place by Nuclear Methods (Shallow Depth).
32. ASTM D 3083	Standard Specification for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining.
33. ASTM D 3350	Standard Specifications for Polyethylene Plastic Pipe and Fittings Materials.
34. ASTM D 3776	Mass Per Unit Area (Weight) of Woven Fabric.
35. ASTM D 4253	Standard Test Method for Maximum Index Density of Soils Using a Vibratory Table
36. ASTM D 4254	Standard Test Method for Minimum Index Density of Soils and Calculations of Relative Density.

TABLE 01010-1 TEST METHODS CITED IN GENERAL SPECIFICATIONS AND CQA PLAN	
37. ASTM D 4318	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
38. ASTM D 4373	Standard Test Method for Calcium Carbonate Content of Soils.
39. ASTM D 4437	Standard Test Methods for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Geomembranes.
40. ASTM D 4491	Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method.
41. ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
42. ASTM D 4632	Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Elongation Method and Peel Strength).
43. ASTM D 4643	Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
44. ASTM D 4716	Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products.
45. ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
46. ASTM D 4716	Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
47. ASTM D 4833	Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
48. ASTM D 5261	Measuring mass per unit area of geotextile.
49. ASTM D 5321	Coefficient of soil and geosynthetics or geosynthetics and geosynthetics friction by direct shear.
50. ASTM D 5890	Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners
51. ASTM D 5891	Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners
52. ASTM E 11	Specification for Wire-Cloth Sieves for Testing Purposes.
53. ASTM F 714	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
54. ASTM C 31	Making and Curing Concrete Test Specimen in the Field.
55. ASTM C 39	Compressive Strength of Cylindrical Concrete Specimens.
56. ASTM C 143	Test Method for Slump of Hydraulic Cement Concrete.
57. ASTM C 173	Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
58. ASTM C 231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY	
1. USEPA Method 9090	Compatibility Test for Wastes and Membrane Liners.

[END OF SECTION]

SECTION 02110
SITE PREPARATION AND EARTHWORK

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary to perform all site preparation, excavation, backfilling, and grading required to construct the landfill or surface impoundment. The work shall be carried out in accordance with this General Specification, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02119 - Prepared Subgrade
B. Section 02221 - Clay Liner

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all testing activities outlined in the CQA Plan and shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. Soil testing (both field and laboratory testing) required by the CQA Plan will be the responsibility of the CQA Engineer. All Quality Control testing required by the General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor. The Contractor shall cooperate with the CQA Engineer during all testing activities. The Contractor shall provide equipment and labor to assist the CQA Engineer in sampling and shall provide access to all areas requiring testing. The Contractor shall repair any damage to finished work caused by the CQA Engineer's sampling or testing activities, except when specifically not required by the General Specifications.

D. The CQA Engineer will coordinate independent surveying required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

E. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 MATERIALS

A. Fill materials shall be obtained from the excavation of the landfill or surface impoundment, from the excavation of diversion ditches, or from borrow sources identified by the Owner.

B. Soil shall be classified as one of the following: (i) structural fill; (ii) clay liner material; (iii) topsoil; (iv) protective soil layer material; (v) cover soil; (vi) vegetative cover; (vii) pipe bedding; (viii) subbase; or (ix) spoil.

1. Soil that is classified according to the Unified Soil Classification System (USCS) as SM, CL, ML, SC or GM or GC (ASTM D 2487) and has a maximum particle size of 4 inches; or other material approved by the Owner, may be used as structural fill. Structural fill shall be placed at the locations shown on the Construction Drawings and in all areas requiring fill that are within 50 feet of the landfill or surface impoundment liner system. Beyond the 50 foot requirement structural fill material characteristics may be modified with the approval of the Owner.

2. Soil that meets the requirements of Section 02221 of these General Specifications may be used as clay liner material.

3. Soil classified as topsoil may be used for revegetation of disturbed areas or for other purposes shown on the Construction Drawings. All revegetation activities shall be carried out in accordance with this Section and Section 02900.

4. Soil that meets the requirements of Section 02716 of these General Specifications may be used as protective soil layer material.

5. Soil that meets the requirements of Section 02226 of these General Specifications may be used a cover soil.

6. Soil that meets the requirements of Section 02227 of these General Specifications may be used as vegetative cover material.

7. Soil that meets the requirements of Section 02228 of these General Specifications may be used as pipe bedding.

8. Soil that meets the requirements of Section 02230 of these General Specifications may be used as subbase.

9. Soil not classified as structural fill, clay liner material, protective soil layer material, cover soil, vegetative cover, or topsoil shall be classified as spoil material. Spoil may be used for purposes specified in the Construction Drawings or by the Owner, or it may be disposed of on site in a manner approved by the Owner.

PART 3: EXECUTION

3.01 SITE PREPARATION

A. The Contractor shall develop access to the construction area in accordance with the requirements of the Construction Drawings.

B. The Contractor shall install silt fences immediately down-slope of each area to be disturbed prior to the beginning of work in that area. The Contractor shall maintain the silt fences for the duration of construction. Accumulated sediment behind the silt fences shall be disposed of on-site by the Contractor in a manner approved by the Owner. The area around the top of landfills and surface impoundments shall be graded to direct surface water away from the structure, wherever possible.

C. All brush, vegetation, rubbish, and other objectionable material shall be removed from the construction area and disposed of in an area designated by the Owner.

D. All topsoil shall be removed from the construction area and stockpiled in areas designated by the Owner for subsequent use on site.

E. A 30-foot wide work area shall be maintained clear of objectionable materials around the edge of the landfill or surface impoundment construction area.

F. Diversion ditches, either permanent or temporary, shall be constructed in accordance with the Construction Drawings or as approved by the Owner. The Contractor shall be responsible for constructing diversion ditches as required to divert run-on around the construction area. The construction of temporary ditches not shown on the Construction Drawings shall not be undertaken until the Contractor's plan for constructing the ditches is approved by the Owner.

G. Temporary access roads to the construction area shall be constructed in accordance with the Construction Drawings or as approved by the Owner.

3.02 STOCKPILING

A. Prior to the start of excavation and if required by the Owner, the Contractor shall prepare a written excavation plan. The plan shall indicate the areas and sequence of excavation, and the anticipated classification of the excavated material (e.g., structural fill, clay liner material). This excavation plan must be reviewed and approved by the

Owner. The Contractor shall take into account that the stockpiling portion of the excavation plan may be modified during construction based on the results of any conformance testing of the excavated material required by the CQA Plan.

B. Excavated fill materials (i.e., clay liner, cover soil, etc.) shall be stockpiled in designated areas free of incompatible soil, clearing debris, or other objectionable materials. Stockpile areas will be shown on the Construction Drawings or designated by the Owner.

C. Excavated material classified as spoil shall be segregated from fill and stockpiled or disposed of in the manner shown on the Construction Drawings or as specified by the Owner.

D. The CQA Engineer shall assist in the determination of what excavation material is select fill or spoil material.

E. Stockpiles of fill or spoil shall be no steeper than 3:1 (horizontal:vertical) or other slope approved by the Owner, graded to drain, sealed by tracking parallel to the slope with a dozer or other means approved by the Owner, and dressed daily during periods of active placement of fill taken from the stockpile. The Contractor may cover fill stockpiles with plastic sheeting or other material approved by the Owner in order to preserve the moisture content of the fill.

F. Stockpiles that will remain out of active use for a period greater than seven months shall either be covered as described in this section or stabilized by revegetation in accordance with the requirements for revegetation given in Section 02900.

G. The Contractor shall not remove fill material from the project site without the prior written approval of the Owner.

3.03 EXCAVATION

A. Upon completion of site preparation, the landfill or surface impoundment shall be excavated to the elevations and grades for the subgrade shown on the Construction Drawings. The excavation shall include provisions for any leakage detection system sump or permanent sump shown on the Construction Drawings. All excavation work shall be carried out in compliance with all applicable OSHA regulations.

B. During construction of the landfill or surface impoundment, the Contractor shall make excavations, as necessary, to ensure the drainage of water to a single area (i.e., a sump) to facilitate water collection and removal. A pump shall be provided for removing water from the sump. The pump shall have a capacity sufficient to meet the requirements of Section 01010 of these General Specifications. Water that accumulates in the sump shall be pumped to the on-site construction water tank or to such other location as designated by the Owner. The Contractor shall maintain the landfill or surface impoundment excavation in a dry and workable condition. Damaged work or delays caused by water from any source shall be the responsibility of the Contractor.

C. For subgrades on slopes steeper than 5:1 (horizontal:vertical) which will serve as foundations for structural fill, the subgrade shall be terraced or keyed to anchor the fill material and prevent slip failures. Each terrace shall be at least 10 feet wide with a maximum vertical elevation difference between terraces of 10 feet. Terraces shall generally run perpendicular to the fall line of the slope. Terraces shall have grades of not less than 2 percent or more than 5 percent away from the face of the embankment. Surface drainage shall be maintained at all times. This requirement does not apply to structural fills placed within the landfill or surface impoundment such as ramps or berms.

D. After excavation or stripping to final grade, the CQA Engineer will inspect the subgrade on the side slopes of the landfill or surface impoundment. The CQA Engineer will identify areas that require additional excavation of weak or excessively weathered subgrade materials on the slopes of the landfill or surface impoundment excavation. The Owner will direct the Contractor to excavate the soft areas identified by the CQA Engineer. Such excavations shall be backfilled with structural fill or clay liner material. Backfill shall be placed and compacted in accordance with the requirements for structural fill given in this section. If clay liner material is used to backfill these areas, it shall be placed in accordance with Section 02221 of these General Specifications. However, permeability tests will not be required.

E. After excavation to final grade, the CQA Engineer will inspect the subgrade on the base of the landfill or surface impoundment. The CQA Engineer may identify areas of the subgrade to be proofrolled. If proofrolling is necessary, the Contractor shall use a 20-ton pneumatic-tired roller or other equipment approved by the CQA Engineer. If soft spots or unsuitable materials are found, the Owner may direct the Contractor to excavate the soft material and either fill the excavated area with the same material (assuming the existing material will provide adequate support if recompacted) or structural fill material. Backfill shall be placed and compacted in accordance with the requirements for structural fill given in this section or clay liner material given in Section 02221.

F. The Contractor shall scarify the portion of the subgrade on the base of the landfill or surface impoundment that is comprised of soil and not treated for soft spots, to a depth of not less than 8 inches and compact it in accordance with the requirements for structural fill as directed by the Owner.

G. The subgrade surface shall be seal-rolled to prevent moisture infiltration unless fill is to be immediately placed on the subgrade.

H. Excavation of the landfill or surface impoundment shall not be considered complete, and no fill shall be placed on the subgrade, until the CQA Engineer confirms that the minimum elevations and grades shown on the Construction Drawings have been achieved in the field. The Contractor shall be responsible for notifying the CQA Engineer that the excavation (or a significant portion thereof) is complete and the Contractor shall plan for the time required for the CQA Engineer to confirm the elevations and grades of the excavation.

3.04 PLACEMENT AND COMPACTION OF STRUCTURAL FILL

A. Specific requirements for placement and compaction of structural fill shall be as specified herein unless other requirements are given on the Construction Drawings.

B. Fill lifts after compaction shall have an average thickness of no more than 6 inches and a maximum thickness of no more than 7 inches. The loose thickness shall be no greater than the length of the pad foot and drum groove of the compaction equipment (7 to 8 inches for a CAT 825).

C. The CQA Engineer must complete field testing of fill placed and compacted to determine compliance with these specifications in accordance with the CQA Plan. The Contractor shall not place a new lift of fill over a preceding lift until approval is given by the CQA Engineer. If the Contractor fails to comply with this requirement, he will be required to remove and replace all unauthorized work at his own expense.

D. Prior to placement of a lift of fill, the previous compacted lift shall be thoroughly scarified to provide good bonding between lifts. Scarification shall be accomplished by raking with a grader, discing, or an alternate method approved by the Owner.

E. The subgrade may be compacted at its natural moisture content.

F. Unless otherwise required by the Construction Drawings, structural fill shall be compacted at a moisture content between 3 percent dry to 3 percent wet of the optimum moisture content and to a minimum dry unit weight of 95 percent of the maximum dry unit weight determined in the modified Proctor compaction test (ASTM D 1557). If the moisture content of the structural fill is outside of the acceptable range, the soil shall be wetted or dried back, as appropriate. During wetting or drying, the soil shall be regularly disced or otherwise mixed so that uniform moisture conditions are obtained.

G. The Contractor may moisture-condition fill in either the stockpile area or work area.

H. Compaction of lifts shall be performed with an appropriately heavy, properly ballasted, penetrating-foot compactor subject to the approval of the CQA Engineer.

I. The Contractor shall not place frozen fill, nor shall he place fill on frozen ground.

J. If fill freezes during construction, the Contractor shall remove the frozen fill, scarify the remaining unfrozen fill, and then place and compact new fill in accordance with these General Specifications. The frozen fill shall not be reused until it has thawed, and been thoroughly blended, and then reworked to an acceptable moisture content.

3.05 SURVEY CONTROL

A. The Surveyor shall survey the location and elevation of the excavation for the landfill or surface impoundment. He shall also survey the location and elevation of the top of subgrade shown on the Construction Drawings. Surveying shall be performed in general accordance with Section 01010 of these General Specifications.

B. The Surveyor shall provide Record Drawings of the location and elevation of the excavation and the top of prepared subgrade (or top of interim cover for cover systems) for the landfill or surface impoundment, in accordance with the requirements of Section 01010 of these General Specifications. The Surveyor shall submit this drawing to the Owner prior to the start of GCL placement or cover GCL placement unless otherwise approved by Owner and CQA Engineer. The Surveyor may submit a partial Record Drawing to obtain approval for a portion of work. The Owner will define the minimum requirements for a partial submittal.

3.06 FIELD QUALITY CONTROL

A. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

3.07 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all materials and all partially-completed and completed work of these General Specifications.

B. In the event of damage, the Owner will identify areas requiring repair, and the Contractor shall make all repairs and replacements necessary to the approval of the Owner at no additional cost to the Owner.

C. At the end of each day, the Contractor shall verify that the entire work area was left in a state that promotes surface drainage off and away from the area and from finished work. If threatening weather conditions are forecast, compacted surfaces shall be seal-rolled or covered with plastic sheeting to protect finished work.

3.08 REVEGETATION

A. At the end of construction, all disturbed areas with exposed soil (including borrow areas, soil stockpiles, material storage areas, Contractor access roads, etc.) shall be graded and revegetated in accordance with the requirements for revegetation in Specification 02900.

3.09 SEDIMENTATION AND EROSION CONTROL

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the installation of geotextiles for sedimentation and erosion control during construction. The work shall be carried out in accordance with the requirements of Section 603 of the New Mexico State Highway and Transportation Department Standard Specifications for Highway and Bridge Construction pertaining to erosion control and silt fences. Silt fences shall be placed as necessary downslope of all disturbed areas, and shall remain until such areas are successfully revegetated.

3.10 PERFORATIONS

A. Perforations in the subgrade or fill resulting from CQA activities will be filled. Such perforations may include, but are not limited to, the following:

1. Shelby tube sample locations; and,
2. Sand-cone or rubber balloon test locations.

B. All perforations resulting from construction and/or CQA activities shall be filled by the Contractor. The CQA Engineer will provide the Contractor with the locations of any perforations made as part of CQA activities.

C. Perforations from construction and/or CQA sampling activities (except nuclear density tests) shall be backfilled by the Contractor with structural fill material. The structural fill material shall be placed and compacted in accordance with the requirements of this section.

[END OF SECTION]

SECTION 02119
PREPARED SUBGRADE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the construction of the prepared subgrade for the landfill or surface impoundment. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02110 - Site Preparation and Earthwork
B. Section 02221 - Clay Liner
C. Section 02714 - Geotextile filter of Cushion Layer
D. Section 02780 - Geosynthetic Clay Liner

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualifications and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all testing activities outlined in the CQA Plan and shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. Soil testing (both field and laboratory testing) required by the CQA Plan will be the responsibility of the CQA Engineer. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor. The Contractor shall cooperate with the CQA Engineer during all testing activities. The Contractor shall provide equipment and labor to assist the CQA Engineer in sampling. The Contractor shall provide access to all areas requiring testing. The Contractor shall repair any damage to finished work caused by the CQA Engineer's sampling or testing activities.

D. The CQA Engineer will coordinate independent surveying. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

E. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 MATERIAL FOR PREPARED SUBGRADE

A. Prepared subgrade material shall be obtained from the landfill or surface impoundment excavation subgrade, borrow areas, or stockpiles identified by the Owner.

B. Purposed subgrade shall classify as CL or CH according to USGS.

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~~B~~C. Prepared subgrade may require processing of in-situ materials, borrow areas, or stockpiles to achieve a maximum particle size of 1-inch..

D.~~C.~~ The water used to increase the moisture content of the prepared subgrade shall be provided by the Owner. The Contractor shall maintain an accurate record of his water usage.

PART 3: EXECUTION

3.01 PREPARED SUBGRADE COMPACTION CRITERIA

A. The compaction moisture content of the prepared subgrade material shall be between 3 percent below and 3 percent above optimum moisture content determined in the modified Proctor compaction test (ASTM D1557). The minimum dry unit weight of the prepared subgrade shall be at least 90 percent of the maximum dry unit weight obtained from the modified Proctor compaction test (ASTM D1557).

3.02 PREPARED SUBGRADE MATERIAL PLACEMENT

A. Prepared subgrade shall be placed at the locations and to the thickness shown on the Construction Drawings.

B. Prepared subgrade placement shall begin only after completion of all, or an approved portion of, excavation, structural fill, or cover soil placement in the landfill or surface impoundment.

C. The Contractor shall not place prepared subgrade material on a surface or subgrade that contains debris, branches, vegetation, mud, ice, or frozen material. If frozen subgrade material is encountered, it shall be removed and replaced in accordance with these General Specifications.

D. Prepared subgrade material shall be placed and compacted in lifts parallel to the underlying surface.

E. If normal handling does not reduce the maximum clod size in the prepared subgrade material to an acceptable size, the Contractor shall use a Caterpillar SS250 soil stabilizer, mechanical mixer, or approved equivalent equipment to break up the clods. The prepared subgrade material shall be pulverized until the maximum soil clod size is reduced to 1 inches or less in largest dimension.

F. Moisture conditioning of the prepared subgrade material shall be accomplished in the processing area prior to prepared subgrade construction. The processing area location shall be approved by the Owner. Prepared subgrade material shall be moisture conditioned using a Caterpillar SS250 soil stabilizer or approved equivalent. If the prepared subgrade material is wetter than required, it shall be repeatedly mixed using a Caterpillar SS250 soil stabilizer, harrow, disc, grader, or equivalent to achieve drying.

G. Prepared subgrade material shall not be placed or compacted during a sustained period of temperature below 32°F that results in frozen material either in place or in the borrow area. Prepared subgrade material may be placed and compacted during periods of early morning freezing temperatures if above-freezing temperatures are anticipated during the day.

H. The Contractor shall not place frozen material nor shall the Contractor place material on frozen ground.

I. If prepared subgrade material freezes after compaction, the Contractor shall either rework the material after it thaws or remove the frozen material. The Contractor shall then place and compact new prepared subgrade or rework the prepared subgrade accordance with the General Specifications. Frozen prepared subgrade shall not be reused until it has thawed and been reworked to an acceptable moisture content. The Contractor shall be responsible for protecting compacted lifts of prepared subgrade material from freezing. If extended freezing conditions are anticipated, the Contractor shall prepare a plan for approval of the Owner which outlines the measures he will take to protect finished work.

J. Prepared subgrade material shall not be placed during periods of unfavorable weather conditions.

3.03 PREPARED SUBGRADE COMPACTION

A. The sequence of compaction of the prepared subgrade for the landfill or surface impoundment shall be as described in the General Specifications or as shown on the Construction Drawings.

B. Compaction of prepared subgrade on the landfill or surface impoundment shall be performed using a vibratory steel drum compactor. In areas where geomembranes will be installed on top of the prepared subgrade, Contractor shall prepare the surface in accordance with geomembrane surface preparation requirements identified in the geomembrane specifications.

C. The daily work area shall extend a sufficient distance so as to maintain soil moisture conditions within an acceptable range to allow continuous operations. Desiccation and crusting of the lift surface shall be avoided as much as possible.

D. The CQA Engineer will identify any areas of significant desiccation and crusting of a lift surface. The Contractor shall scarify the surface of such areas to a nominal depth of 1 to 2 inches or to the depth of desiccation identified by the CQA Engineer, and then water condition, disc or mix as necessary, and recompact the area.

E. Corners and other areas inaccessible to driven compaction equipment shall be compacted using hand operated equipment (such as a walk-behind roller) approved by the Owner.

3.04 SURVEY CONTROL

A. The Surveyor shall survey the final location and elevations of the top of the prepared subgrade. Surveying shall be performed in accordance with Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing to the Owner of the final location and elevation of the top of the prepared subgrade. The Surveyor shall submit this drawing prior to liner construction unless otherwise approved by the Owner and the CQA engineer. The Contractor may submit a partial record to obtain approval for a portion of the work. The Owner will define the minimum requirements for a partial submittal.

3.05 FIELD QUALITY CONTROL

A. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

B. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at his own expense until acceptable test results are obtained.

3.06 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all materials and partially completed work of these General Specifications.

B. In the event of damage, the CQA Engineer will identify areas requiring repair, and the Contractor shall make repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

C. The Contractor shall minimize, to the maximum extent feasible, desiccation cracking of prepared subgrade material. The Contractor shall sprinkle the prepared subgrade with water if cracking is observed or if directed by the Owner. The Contractor may seal roll the surface of the prepared subgrade to reduce drying and desiccation. The Contractor may protect exposed surfaces using light colored or translucent membranes, such as Visqueen, to inhibit drying of the prepared subgrade. The CQA Engineer will identify areas of significant cracking of the surface of the prepared subgrade and the Contractor shall repair the identified area to the satisfaction of the Owner and at no additional cost to the Owner.

D. Desiccation cracks larger than 0.2 feet deep or 0.25 inches wide shall be excavated to the full depth of the crack and repaired. Desiccation cracks on the prepared subgrade surface less than 0.2 feet deep and 0.25 inches wide shall be moistened and compacted with a smooth drum roller until the surfaces meet the requirements of the CQA plan.

3.07 PERFORATIONS

A. Perforations in the prepared subgrade resulting from construction and CQA activities shall be filled. Such perforations may include, but are not limited to, the following:

1. Nuclear density test probe locations;
2. Shelby tube sample locations;
3. Sand-cone or rubber-balloon test locations; and,
4. Survey stake locations.

B. Perforations in the prepared subgrade resulting from nuclear density tests will be filled by the CQA Engineer. All other perforations in the prepared subgrade resulting from construction and/or CQA sampling activities shall be filled by the Contractor. The CQA Engineer will provide the Contractor with the locations of any tests made as part of CQA activities, except nuclear density tests.

C. Perforations from construction and/or CQA sampling activities (except nuclear density tests) shall be backfilled by the Contractor with prepared subgrade material. The prepared subgrade material shall be placed and compacted (hand tamped) in accordance with the requirements of this section. Perforations in the prepared subgrade from nuclear density tests will be backfilled by the CQA Engineer with prepared subgrade material and compacted by hand tamping.

[END OF SECTION]

SECTION 02221
CLAY LINER

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the construction of the clay liner component of the liner system for the landfill or surface impoundment. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02110 - Site Preparation and Earthwork
B. Section 02710 - Geocomposite
C. Section 02714 - Filter or Cushion Geotextile
D. Section 02775 - Geomembrane Liners
E. Section 02780 - Geosynthetic Clay Liners

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualifications and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all testing activities outlined in the CQA Plan and shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. Soil testing (both field and laboratory testing) required by the CQA Plan will be the responsibility of the CQA Engineer. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor. The Contractor shall cooperate with the CQA Engineer during all testing activities. The Contractor shall provide equipment and labor to assist the CQA Engineer in sampling. The Contractor shall provide access to all areas requiring testing. The Contractor shall repair any damage to finished work caused by the CQA Engineer's sampling or testing activities.

D. The CQA Engineer will coordinate independent surveying. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

E. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 MATERIALS

Clay liner material may only be used for construction if it has been shown to be suitable in a test fill program. The test fill program will have been performed prior to construction of the landfill or surface impoundment, and it is not part of the work included in this General Specification. These General Specifications may be modified per the results of the test fill.

A. Clay liner material shall be obtained from borrow areas or stockpiles identified by the Owner.

B. Clay liner material for landfill or surface impoundment construction shall:

1. Be classified according to the Unified Soil Classification System (USCS) as CL or CH (ASTM D 2487) and exhibit a minimum liquid limit of 30 and a minimum plasticity index of 11.

2. Have a percentage of gravel (i.e., dry weight retained on a U.S. No. 4 sieve) of less than 15 percent.

3. Have particles no larger than 2 inches (in largest dimension) after processing but prior to placement and no larger than 1 inch (in largest dimension) after placement and compaction.

4. Have a hydraulic conductivity of not more than 1×10^{-7} cm/sec when compacted in accordance with these General Specifications and tested in the laboratory in accordance with ASTM D 5084 at an average effective confining pressure of 5 psi.

C. The water used to increase the moisture content of the clay liner shall be provided by the Owner. The Contractor shall maintain an accurate record of his water usage.

PART 3: EXECUTION

The requirements of Part 3 may be modified based on the results of the test fill.

3.01 CLAY LINER COMPACTION CRITERIA

A. The compaction moisture content and the minimum dry unit weight of on-site clay, if used as clay liner material, shall plot within the placement window as shown on figure 02221-1.

3.02 CLAY LINER PLACEMENT

A. The clay liner shall be constructed to the elevations, grades, and thicknesses shown on the Construction Drawings. The thickness of the clay liner at any location shall be measured perpendicular to the plane of the slope at that location.

B. Clay liner placement shall begin only after completion of all, or an approved portion of excavation, structural fill placement, geosynthetic installation in the landfill or surface impoundment. Placement shall not begin until the Contractor has verified that prepared elevations and grades conform to the Construction Drawings and the CQA Engineer has completed testing and surveying required by the CQA Plan.

C. The Contractor shall not place clay liner material on a surface or subgrade that contains debris, branches, vegetation, mud, ice, or frozen material. If frozen material is encountered, it shall be removed and replaced in accordance with these General Specifications. Immediately prior to clay liner placement, any wet or soft areas shall be proof-rolled as directed by the Owner. Any excessively wet or soft areas shall be excavated and replaced with properly compacted structural fill.

D. The Contractor shall construct the clay liner in lifts. Each lift of the clay liner shall meet the minimum requirements of this General Specification.

E. The average lift thickness after compaction shall be no more than 6 inches, and the maximum lift thickness shall be 7 inches after compaction.

F. On slopes of 3:1 (horizontal:vertical) or flatter, clay liner material may either be placed and compacted in lifts that are parallel to the slope or in horizontal lifts. For steeper slopes, clay liner material shall be placed and compacted in horizontal lifts.

G. Prior to placement of a lift of clay liner material, Contractor shall allow the CQA Engineer to complete field testing in accordance with the CQA Plan. The Contractor shall not place a new lift of clay liner material over a preceding lift until approval is given by the CQA Engineer. If the Contractor fails to comply with this requirement, he will be required by the Owner to remove and replace all unauthorized work at no additional cost to the Owner.

Insert Figure 02221-1

H. Prior to placement of a lift of clay liner material, the previous lift shall be thoroughly scarified to a nominal depth of about 1 to 2 inches to provide good bonding between lifts. Scarification shall be accomplished by discing, ripping with a grader, penetration by a sheepsfoot compactor or an alternative method approved by the Owner.

I. The excessive trafficking of scarified surfaces by non-placement trucks or other equipment shall not be permitted during the period between scarification and placement of the following lift.

J. If normal handling does not reduce the maximum clod size in on-site clay to an acceptable size, the Contractor shall use a Caterpillar SS250 soil stabilizer, mechanical mixer, or approved equivalent equipment to break up the clods. The on-site clay material shall be pulverized until the maximum soil clod size is reduced to 2 inches or less in largest dimension.

K. Moisture conditioning of the clay liner material shall be accomplished in the processing area prior to clay liner construction. The processing area location shall be approved by the Owner. Clay liner material shall be moisture conditioned using a Caterpillar SS250 soil stabilizer or approved equivalent. If the clay liner material is wetter than required, it shall be repeatedly mixed using a Caterpillar SS250 soil stabilizer, harrow disc, grader, or equivalent to achieve drying.

L. No more than 3 percent moisture shall be added to the clay liner material at the time of compaction. Clay liner material requiring more than 3 percent moisture shall be removed, returned to the processing area, and conditioned until the proper moisture content is achieved. If the in-place moisture content is too high, the clay may be dozed, windrowed, disced, and/or otherwise mixed to facilitate drying.

M. Clay liner material shall not be placed or compacted during a sustained period of temperature below 32°F that results in frozen clay, either in place or in the borrow area. Clay liner material may be placed and compacted during periods of early morning freezing temperatures if above-freezing temperatures are anticipated during the day.

N. The Contractor shall not place frozen clay nor shall the Contractor place clay on frozen ground.

O. If clay liner material freezes after compaction, the Contractor shall remove the frozen material, scarify the remaining unfrozen clay, and then place and compact new clay in accordance with the General Specifications. Frozen clay shall not be reused until it has thawed and been reworked to an acceptable moisture content. The Contractor shall be responsible for protecting compacted lifts of clay liner material from freezing. If extended freezing conditions are anticipated, the Contractor shall prepare a plan for approval of the Owner which outlines the measures he will take to protect finished work.

P. Clay liner material shall not be placed during periods of unfavorable weather conditions.

Q. The first lift of clay liner material above any geosynthetics be constructed using a 12-inch thick loose lift. The lift shall be placed and spread using a low-ground pressure dozer (e.g., Caterpillar D6H LGP or other equipment approved by the Owner). Extreme care shall be taken during placement and spreading operations to ensure that the earthwork equipment does not damage the underlying geosynthetics.

3.03 CLAY LINER COMPACTION

A. The sequence of compaction of the clay liner for a landfill or surface impoundment shall be as described in the General Specifications or as shown on the Construction Drawings.

B. Compaction of the clay liner for the landfill or surface impoundment shall be performed using a Caterpillar 825 compactor or equal.

C. The daily work area shall extend a sufficient distance so as to maintain soil moisture conditions within an acceptable range to allow continuous operations. Desiccation and crusting of the lift surface shall be avoided as much as possible.

D. The CQA Engineer will identify any areas of significant desiccation and crusting of a lift surface. The Contractor shall scarify the surface of such areas to a nominal depth of 1 to 2 inches or to the depth of desiccation identified by the CQA Engineer, and then water condition, disc or mix as necessary, and recompact the area.

E. The transition from an existing full-depth section of clay liner to the beginning of an adjacent section that is to be constructed subsequently shall be accomplished by sloping (cutting back) the end of the full-depth section at 3:1 (horizontal:vertical) or flatter, scarifying the slope of the existing full-depth liner at the transition, and then immediately placing the adjacent lifts of clay liner.

F. If a dual-drum compactor which has the drums laterally separated by the operator's cab and the differential (such as a CAT 825) is used, one trip up and a staggered trip back, to cover the uncompacted area between the drums, shall be considered one pass. The minimum number of compactor passes on each lift of the secondary clay liner shall be as follows:

1. The clay liner shall be compacted with a minimum of 10 passes of the CAT 825 if the on-site clay is used or the number of passes determined during test fill construction.

It should be noted that more than the minimum number of passes may be necessary to satisfy the compaction criteria.

G. Corners and other areas inaccessible to driven compaction equipment shall be compacted using hand operated equipment (such as a walk-behind roller) approved by the Owner.

H. In areas where geomembranes will be installed on top of the clay liner, Contractor shall prepare the surface in accordance with geomembrane surface preparation requirements identified in the geomembrane specifications.

3.04 SURVEY CONTROL

A. The Surveyor shall survey the final location and elevation of the top of the clay liner. Surveying shall be performed in accordance with Section 01010 of these General Specifications. As part of this work, the Surveyor shall survey the location and elevation of the leak detection system sump. The survey will ensure:

1. The specified thickness of the clay liner has been achieved.

2. The top of the clay liner is at the grades and elevations specified on the contract drawings.

B. The Surveyor shall provide a Record Drawing to the Owner of the final location and elevation of the top of the clay liner, in accordance with the requirements of Section 01010 of these General Specifications. The Surveyor shall submit this drawing prior to additional construction unless otherwise approved by the Owner and the CQA engineer. The Contractor may submit a partial record to obtain approval for a portion of the work. The Owner will define the minimum requirements for a partial submittal.

3.05 FIELD QUALITY CONTROL

A. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

B. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at his own expense until acceptable test results are obtained.

3.06 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all materials and partially-completed and completed work of these General Specifications.

B. In the event of damage, the CQA Engineer will identify areas requiring repair, and the Contractor shall make repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

C. The Contractor shall minimize, to the maximum extent feasible, desiccation cracking of clay liner material. The Contractor shall sprinkle the clay with water if cracking is observed or if directed by the Owner. The Contractor may seal roll the surface of the clay to reduce drying and desiccation. The Contractor may protect exposed surfaces using light-colored or translucent membranes, such as Visqueen, to inhibit drying of the clay. The CQA Engineer will identify areas of significant cracking of the surface of the clay liner and the Contractor shall repair the identified area to the satisfaction of the Owner and at no additional cost to the Owner.

D. The clay liner surface shall be seal rolled and made smooth and free from ruts or indentations at the end of every working day when precipitation is forecast and/or at the completion of compaction operations in an area.

E. The Contractor shall maintain the clay liner surface in a condition suitable for geomembrane installation as specified in the CQA plan until the surface is covered. Desiccation cracks larger than 0.2 feet deep or 0.25 inches wide shall be excavated to the full depth of the crack and repaired. Desiccation cracks on the liner surface less than 0.2 feet deep and 0.25 inches wide shall be moistened and compacted with a smooth drum roller until the surfaces meet the requirements of the CQA Plan.

F. The layer of over-built material shall be removed prior to placement of overlying materials. The over-built material may be removed in sections to coordinate construction. Where the over-built material is removed, the finished surface shall be protected and maintained as required by the specifications.

G. No synthetic sealants or other chemical treatments may be applied to the clay liner material.

H. The CQA Engineer will issue an approval of the installation of the clay liner to the Owner prior to placement of material over the clay liner in accordance with the requirements of the CQA Plan.

3.07 PERFORATIONS

A. Perforations in the clay liner resulting from construction and CQA activities shall be filled. Such perforations may include, but are not limited to, the following:

1. Nuclear density test probe locations;
2. Shelby tube sample locations;
3. Sand-cone or rubber-balloon test locations; and,
4. ~~4.~~ Survey stake locations.

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B. Perforations in the clay liner resulting from nuclear density tests will be filled by the CQA Engineer. All other perforations in the clay liner resulting from construction and/or CQA sampling activities shall be filled by the Contractor. The CQA Engineer will provide the Contractor with the locations of any tests made as part of CQA activities, except nuclear density tests.

C. Perforations from construction and/or CQA sampling activities (except nuclear density tests) shall be backfilled by the Contractor with clay liner material. The clay liner material shall be placed and compacted (hand tamped) in accordance with the requirements of this section. Perforations in the clay liner from nuclear density tests will be backfilled by the CQA Engineer with clay liner material and compacted by hand tamping.

[END OF SECTION]

SECTION 02224
DRAINAGE GRAVEL

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the placement of drainage gravel associated with the landfill and surface impoundment. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02710 - Geocomposite Detection or Collection Layer
B. Section 02714 - Geotextile Filter or Cushion Layer
C. Section 02718 - Polyethylene Pipe and Fittings
D. Section 02775 - Geomembrane Liners

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule.

C. On-site testing as specified in the CQA Plan for the drainage gravel (which does not include quality control testing at the source) will be the responsibility of the CQA Engineer. The Contractor shall cooperate with the CQA Engineer during all sampling and testing activities. The Contractor shall provide equipment and labor to assist the CQA Engineer in sampling. The Contractor shall provide access to all areas requiring testing. The Contractor will repair any damage to finished work caused by the CQA Engineer's sampling and testing activities.

D. Quality control testing (in accordance with Part 2.02 of this section) of the drainage gravel at the source shall be the responsibility of the Contractor.

PART 2: PRODUCTS

2.01 MATERIAL FOR DRAINAGE GRAVEL

A. Drainage gravel for the work shall consist of clean, hard, durable, non-carbonate, rounded, sub-rounded to sub-angular particles which are free of metals, roots, trees, stumps, concrete, construction debris, other organic matter, and deleterious materials and coatings.

B. The gravel shall be screened and washed to have a gradation (when tested in accordance with ASTM D 422) after placement equivalent to the following:

Sieve	Percent Passing
1”	100%
¾”	85-100%
3/8”	12-30%
4”	1-4%
40”	0-1%

C. Drainage gravel shall have a hydraulic conductivity of at least 1 cm/sec when hand compacted in the laboratory in 3 lifts and tested in accordance with ASTM D 2434.

D. Drainage gravel shall have less than 30% loss when tested in accordance with ASTM C 131 for abrasion and less than 12% loss when tested in accordance with ASTM C 88.

E. Drainage gravel shall have less than 5 percent loss of weight, when tested for calcium carbonate content in accordance with ASTM D 4373. This requirement may be waived by the Owner if it can be otherwise demonstrated that the material contains no significant carbonate content.

2.02 DRAINAGE GRAVEL SUPPLIER QUALITY CONTROL

A. The Contractor shall require that the drainage gravel Supplier sample and test the gravel to demonstrate that the material conforms to the requirements of Part 2.01 of this section. The Contractor shall require the gravel Supplier provide to the Owner written certification along with test results, that tests have been performed on representative samples of the gravel material that will be delivered to the Owner's site. The analysis shall demonstrate that tests (i.e., ASTM D 422, ASTM D 2434, ASTM D 4373, AASHTO T96, and AASHTO T104) have been performed and that acceptable results were obtained.

B. If a gravel sample fails to meet the quality control requirements of this General Specification, the Contractor shall require the gravel Supplier to perform sufficient sampling and testing to identify the extent of the nonconforming material to the satisfaction of the CQA Engineer. The Contractor shall not use nonconforming material.

C. The Contractor shall require that the gravel Supplier comply with the certification and submittal requirements of the CQA Plan.

D. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

2.03 TRANSPORTATION

A. Transportation of gravel shall be the responsibility of the Contractor.

2.04 HANDLING AND STORAGE

A. Handling, stockpiling, and protection of the gravel prior to and following incorporation into the work is the responsibility of the Contractor. The Contractor shall be liable for contamination of the material incurred prior to final acceptance.

B. The Contractor shall be responsible for storage of the gravel at the site. The Contractor shall store the gravel at a location approved by the Owner and in such a manner so that it is not contaminated by dirt, mud, vegetation, or excessive dust. During stockpiling, the Contractor may elect to place the gravel on a protective sheet and/or to cover it to prevent contamination. The CQA Engineer will identify contaminated material which will be rejected by the Owner.

PART 3: EXECUTION

3.01 PLACEMENT AND COMPACTION

A. Gravel shall be placed at the locations and to the thicknesses shown on the Construction Drawings.

B. Gravel shall not be placed directly on the geomembrane liner. Gravel may be placed on top of a geotextile cushion layer, geonet, geocomposite drainage layer, or geomembrane rub sheet, as shown on the Construction Drawings. Gravel may be placed using a backhoe, front-end loader, belt conveyor, spreader box, or other method approved by the Owner, as long as the ground-pressure requirements of this Section are not exceeded. The maximum acceptable gravel drop height is 3 feet.

C. Final spreading of the gravel may be performed using a low ground-pressure dozer (Caterpillar D6H-LGP or other similar equipment approved by the CQA Engineer), low-ground pressure front-end loader, or by hand. The tracked equipment shall operate only over previously-placed gravel or other soil. The Contractor shall not operate equipment directly on geosynthetics.

D. Unless otherwise specified by the Owner, the equipment used to spread gravel shall not exert ground pressures exceeding the following:

Allowable Equipment Ground Pressure (psi)	*Thickness of Gravel Above Geosynthetic (inches)*
<5	12
<10	18
<20	24
>20	36

The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the Owner at the Contractor's expense.

E. The Contractor shall operate equipment in a manner that is protective of polyethylene pipes and underlying geosynthetics. If it is suspected that damage to polyethylene pipes or underlying geosynthetics may have occurred, the Owner will instruct the Contractor to remove the overlying material to expose the potentially-damaged materials. The Contractor shall repair, at his own expense, any observed damage, in accordance with the requirements of these General Specifications.

F. Within 1 foot of the toe of a slope, gravel shall be spread by hand. Extreme care shall be taken when placing gravel to protect the installed components of the liner system.

G. Geotextile filter or cushion layers shall be placed as shown on the Construction Drawings. Geotextile filter and cushion layer placement shall be in accordance with Section 02714 of these General Specifications.

3.02 FIELD QUALITY CONTROL

A. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

B. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at his own expense until acceptable test results are obtained.

3.03 PROTECTION OF WORK

A. After the gravel has been incorporated into the work, the Contractor shall maintain it free of ruts, depressions, and damage resulting from the hauling and handling of any material, equipment, tools, etc.

B. The Contractor shall use all means necessary to protect all prior work, materials and completed and partially completed work of other Sections of these General Specifications.

C. In the event of damage, the CQA Engineer will identify areas requiring repair, and the Contractor shall make repairs and replacements necessary, to the approval of the Owner at no additional cost to the Owner.

3.04 SURVEY CONTROL

A. The Surveyor shall survey the final location and elevation of the top of the drainage gravel. Surveying shall be performed in accordance with of Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing to the Owner of the final location and elevation of the final surface of the drainage gravel, in accordance with the requirements of Section 01010 of these General Specifications.

[END OF SECTION]

SECTION 02225
ROAD BASE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, testing, and installation services necessary for the installation of road base where shown on the Construction Drawings. The work shall be carried out in accordance with the Construction Drawings and the requirements of Section 304 of the New Mexico State Highway and Transportation Department Standard Specification for Road and Bridge Construction.

1.02 RELATED SECTIONS

A. Section 02230 - Subbase
B. Section 02714 - Filter or Cushion Geotextile

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule.

C. On-site testing as specified in the CQA Plan for the road base (which does not include quality control testing at the source) will be the responsibility of the CQA Engineer. The Contractor shall cooperate with the CQA Engineer during all sampling and testing activities. The Contractor shall provide equipment and labor to assist the CQA Engineer in sampling. The Contractor shall provide access to all areas requiring testing. The Contractor will repair any damage to finished work caused by the CQA Engineer's sampling and testing activities.

D. Quality control testing (in accordance with Part 2.02 of this section) of the road base at the source shall be the responsibility of the Contractor.

PART 2: PRODUCTS

2.01 MATERIAL FOR ROAD BASE AGGREGATE

A. Road base for the work shall consist of clean, hard, durable, non-carbonate, rounded, sub-rounded to sub-angular particles which are free of metals, roots, trees, stumps, concrete, construction debris, other organic matter, and deleterious materials and coatings.

B. The road base shall have a gradation (when tested in accordance with ASTM D 422) of Type II-B aggregate as defined in Section 304 of the New Mexico State Highway and Transportation Department Standard Specification for Road and Bridge Construction.

C. Road base shall have less than 5 percent loss of weight, when tested for calcium carbonate content in accordance with ASTM D 4373. This requirement may be waived by the owner if it can be otherwise demonstrated that the material contains no significant carbonate content.

2.02 ROAD BASE SUPPLIER QUALITY CONTROL

A. The Contractor shall require that the road base Supplier sample and test the road base to demonstrate that the material conforms to the requirements of Part 2.01 of this section. The Contractor shall require the road base Supplier provide to the Owner written certification along with test results, that tests have been performed on representative samples of the road base material that will be delivered to the Owner's site. The analysis shall demonstrate that tests (i.e., ASTM D 422, ASTM D 2434, ASTM D 4373, ASTM C 131, and ASTM C 88) have been performed and that acceptable results were obtained.

B. If a road base sample fails to meet the quality control requirements of this General Specification, the Contractor shall require the road base Supplier to perform sufficient sampling and testing to identify the extent of the nonconforming material to the satisfaction of the CQA Engineer. The Contractor shall not use nonconforming material.

C. The Contractor shall require that the road base Supplier comply with the certification and submittal requirements of the CQA Plan.

D. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

2.03 TRANSPORTATION

A. Transportation of road base shall be the responsibility of the Contractor.

2.04 HANDLING AND STORAGE

A. Handling, stockpiling, and protection of the road base prior to and following incorporation into the work is the responsibility of the Contractor. The Contractor shall be liable for contamination of the material incurred prior to final acceptance.

B. The Contractor shall be responsible for storage of the road base at the site. The Contractor shall store the road base at a location approved by the Owner and in such a manner so that it is not contaminated by dirt, mud, vegetation, or excessive dust. During stockpiling, the Contractor may elect to place the road base on a protective sheet and/or to cover it to prevent contamination. The CQA Engineer will identify contaminated material which will be rejected by the Owner.

PART 3: EXECUTION

3.01 GRAVEL COMPACTION CRITERIA

A. The compaction moisture content of the road base shall be between 3 percent below and 3 percent above optimum moisture content determined in the modified Proctor compaction test (ASTM D1557). The minimum dry unit weight of the road base aggregate shall be at least 95 percent of the maximum dry unit weight obtained from the modified Proctor compaction test (ASTM D1557).

3.02 PLACEMENT AND COMPACTION

A. Road base shall be placed at the locations and to the thicknesses shown on the Construction Drawings

B. Road base shall not be placed directly on geosynthetics unless required by the General Specifications or the Construction Drawings. Road base may be placed using a backhoe, front-end loader, belt conveyor, spreader box, or other method approved by the Owner in maximum 12-inch loose lifts.

C. Final spreading of the road base may be performed using a dozer or grader. Equipment shall operate only over previously-placed road base or other soil. The Contractor shall not operate equipment directly on geosynthetics.

D. Road base placed on top of geotextile shall have a first lift minimum thickness of 12 inches

E. The Contractor shall operate equipment in a manner that is protective of polyethylene pipes and underlying geosynthetics. If it is suspected that damage to polyethylene pipes or underlying geosynthetics may have occurred, the Owner will instruct the Contractor to remove the overlying material to expose the potentially-damaged materials. The Contractor shall repair, at his own expense, any observed damage, in accordance with the requirements of these General Specifications.

F. Geotextile filter or cushion layers shall be placed as shown on the Construction Drawings. Geotextile filter and cushion layer placement shall be in accordance with Section 02714 of these General Specifications.

3.03 FIELD QUALITY CONTROL

A. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

B. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at his own expense until acceptable test results are obtained.

3.04 PROTECTION OF WORK

A. After the road base has been incorporated into the work, the Contractor shall maintain it free of ruts, depressions, and damage resulting from the hauling and handling of any material, equipment, tools, etc.

B. The Contractor shall use all means necessary to protect all prior work, materials and completed and partially completed work of other Sections of these General Specifications.

C. In the event of damage, the CQA Engineer will identify areas requiring repair, and the Contractor shall make repairs and replacements necessary, to the approval of the Owner at no additional cost to the Owner.

3.05 SURVEY CONTROL

A. The Surveyor shall survey the final location and elevation of the top of the road base. Surveying shall be performed in accordance with of Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing to the Owner of the final location and elevation of the final surface of the road base, in accordance with the requirements of Section 01010 of these General Specifications.

[END OF SECTION]

SECTION 02226
~~COVER~~PROTECTIVE SOIL

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the construction of the soil component of the landfill. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02119 - Prepared Subgrade
B. Section 02710 - Geocomposite Detection or Collection Layer

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all testing activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. Soil testing (both field and laboratory testing) required by the CQA Plan will be the responsibility of the CQA Engineer. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor. The Contractor shall cooperate with the CQA Engineer during all testing activities. The Contractor shall provide equipment and labor to assist the CQA Engineer in sampling. The Contractor shall provide access to all areas requiring testing. The Contractor shall repair any damage to finished work caused by the CQA Engineer sampling or testing activities.

D. The CQA Engineer will coordinate independent surveying required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

E. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 MATERIALS

A. Soil material shall be obtained from the landfill or surface impoundment excavation or from on-site or off-site borrow sources.

B. Soil layer material shall classify as CL, ML, SC, GC, SM, or GM according to the Unified Soil Classification System (ASTM D 2487) and shall have a maximum particle size not exceeding 3 inches.

PART 3: EXECUTION

3.01 SOIL LAYER COMPACTION CRITERIA

A. The Contractor shall place and compact the soil as described in this Section.

3.02 PLACEMENT AND COMPACTION

A. Soil material shall be placed above the waste material at the locations and to the thicknesses shown on the Construction Drawings.

B. The Contractor shall not place the soil layer until the CQA Engineer confirms that the constructed grades and elevations of the waste meet the requirements of the Construction Drawings, all field testing is complete, and approved in accordance with the requirements of the CQA Plan.

C. The final in-place thickness of the soil layer shall be not less than 18 inches.

D. The soil material shall be spread in 2 lifts. The Contractor shall not operate equipment directly on geomembranes, geotextiles, GCL's, or geocomposites.

E. Unless otherwise specified by the Owner, the equipment used to haul and spread the soil layer in areas within 5 feet of geosynthetics shall not exert ground pressures exceeding the following:

Allowable Equipment Ground Pressure (psi)	*Minimum Thickness of Soil Layer Above the Geosynthetic (inches)*
<5	12
<10	18
<20	24
>20	36

The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the Owner at the Contractor's expense.

F. Soil shall be compacted at a moisture content between 3 percent below to 3 percent above optimum moisture content and to a minimum dry unit weight of 90 percent of the maximum dry unit weight determined in the modified Proctor compaction test (ASTM D 1557).

G. In areas of heavy traffic, the thickness of the soil layer shall be increased at the direction of the Owner to satisfy the requirements of this Section. Heavy traffic areas shall be compacted with a smooth drum roller or other equipment approved by the Owner.

H. The Contractor shall operate equipment in a manner that is protective of underlying geosynthetics. If it is suspected that any damage to the underlying geosynthetics may have occurred, the Owner will instruct the Contractor to remove overlying soil layer material to expose the geosynthetics. The Contractor shall repair, at his own expense, any damage of the underlying geosynthetics in accordance with these General Specifications.

I. The Contractor shall minimize to the extent possible the generation of dust during placement of the soil layer. Water may be used for dust control if approved by the Owner. Chemical dust suppressants shall not be used.

J. No soil material shall be placed or compacted during a sustained period of temperature below 32°F that results in frozen material, either in-place or in the borrow area. With the approval of the Owner, soil material may be placed and compacted during periods of early morning freezing temperatures if above-freezing temperatures are anticipated during the day.

K. The Contractor shall not place frozen soil material nor shall he place soil material on frozen ground.

L. Soil material shall not be placed during periods of precipitation or unfavorable weather conditions.

3.03 SURVEY CONTROL

A. The Surveyor shall survey the final location and elevation of the top of the soil layer installed by the Contractor. Surveying shall be performed in accordance with Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing of the location and elevation of the top of the soil layer to the Owner in accordance with the requirements of Section 01010 of these General Specifications.

3.04 FIELD QUALITY CONTROL

A. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

B. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at his own expense until acceptable test results are obtained.

3.05 PROTECTION OF WORK

A. After the soil layer has been placed, the Contractor shall maintain it free of ruts, depressions, and damage resulting from the hauling and handling of any material, equipment, tools, etc.

B. The Contractor shall use all means necessary to protect all materials and partially-completed and completed work of these General Specifications.

C. In the event of damage, the CQA Engineer will identify any areas requiring repair, and the Contractor shall make repairs and replacements necessary, to the approval of the Owner and at no additional cost to the Owner.

[END OF SECTION]

SECTION 02227
VEGETATIVE COVER

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the construction of the vegetative cover component of the landfill. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02710 - Geocomposite
B. Section 02714 - Filter or Cushion Geotextile

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all testing activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. Soil testing (both field and laboratory testing) required by the CQA Plan will be the responsibility of the CQA Engineer. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor. The Contractor shall cooperate with the CQA Engineer during all testing activities. The Contractor shall provide equipment and labor to assist the CQA Engineer in sampling. The Contractor shall provide access to all areas requiring testing. The Contractor shall repair any damage to finished work caused by the CQA Engineer sampling or testing activities.

D. The CQA Engineer will coordinate independent surveying required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

E. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 MATERIALS

A. Vegetative cover material shall be obtained from the landfill or surface impoundment excavation or from on-site or off-site borrow sources.

B. Vegetative cover material shall classify as CL, ML, SC, GC, SM, or GM according to the Unified Soil Classification System (ASTM D 2487) and shall have a maximum particle size not exceeding 3 inches.

PART 3: EXECUTION

3.01 VEGETATIVE COVER LAYER COMPACTION CRITERIA

A. The Contractor shall place and compact the soil as described in of this Section.

3.02 PLACEMENT AND COMPACTION

A. Vegetative cover material shall be placed above the cover system geocomposite at the locations and to the thicknesses shown on the Construction Drawings.

B. The Contractor shall not place the vegetative soil layer until the CQA Engineer confirms that the constructed grades and elevations of the cover prepared subgrade meet the requirements of the Construction Drawings, all field testing is complete, and the geocomposite has been installed, tested, and approved in accordance with the requirements of the CQA Plan.

C. Prior to placing the vegetative cover layer, the CQA Engineer will verify that the underlying geosynthetic components are free of holes, tears, excessive wrinkles, or foreign objects. As instructed by the Owner, the Contractor shall "work out" or repair all excessive wrinkles to the satisfaction of the CQA Engineer prior to placement of the vegetative cover. In all cases, wrinkles in the geomembrane cover shall not be of a size that they could fold back on themselves.

D. The final in-place thickness of the vegetative cover layer shall be not less than 30 inches.

E. The vegetative cover material shall be spread in one lift using a low ground-pressure dozer (Caterpillar D6H-LGP, or other equipment approved by the Owner), low-ground pressure tracked front-end loader, or belt conveyor. Equipment shall operate only over previously-placed vegetative cover layer material. The Contractor shall not operate equipment directly on geomembranes, geotextiles, gcls, or geocomposites.

F. Unless otherwise specified by the Owner, the equipment used to haul and spread the vegetative cover layer shall not exert ground pressures exceeding the following:

Minimum Thickness

Allowable Equipment	*of Protective Soil Layer*
Ground Pressure (psi)	*Above the Geosynthetic (inches)*
<5	12
<10	18
<20	24
>20	36

The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the Owner at the Contractor's expense.

G. Vegetative cover material shall be compacted by two passes of tracked equipment such as a Caterpillar D6H-LGP or other equipment approved by the Owner.

H. In areas of heavy traffic, the thickness of the vegetative cover layer shall be increased at the direction of the Owner to satisfy the requirements of this Section. Heavy traffic areas shall be compacted with a smooth drum roller or other equipment approved by the Owner.

I. The Contractor shall operate equipment in a manner that is protective of underlying geosynthetics. If it is suspected that any damage to the underlying geosynthetics may have occurred, the Owner will instruct the Contractor to remove overlying vegetative cover material to expose the geosynthetics. The Contractor shall repair, at his own expense, any damage of the underlying geosynthetics in accordance with these General Specifications.

J. The Contractor shall minimize to the extent possible the generation of dust during placement of the vegetative cover layer. Water may be used for dust control if approved by the Owner. Chemical dust suppressants shall not be used.

K. No vegetative cover material shall be placed or compacted during a sustained period of temperature below 32°F that results in frozen material, either in-place or in the borrow area. With the approval of the Owner, vegetative cover material may be placed and compacted during periods of early morning freezing temperatures if above-freezing temperatures are anticipated during the day.

L. The Contractor shall not place frozen vegetative cover material nor shall he place vegetative cover material on frozen ground.

M. Vegetative cover material shall not be placed during periods of precipitation or unfavorable weather conditions.

3.03 SURVEY CONTROL

A. The Surveyor shall survey the final location and elevation of the top of the vegetative cover layer installed by the Contractor. Surveying shall be performed in accordance with Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing of the location and elevation of the top of the vegetative cover layer to the Owner in accordance with the requirements of Section 01010 of these General Specifications.

3.04 FIELD QUALITY CONTROL

A. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

B. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at his own expense until acceptable test results are obtained.

3.05 PROTECTION OF WORK

A. After the vegetative cover layer has been placed, the Contractor shall maintain it free of ruts, depressions, and damage resulting from the hauling and handling of any material, equipment, tools, etc.

B. The Contractor shall use all means necessary to protect all materials and partially-completed and completed work of these General Specifications.

C. In the event of damage, the CQA Engineer will identify any areas requiring repair, and the Contractor shall make repairs and replacements necessary, to the approval of the Owner and at no additional cost to the Owner.

[END OF SECTION]

SECTION 02228
PIPE BEDDING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the construction of pipe bedding material. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02714 - Filter or Cushion Geotextile
B. Section 02718 - Polyethylene Pipe and Fittings

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all testing activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. Soil testing (both field and laboratory testing) required by the CQA Plan will be the responsibility of the CQA Engineer. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor. The Contractor shall cooperate with the CQA Engineer during all testing activities. The Contractor shall provide equipment and labor to assist the CQA Engineer in sampling. The Contractor shall provide access to all areas requiring testing. The Contractor shall repair any damage to finished work caused by the CQA Engineer sampling or testing activities.

D. The CQA Engineer will coordinate independent surveying required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

E. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 MATERIALS

A. Pipe bedding material shall be obtained from the landfill or surface impoundment excavation or from on-site or off-site borrow sources.

B. Pipe bedding material shall classify as ML, SM, SP, SW, or GM according to the Unified Soil Classification System (ASTM D 2487) and shall have a maximum particle size not exceeding 1 inches.

PART 3: EXECUTION

3.01 PIPE BEDDING COMPACTION CRITERIA

A. The Contractor shall place and compact the soil as described in of this Section.

3.02 PLACEMENT AND COMPACTION

A. Pipe bedding shall be placed at the locations and to the thicknesses shown on the Construction Drawings.

B. The Contractor shall not place the pipe bedding material until the CQA Engineer confirms that the constructed grades and elevations of the underlying materials meet the requirements of the Construction Drawings, all field testing is complete, and the underlying materials have been installed, tested, and approved in accordance with the requirements of the CQA Plan.

C. Prior to placing the pipe bedding material, the CQA Engineer will verify that the underlying geosynthetic components are free of holes, tears, excessive wrinkles, or foreign objects. As instructed by the Owner, the Contractor shall "work out" or repair all excessive wrinkles to the satisfaction of the CQA Engineer prior to placement of the pipe bedding. In all cases, wrinkles in the geomembrane shall not be of a size that they could fold back on themselves.

D. Pipe bedding may be placed using a backhoe, front-end loader, belt conveyor, spreader box, or other method approved by the Owner. The maximum drop height is 3 feet.

E. The pipe bedding material shall be shovel sliced into the haunches of the pipe.

F. Contractor shall not operate equipment directly on geosynthetics when placing pipe bedding material.

G. The Contractor shall operate equipment in a manner that is protective of underlying polyethylene pipes and geosynthetics. If it is suspected that any damage to the underlying polyethylene pipes or geosynthetics may have occurred, the Owner will instruct the Contractor to remove overlying pipe bedding material to expose the potentially damaged materials. The Contractor shall repair, at his own expense, any damage of the underlying materials in accordance with these General Specifications.

H. No pipe bedding material shall be placed or compacted during a sustained period of temperature below 32°F that results in frozen material, either in-place or in the borrow area. With the approval of the Owner, pipe bedding material may be placed and compacted during periods of early morning freezing temperatures if above-freezing temperatures are anticipated during the day.

I. The Contractor shall not place frozen pipe bedding material.

J. Pipe bedding material shall not be placed during periods of precipitation or unfavorable weather conditions.

K. Pipe bedding material shall be compacted with two passes of a hand operated vibrating compactor such as a hand tamper or walk-behind vibrating compactor or other method approved by the Owner.

3.03 SURVEY CONTROL

A. The Surveyor shall survey the final location and elevation of the top of the pipe bedding material installed by the Contractor. Surveying shall be performed in accordance with Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing of the location and elevation of the top of the pipe bedding material to the Owner in accordance with the requirements of Section 01010 of these General Specifications.

3.04 FIELD QUALITY CONTROL

A. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

B. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at his own expense until acceptable test results are obtained.

3.05 PROTECTION OF WORK

A. After the pipe bedding material has been placed, the Contractor shall maintain it free of ruts, depressions, and damage resulting from the hauling and handling of any material, equipment, tools, etc.

B. The Contractor shall use all means necessary to protect all materials and partially-completed and completed work of these General Specifications.

C. In the event of damage, the CQA Engineer will identify any areas requiring repair, and the Contractor shall make repairs and replacements necessary, to the approval of the Owner and at no additional cost to the Owner.

[END OF SECTION]

SECTION 02229
SELECT SUBBASE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, testing, and installation services necessary for the installation of select subbase where shown on the Construction Drawings. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02710 - Geocomposite Detection or Collection Layer
B. Section 02714 - Filter or Cushion Geotextile

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule.

C. On-site testing as specified in the CQA Plan for the select subbase (which does not include quality control testing at the source) will be the responsibility of the CQA Engineer. The Contractor shall cooperate with the CQA Engineer during all sampling and testing activities. The Contractor shall provide equipment and labor to assist the CQA Engineer in sampling. The Contractor shall provide access to all areas requiring testing. The Contractor will repair any damage to finished work caused by the CQA Engineer's sampling and testing activities.

D. Quality control testing (in accordance with Part 2.02 of this section) of the select subbase at the source shall be the responsibility of the Contractor.

PART 2: PRODUCTS

2.01 MATERIAL FOR SELECT SUBBASE

A. Select subbase for the work shall consist of clean, hard, durable, non-carbonate, rounded, sub-rounded to sub-angular particles which are free of metals, roots, trees, stumps, concrete, construction debris, other organic matter, and deleterious materials and coatings.

B. The select subbase shall be screened and washed to have a gradation (when tested in accordance with ASTM D 422) after placement equivalent to the following:

Sieve	Percent Passing
¼"	100
#10	50-80
#20	30-60
#40	10-40
#60	0-30
#100	0-10
#200	0-2

C. Select subbase shall have less than 5 percent loss of weight, when tested for calcium carbonate content in accordance with ASTM D 4373. This requirement may be waived by the owner if it can be otherwise demonstrated that the material contains no significant carbonate content.

2.02 SELECT SUBBASE SUPPLIER QUALITY CONTROL

A. The Contractor shall require that the select subbase Supplier sample and test the select subbase to demonstrate that the material conforms to the requirements of Part 2.01 of this section. The Contractor shall require the select subbase Supplier provide to the Owner written certification along with test results, that tests have been performed on representative samples of the material that will be delivered to the Owner's site. The analysis shall demonstrate that tests (i.e., ASTM D 422, ASTM D 2434, ASTM D 4373, ASTM C 131, and ASTM C 88) have been performed and that acceptable results were obtained.

B. If a select subbase sample fails to meet the quality control requirements of this General Specification, the Contractor shall require the Supplier to perform sufficient sampling and testing to identify the extent of the nonconforming material to the satisfaction of the CQA Engineer. The Contractor shall not use nonconforming material.

C. The Contractor shall require that the gravel Supplier comply with the certification and submittal requirements of the CQA Plan.

D. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

2.03 TRANSPORTATION

A. Transportation of select subbase shall be the responsibility of the Contractor.

2.04 HANDLING AND STORAGE

A. Handling, stockpiling, and protection of the select subbase prior to and following incorporation into the work is the responsibility of the Contractor. The Contractor shall be liable for contamination of the material incurred prior to final acceptance.

B. The Contractor shall be responsible for storage of the select subbase at the site. The Contractor shall store the select subbase at a location approved by the Owner and in such a manner so that it is not contaminated by dirt, mud, vegetation, or excessive dust. During stockpiling, the Contractor may elect to place the select subbase on a protective sheet and/or to cover it to prevent contamination. The CQA Engineer will identify contaminated material which will be rejected by the Owner.

PART 3: EXECUTION

3.01 SELECT SUBBASE COMPACTION CRITERIA

A. The compaction moisture content of the select subbase shall be between 3 percent and 3 percent above optimum moisture content determined in the modified Proctor compaction test (ASTM D 1557). The minimum dry unit weight of the select subbase shall be at least 95 percent of the maximum dry unit weight obtained from the modified Proctor compaction test (ASTM D 1557).

3.02 PLACEMENT AND COMPACTION

A. Select subbase shall be placed at the locations and to the thicknesses shown on the Construction Drawings

B. Select subbase shall not be placed directly on geosynthetics unless required by the General Specifications or Construction Drawings. Select subbase may be placed using a backhoe, front-end loader, belt conveyor, spreader box, or other method approved by the Owner in maximum 12-inch loose lifts.

C. Final spreading of the select subbase may be performed using a low ground-pressure dozer (Caterpillar D6H-LGP or other similar equipment approved by the CQA Engineer), low-ground pressure front-end loader, or by hand. The tracked equipment shall operate only over previously-placed select subbase or other soil. The Contractor shall not operate equipment directly on geosynthetics.

D. Unless otherwise specified by the Owner, the equipment used to spread select subbase shall not exert ground pressures exceeding the following:

Allowable Equipment Ground Pressure (psi)	*Thickness of Gravel Above Geosynthetic (inches)*
<5	12
<10	18
<20	24
>20	36

The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the Owner at the Contractor's expense.

E. The Contractor shall operate equipment in a manner that is protective of polyethylene pipes and underlying geosynthetics. If it is suspected that damage to polyethylene pipes or underlying geosynthetics may have occurred, the Owner will instruct the Contractor to remove the overlying material to expose the potentially-damaged materials. The Contractor shall repair, at his own expense, any observed damage, in accordance with the requirements of these General Specifications.

3.03 FIELD QUALITY CONTROL

A. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

B. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at his own expense until acceptable test results are obtained.

3.04 PROTECTION OF WORK

A. After the select subbase has been incorporated into the work, the Contractor shall maintain it free of ruts, depressions, and damage resulting from the hauling and handling of any material, equipment, tools, etc.

B. The Contractor shall use all means necessary to protect all prior work, materials and completed and partially completed work of other Sections of these General Specifications.

C. In the event of damage, the CQA Engineer will identify areas requiring repair, and the Contractor shall make repairs and replacements necessary, to the approval of the Owner at no additional cost to the Owner.

3.05 SURVEY CONTROL

A. The Surveyor shall survey the final location and elevation of the top of the select subbase. Surveying shall be performed in accordance with of Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing to the Owner of the final location and elevation of the final surface of the road base, in accordance with the requirements of Section 01010 of these General Specifications.

[END OF SECTION]

SECTION 02230
SUBBASE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, testing, and installation services necessary for the installation of subbase where shown on the Construction Drawings. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02110 - Site Preparation and Earthwork
B. Section 02225 - Road Base

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. On-site testing as specified in the CQA Plan for the subbase (which does not include quality control testing at the source) will be the responsibility of the CQA Engineer. The Contractor shall cooperate with the CQA Engineer during all sampling and testing activities. The Contractor shall provide equipment and labor to assist the CQA Engineer in sampling. The Contractor shall provide access to all areas requiring testing. The Contractor will repair any damage to finished work caused by the CQA Engineer's sampling and testing activities.

D. Quality control testing of the subbase at the source shall be the responsibility of the Contractor.

E. The CQA Engineer will coordinate independent surveying required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

F. If the CQA Engineer's tests indicate work does not meet the requirements of the specification, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results area obtained.

PART 2: PRODUCTS

2.01 MATERIAL FOR SUBBASE

A. Subbase for the work shall obtained from the landfill or surface impoundment excavation or from on-site or off-site borrow sources. Subbase material shall be free of metals, roots, trees, stumps, concrete, construction debris, other organic matter, and deleterious materials and coatings.

B. The subbase shall classify as SM, SW, GM, or GW according to the Unified Soil Classification System (ASTM D2487) and shall have a maximum particle size of 3 inches.

PART 3: EXECUTION

3.01 SUBBASE COMPACTION CRITERIA

A. The compaction moisture content of the subbase shall be between 3 percent and 3 percent above optimum moisture content determined in the modified Proctor compaction test (ASTM D 1557). The minimum dry unit weight of the subbase shall be at least 95 percent of the maximum dry unit weight obtained from the modified Proctor compaction test (ASTM D 1557).

3.02 PLACEMENT AND COMPACTION

A. Subbase shall be placed at the locations and to the thicknesses shown on the Construction Drawings

B. Subbase shall not be placed directly on geosynthetics unless required by the General Specifications or Construction Drawings. Subbase may be placed using a backhoe, front-end loader, belt conveyor, spreader box, or other method approved by the Owner in maximum 12-inch loose lifts.

C. Final spreading of the subbase may be performed using a low ground-pressure dozer (Caterpillar D6H-LGP or other similar equipment approved by the CQA Engineer), low-ground pressure front-end loader, or by hand. The tracked equipment shall operate only over previously-placed subbase or other soil. The Contractor shall not operate equipment directly on geosynthetics.

D. Unless otherwise specified by the Owner, the equipment used to spread subbase shall not exert ground pressures exceeding the following:

Allowable Equipment Ground Pressure (psi)	*Thickness of Gravel Above Geosynthetic (inches)*
<5	12
<10	18
<20	24
>20	36

The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the Owner at the Contractor's expense.

E. The Contractor shall operate equipment in a manner that is protective of polyethylene pipes and underlying geosynthetics. If it is suspected that damage to polyethylene pipes or underlying geosynthetics may have occurred, the Owner will instruct the Contractor to remove the overlying material to expose the potentially-damaged materials. The Contractor shall repair, at his own expense, any observed damage, in accordance with the requirements of these General Specifications.

3.03 FIELD QUALITY CONTROL

A. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

B. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at his own expense until acceptable test results are obtained.

3.04 PROTECTION OF WORK

A. After the subbase has been incorporated into the work, the Contractor shall maintain it free of ruts, depressions, and damage resulting from the hauling and handling of any material, equipment, tools, etc.

B. The Contractor shall use all means necessary to protect all prior work, materials and completed and partially completed work of other Sections of these General Specifications.

C. In the event of damage, the CQA Engineer will identify areas requiring repair, and the Contractor shall make repairs and replacements necessary, to the approval of the Owner at no additional cost to the Owner.

3.05 SURVEY CONTROL

A. The Surveyor shall survey the final location and elevation of the top of the road base. Surveying shall be performed in accordance with of Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing to the Owner of the final location and elevation of the final surface of the road base, in accordance with the requirements of Section 01010 of these General Specifications.

[END OF SECTION]

SECTION 02231
FOUNDATION SAND

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, testing, and installation services necessary for the installation of foundation sand where shown on the Construction Drawings. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02110 - Site Preparation and Earthwork
B. Section 02718 - Polyethylene Pipe and Fittings
C. Section 02775 - Geomembrane Liners

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. On-site testing as specified in the CQA Plan for the foundation sand will be the responsibility of the CQA Engineer. The Contractor shall cooperate with the CQA Engineer during all sampling and testing activities. The Contractor shall provide equipment and labor to assist the CQA Engineer in sampling. The Contractor shall provide access to all areas requiring testing. The Contractor will repair any damage to finished work caused by the CQA Engineer's sampling and testing activities.

D. Quality control testing of the foundation sand at the source shall be the responsibility of the Contractor.

E. The CQA Engineer will coordinate independent surveying required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

F. If the CQA Engineer's tests indicate work does not meet the requirements of the specification, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results area obtained.

PART 2: PRODUCTS

2.01 MATERIAL FOR FOUNDATION SAND

A. Foundation sand for the work shall obtained from the landfill or surface impoundment excavation or from on-site or off-site borrow sources. Foundation sand material shall be free of metals, roots, trees, stumps, concrete, construction debris, other organic matter, and deleterious materials and coatings.

B. The foundation sand shall classify as SM or SW according to the Unified Soil Classification System (ASTM D2487) and shall have a maximum particle size of 1/4 inches.

PART 3: EXECUTION

3.01 FOUNDATION SAND COMPACTION CRITERIA

A. The compaction moisture content of the foundation sand shall be between 3 percent and 3 percent above optimum moisture content determined in the modified Proctor compaction test (ASTM D 1557). The minimum dry unit weight of the foundation shall be at least 95 percent of the maximum dry unit weight obtained from the modified Proctor compaction test (ASTM D 1557).

3.02 PLACEMENT AND COMPACTION

A. Foundation sand shall be placed at the locations and to the thicknesses shown on the Construction Drawings

B. Foundation sand shall not be placed directly on geosynthetics unless required by the General Specifications or Construction Drawings. Foundation sand may be placed using a backhoe, front-end loader, belt conveyor, spreader box, or other method approved by the Owner in maximum 12-inch loose lifts.

C. Final spreading of the foundation sand may be performed using a low ground-pressure dozer (Caterpillar D6H-LGP or other similar equipment approved by the CQA Engineer), low-ground pressure front-end loader, or by hand. The tracked equipment shall operate only over previously-placed foundation sand or other soil. The Contractor shall not operate equipment directly on geosynthetics.

D. Unless otherwise specified by the Owner, the equipment used to spread subbase shall not exert ground pressures exceeding the following:

Allowable Equipment Ground Pressure (psi)	*Thickness of Gravel Above Geosynthetic (inches)*
<5	12
<10	18
<20	24
>20	36

The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the Owner at the Contractor's expense.

E. The Contractor shall operate equipment in a manner that is protective of polyethylene pipes and underlying geosynthetics. If it is suspected that damage to polyethylene pipes or underlying geosynthetics may have occurred, the Owner will instruct the Contractor to remove the overlying material to expose the potentially-damaged materials. The Contractor shall repair, at his own expense, any observed damage, in accordance with the requirements of these General Specifications.

3.03 FIELD QUALITY CONTROL

A. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

B. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at his own expense until acceptable test results are obtained.

3.04 PROTECTION OF WORK

A. After the foundation sand has been incorporated into the work, the Contractor shall maintain it free of ruts, depressions, and damage resulting from the hauling and handling of any material, equipment, tools, etc.

B. The Contractor shall use all means necessary to protect all prior work, materials and completed and partially completed work of other Sections of these General Specifications.

C. In the event of damage, the CQA Engineer will identify areas requiring repair, and the Contractor shall make repairs and replacements necessary, to the approval of the Owner at no additional cost to the Owner.

3.05 SURVEY CONTROL

A. The Surveyor shall survey the final location and elevation of the top of the road base. Surveying shall be performed in accordance with of Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing to the Owner of the final location and elevation of the final surface of the road base, in accordance with the requirements of Section 01010 of these General Specifications.

[END OF SECTION]

SECTION 02232
PROTECTIVE SOIL LAYER

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the construction of the protective soil layer component of the landfill. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02710 - Geocomposite
B. Section 02714 - Filter or Cushion Geotextile

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all testing activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. Soil testing (both field and laboratory testing) required by the CQA Plan will be the responsibility of the CQA Engineer. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor. The Contractor shall cooperate with the CQA Engineer during all testing activities. The Contractor shall provide equipment and labor to assist the CQA Engineer in sampling. The Contractor shall provide access to all areas requiring testing. The Contractor shall repair any damage to finished work caused by the CQA Engineer sampling or testing activities.

D. The CQA Engineer will coordinate independent surveying required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

E. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 MATERIALS

A. Protective soil layer material shall be obtained from the landfill or surface impoundment excavation or from on-site or off-site borrow sources identified by the Owner.

B. Protective soil layer material shall classify as CL, ML, SC, GC, SM, or GM according to the Unified Soil Classification System (ASTM D 2487) and shall have a maximum particle size not exceeding 2 inches.

PART 3: EXECUTION

3.01 PROTECTIVE SOIL LAYER COMPACTION CRITERIA

A. The Contractor shall place and compact the soil as described in ~~of~~ this Section.

3.02 PLACEMENT AND COMPACTION

A. Protective soil layer material shall be placed at the locations and to the thicknesses shown on the Construction Drawings.

B. The Contractor shall not place the protective soil layer until the CQA Engineer confirms that the constructed grades and elevations of the underlying materials meet the requirements of the Construction Drawings, all field testing is complete, the underlying materials have been installed, tested, and approved in accordance with the requirements of the CQA Plan.

C. Prior to placing the protective soil layer, the CQA Engineer will verify that the underlying geosynthetic components are free of holes, tears, excessive wrinkles, or foreign objects. As instructed by the Owner, the Contractor shall "work out" or repair all excessive wrinkles to the satisfaction of the CQA Engineer prior to placement of the protective soil layer.

D. The final in-place thickness of the protective soil layer shall be not less than 24 inches or as shown on the drawings.

E. The protective soil material shall be spread in one lift using a low ground pressure dozer (Caterpillar D6H-LGP, or other equipment approved by the Owner), low ground pressure tracked front-end loader, or belt conveyor. Equipment shall operate only over previously placed protective soil layer material. The Contractor shall not operate equipment directly on geosynthetics.

F. Unless otherwise specified by the Owner and to prevent damage of the liner system, the equipment used to haul and spread the protective soil layer shall not exert ground pressures exceeding the following:

Allowable Equipment Ground Pressure (psi)	*Minimum Thickness of Protective Soil Layer Above the Geosynthetic Liner (inches)*
<5	12
<10	18
<20	24
>20	36

The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the Owner at the Contractor's expense.

G. Protective soil layer material shall be compacted by two passes of tracked equipment such as a Caterpillar D6H-LGP or other equipment approved by the Owner.

H. In areas of heavy traffic, the thickness of the protective soil layer shall be increased at the direction of the Owner to satisfy the requirements of this Section. Heavy traffic areas shall be compacted with a smooth drum roller or other equipment approved by the Owner.

I. The Contractor shall operate equipment in a manner that is protective of underlying geosynthetics. If it is suspected that any damage to the underlying geosynthetics may have occurred, the Owner will instruct the Contractor to remove overlying protective soil layer material to expose the geosynthetics. The Contractor shall repair, at his own expense, any damage of the underlying geosynthetics in accordance with these General Specifications.

J. The Contractor shall minimize to the extent possible the generation of dust during placement of the protective soil layer. Water may be used for dust control if approved by the Owner. Chemical dust suppressants shall not be used.

K. No protective soil layer material shall be placed or compacted during a sustained period of temperature below 32°F that results in frozen material, either in-place or in the borrow area. With the approval of the Owner, protective soil layer material may be placed and compacted during periods of early morning freezing temperatures if above freezing temperatures are anticipated during the day.

L. The Contractor shall not place frozen protective soil layer material nor shall he place protective soil layer material on frozen ground.

M. Protective soil layer material shall not be placed during periods of precipitation or unfavorable weather conditions.

3.03 SURVEY CONTROL

A. The Surveyor shall survey the final location and elevation of the top of the protective soil layer installed by the Contractor. Surveying shall be performed in accordance with Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing of the location and elevation of the top of the protective soil layer to the Owner in accordance with the requirements of Section 01010 of these General Specifications.

3.04 FIELD QUALITY CONTROL

A. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

B. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at his own expense until acceptable test results are obtained.

3.05 PROTECTION OF WORK

A. After the protective soil layer has been placed, the Contractor shall maintain it free of ruts, depressions, and damage resulting from the hauling and handling of any material, equipment, tools, etc.

B. The Contractor shall use all means necessary to protect all materials and partially-completed and completed work of these General Specifications.

C. In the event of damage, the CQA Engineer will identify any areas requiring repair, and the Contractor shall make repairs and replacements necessary, to the approval of the Owner and at no additional cost to the Owner.

[END OF SECTION]

SECTION 02710
GEOCOMPOSITE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the installation of the geocomposite layer of the landfill or surface impoundment. The work shall be carried out in accordance with these General Specifications, Supplemental Specifications, the CQA Plan, and the Construction Drawings.

B. This specification shall also apply to geocomposite installation in the truck roll off area and truck wash facility, unless otherwise indicated on the drawings.

1.02 RELATED SECTIONS

A. Section 02221 - Clay Liner
B. Section 02229 - Select Subbase
C. Section 02714 - Filter or Cushion Geotextile
D. Section 02232 - Protective Soil Layer
E. Section 02775 - Geomembrane Liners

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. If testing is not completed prior to delivery to the site, the Contractor shall deliver geocomposite to the site at least 14 calendar days prior to installation to allow sufficient time for testing required by the CQA Plan.

D. Any geocomposite rolls that do not meet the requirements of these General Specifications will be rejected. The Contractor shall replace the rejected material with new material that conforms to the specification requirements, at no additional cost to the Owner.

E. If the CQA Engineer's test indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 GEOCOMPOSITE PROPERTIES

A. The Contractor shall require that the geocomposite Manufacturer furnish material with minimum average roll values, as defined by the Federal Highway Administration (FHWA), meeting or exceeding the criteria specified in Table 02710-1. The Contractor shall require that the Manufacturer provide results for tests performed using the procedures listed in Table 02710-1, as well as a certification that the material delivered to the site meets or exceeds the specified values.

B. In addition to the property values listed in Table 02710-1, the geocomposite shall:

1. Retain its structure during handling, placement, and long-term service.

2. Be capable of withstanding outdoor (i.e., ultra-violet light) exposure for a minimum of 30 days with no measurable degradation in the specified physical properties.

3. Meet any additional requirements of the Construction Drawings.

4. Be manufactured with a geonet that does not contain any reclaimed polymer, nor any foaming or blowing agents.

5. Consist of a geonet with a geotextile bonded to both sides of geonet.

2.02 MANUFACTURING QUALITY CONTROL

A. The Contractor shall require that the geocomposite Manufacturer sample and test the geocomposite to demonstrate that the material conforms to the requirements of these General Specifications. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor. Test results shall be provided to the Owner. Sampling shall, in general, be performed on sacrificial portions of the geocomposite material such that repair is not required. The Contractor shall require that the geocomposite Manufacturer sample and test the geocomposite at a minimum of once every 50,000 ft^2 and perform manufacturing quality control tests as indicated in Table 02710-1.

B. Any geocomposite sample that does not comply with these General Specifications shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected rolls at no additional cost to the Owner.

C. If a geocomposite sample fails to meet the quality control requirements of this General Specification the Contractor shall require that the geocomposite Manufacturer sample and test each roll manufactured in the same lot, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until a pattern of acceptable test results as determined by the CQA Engineer is established.

D. Additional sample testing may be performed, at the geocomposite Manufacturer's discretion and expense, to more closely identify any non-complying rolls and/or to qualify individual rolls.

E. If required by the Owner, the Contractor shall require the geocomposite Manufacturer to retain a coupon of geocomposite (10 feet by 2 feet) provided for the project for every 20,000 ft^2 of geocomposite produced for the project until the work is accepted by the Owner.

F. The Contractor shall require that the geocomposite Manufacturer comply with the certification and submittal requirements of the CQA Plan.

2.03 LABELING

A. Geocomposite rolls shall be labeled with the following information.

1. Name of Manufacturer;
2. Product identification;
3. Lot number;
4. Roll number; and,
5. Roll dimensions.

B. If any special handling is required, it shall be so marked on the geocomposite itself, e.g., "This Side Up" or "This Side Against Soil To Be Retained".

2.04 TRANSPORTATION

A. Transportation of the geocomposite shall be the responsibility of the Contractor. The Contractor shall be liable for damage to the geocomposite incurred prior to and during transportation to the site. The Contractor shall replace damaged rolls at no additional cost to the Owner.

2.05 HANDLING AND STORAGE

A. Geocomposite shall be shipped and stored in watertight and opaque protective covers.

B. Handling, storage, and care of the geocomposite prior to and following incorporation into the work is the responsibility of the Contractor. The Contractor shall be liable for damage to the material incurred prior to final acceptance by the Owner. The Contractor shall repair damage in accordance with Part 3.03 of this section and at no additional cost the Owner.

C. The Contractor shall be responsible for storage of the geocomposite at the site. The geocomposite shall be stored off the ground and out of direct sunlight and shall be protected from puncture, cutting, and excessive heat, cold, moisture, mud, dirt, dust or any other damaging or deleterious condition. The geocomposite shall be stored in accordance with any additional requirements of the geocomposite Manufacturer.

PART 3: EXECUTION

3.01 HANDLING AND PLACEMENT

A. Geocomposite shall be installed at all locations shown on the Construction Drawings.

B. The Contractor shall handle the geocomposite in such a manner as to ensure the geocomposite is not damaged in any way.

C. When placing geocomposite on geomembrane, the geomembrane liner that will underlie the geocomposite shall be clean and free of excessive dust and dirt, stones, rocks, or other obstructions that could potentially damage the geomembrane. The geomembrane shall be swept clean prior to geocomposite placement. At the direction of the Owner, the Contractor shall clean the geomembrane with water.

D. The Contractor shall take all necessary precautions to prevent damage to underlying layers during placement of the geocomposite.

E. In the presence of excessive wind, the Contractor shall weight the geocomposite with sandbags or equivalent weight approved by the Owner.

F. On side slopes, the geocomposite shall be secured, by the Contractor, at the top of the slope and then rolled down the slope.

G. If necessary, the Contractor shall position the geocomposite by hand after it is unrolled to minimize wrinkles.

H. Geocomposite shall be clean when installed. During installation, care shall be taken by the Contractor not to entrap stones, excessive dirt, or moisture that could damage the underlying geomembrane, clog drains or filters, or hamper subsequent seaming.

I. Geocomposite shall not be welded to the geomembrane liners. Geocomposite shall only be cut using a cutter approved by the geocomposite Manufacturer and the Owner.

J. Tools shall not be left on or in the geocomposite.

K. After placing the geocomposite, the geocomposite shall not be left exposed for a period in excess of 30 days unless a longer exposure period is approved by the Owner based on a formal demonstration from the Contractor (e.g., a certification from the geocomposite Manufacturer) that the geotextile component of the geocomposite is stabilized against ultra-violet (UV) light degradation for a period in excess of 30 days.

L. If white colored geotextile is used in the geocomposite, precautions shall be taken against "snow blindness" of personnel.

3.02 SEAMS AND OVERLAPS

A. The components of the geocomposite (e.g., geotextile-geonet-geotextile) are not bonded together at the ends and edges of the rolls. Each component shall be secured or seamed to the like component at overlaps.

B. No horizontal seams shall be allowed on slopes steeper than 5:1 (horizontal:vertical), unless approved by the Owner.

C. *Geonet Components*

1. The geonet components shall be overlapped by at least 4 inches. These overlaps shall be secured by tying.

2. Tying shall be achieved by nylon strings, plastic fasteners, or polymer braid. Metallic devices shall not be used. Tying devices shall be provided in a color different than the geonet to allow easy inspection.

3. For slopes steeper than 5:1 (horizontal:vertical), tying shall be every 5 feet along the slope, every 2 feet across the slope, and every 6 inches in the anchor trench. For slopes flatter than 5:1 (horizontal:vertical), tying shall be every 10 feet in both directions and every 6 inches in the anchor trench.

4. In all cases, at least 2 ties per panel dimension shall be installed.

5. When more than one layer of geocomposite is installed, joints shall be staggered at least 1 foot.

6. The joints on adjacent geocomposite panels shall be staggered at least 1 foot.

D. *Geotextile Components*

1. The bottom layers of the geotextile shall be overlapped.

2. The top layers of geotextiles shall be continuously sewn (i.e., spot sewing is not allowed). Geotextiles shall be overlapped a minimum of 3 inches prior to sewing.

3. Polymeric thread shall be used for all sewing. The seam type shall be Federal Standard (No. 751.a) Type SSa. The seams shall be sewn using Stitch Type 401.

E. *Geocomposite Components*

1. The geocomposite shall be overlapped by at least 4 inches. These overlaps shall be secured by tying.

2. Cut geocomposite using scissors or other cutting tools, approved by the Owner. Do not damage underlying geosynthetics.

3. Tying shall be achieved by nylon strings, plastic fasteners, or polymer braid. Metallic devices shall not be used. Tying devices shall be provided in a color different than the geocomposite to allow easy inspection.

4. For slopes steeper than 5:1 (horizontal:vertical), tying shall be every 5 feet along the slope, every 2 feet across the slope, and every 6 inches in the anchor trench. For slopes flatter that 5:1 (horizontal:vertical), tying shall be every 10 feet in both directions and every 6 inches in the anchor trench.
5. In all cases, at least 2 ties per panel dimension shall be installed.
6. When more than one layer of geocomposite is installed, joints shall be staggered at least 1 foot.
7. The joints on adjacent geocomposite panels shall be staggered at least 1 foot.
8. In areas where this installation method is used, place geotextile over seams which overlap ties 1 foot on each side. This geotextile shall be heat sealed to the top of the geotextile component of the geocomposite.

3.03 REPAIR

A. Any holes or tears in the geocomposite shall be repaired by placing a patch extending 1 foot beyond the edges of the hole or tear. The patch shall be secured over the hole or tear by tying fasteners through the geocomposite patch, and through the top geotextile and geonet beneath the patch. The patch shall be secured every 6 inches with approved tying devices. A larger geotextile patch shall be placed over the geocomposite patch and shall be heat sealed to the top geotextile of the geocomposite needing repair. If the hole or tear width across the roll is more than 50 percent of the width of the roll, the damaged area shall be cut out and the two portions of the geocomposite shall be joined in accordance with Part 3.02 of this section.

3.04 PLACEMENT OF OVERLYING MATERIALS

A. Overlying materials as required by the Construction Drawings, shall be placed as soon as possible after placement and approval of the geocomposite. Placement of each overlying material shall be in accordance with the appropriate sections of these General Specifications.

B. The Contractor shall place overlying soil materials in such a manner as to ensure that:

1. The geocomposite and underlying geosynthetic materials are not damaged;
2. Minimal slippage occurs between the geocomposite and underlying layers; and,
3. Excessive stresses are not produced in the geocomposite.

C. Unless otherwise specified by the Owner, the equipment operating on soil material overlying a geocomposite shall comply with the following:

Maximum Allowable Equipment Ground Pressure (psi)	*Thickness of Soil Above Geocomposite (inches)*
<5	12

<10	18
<20	24
>20	36

The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the Owner at the Contractor's expense.

The requirements do not apply to equipment used to construct the sump secondary or primary clay liners; however, the Owner can restrict the use of equipment that, in the Owner's opinion, may be potentially damaging to the geocomposite.

D. The CQA Engineer will provide monitoring of the spreading of soils over the geocomposite in accordance with the CQA Plan.

3.05 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all materials and partially completed and completed work of these General Specifications.

B. The CQA Engineer will identify any areas requiring repair. The Contractor shall immediately make repairs and replacements necessary, to the approval of the Owner and at no additional cost to Owner.

C. The CQA Engineer will issue an approval of the geocomposite installation to the Owner prior to placement of material over the geocomposite in accordance with the CQA Plan.

TABLE 02710-1
REQUIRED GEOCOMPOSITE PROPERTIES

Properties	Units	Specified Values^(4)	Test Method
Geonet Component:			
Polymer composition	%	95 polyethylene by weight	
Polymer specific gravity		0.92	ASTM D 1505
Polymer melt index	g/10 min.	0.1 - 0.5	ASTM D 1238
Carbon black content	%	2 - 3	ASTM D 1603
Nominal thickness	mm	5	ASTM D 374C or D1777
Geotextile Component (both sides of geonet):			
Polymer composition	%	95 polyester polypropylene, or polyethylene by weight	
Mass per unit area	oz/yd^2	7.1	ASTM D 3776
Apparent opening size	mm	$0_{95} < 0.210$ mm	ASTM D 4751
Permitivity	sec^{-1}	1.47	ASTM D 4491
Grab strength	lb	210	ASTM D 4632^(1)
Tear strength	lb	75	ASTM D 4533^(2)
Puncture strength	lb	95	ASTM D 4833^(3)
Geocomposite:			
Transmissivity	m^2/s	2×10^{-4}	ASTM D 4716^(5)
Peel Strength	lb/in.	2	ASTM D 413

NOTES:

(1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on constant rate of extension (CRE) machine.

(2) Minimum value measured in machine and cross machine direction.

(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with a 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.

(4) Values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table). Where ranges of values are specified, the average roll value must be within the specified range. The apparent opening size specified is a maximum average roll value.

(5) The design transmissivity is the hydraulic transmissivity of the geocomposite measured using water at 68°F ± 3°F with a hydraulic gradient of 0.1, under a compressive stress of not less than 1~~0~~5,000 psf. For the test, the geocomposite shall be sandwiched between a layer of protective soil material representative of the material that will be used in the landfill and a 60-mil thick textured HDPE geomembrane. The minimum test duration shall be 24 hours and the report of results shall include measurements at intervals over the entire test duration.

[END OF SECTION]

SECTION 02712
GEONET

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the installation of the geonet for the landfill or surface impoundment. The work shall be carried out in accordance with this General Specification, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02221 - Clay Liner
B. Section 02775 - Geomembrane Liners

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. All work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. If CQA testing is not completed prior to delivery at the site, the Contractor shall deliver geonet to the site at least 14 calendar days prior to installation to allow sufficient time for testing required by the CQA Plan.

D. Any geonet rolls that do not meet the requirements of these General Specifications will be rejected. The Contractor shall replace the rejected material with new material that conforms to the specification requirements, at no additional cost to the Owner.

E. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 GEONET PROPERTIES

A. The Contractor shall require that the geonet Manufacturer furnish material with minimum average roll values, as defined by the Federal Highway Administration (FHWA), meeting or exceeding the criteria specified in Table 02712-1. The Contractor shall require that the geonet Manufacturer provide results for tests performed using the procedures listed in Table 02712-1, as well as a certification that the material properties for the material delivered to the site will meet or exceed the specified values.

B. In addition to the property values listed in Table 02712-1, the geonet shall:

1. Retain its structure during handling, placement, and long-term service.

2. Meet any additional requirements of the Construction Drawings.

3. Not be manufactured from any reclaimed polymer, nor any foaming or blowing agents.

2.02 MANUFACTURING QUALITY CONTROL

A. The Contractor shall require that the geonet Manufacturer sample and test the geonet to demonstrate that the material conforms to the requirements of these General Specifications. All Quality Control testing required by the General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor. Test results shall be provided to the Owner. Sampling shall, in general, be performed on sacrificial portions of the geonet material such that repair is not required. The Contractor shall require that the geonet Manufacturer sample and test the geonet, at a minimum, once every 50,000 ft^2 and perform the manufacturing quality control tests indicated in Table 02712-1.

B. Any geonet sample that does not comply with these General Specifications shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected rolls at no additional cost to the Owner.

C. If a geonet sample fails to meet the quality control requirements of these General Specifications, the Contractor shall require that the geonet Manufacturer sample and test each roll manufactured, in the same lot, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established as specified within the CQA Plan.

D. Additional sample testing may be performed, at the geonet Manufacturer's discretion and expense, to more closely identify any non-complying rolls and/or to qualify individual rolls.

E. If requested by Owner, the Contractor shall require the geonet Manufacturer to retain a coupon of geonet (10 feet by 2 feet) provided for the project for every 20,000 ft^2 of geonet produced for the project until the work is accepted by the Owner.

F. The Contractor shall require that the geonet Manufacturer comply with the certification and submittal requirements of the CQA Plan.

2.03 LABELING

A. Geonet rolls shall be labeled with the following information.

1. Name of Manufacturer;
2. Product identification;
3. Lot number;
4. Roll number; and,
5. Roll dimensions.

2.04 TRANSPORTATION

A. Transportation of geonet shall be the responsibility of the Contractor. The Contractor shall be liable for damage to the geonet incurred prior to and during transportation to the site. The Contractor shall repair or replace damaged rolls at no additional cost to the Owner.

2.05 HANDLING AND STORAGE

A. Geonet shall be protected from damage during shipping and storage.

B. Handling, storage, and care of the geonet prior to and following incorporation into the work is the responsibility of the Contractor. The Contractor shall be liable for damage to the material incurred prior to final acceptance by the Owner. The Contractor shall repair damage in accordance with Part 3.03 of this Section and at no additional cost to the Owner.

C. The Contractor shall be responsible for storage of the geonet at the site. The geonet shall be stored off the ground and shall be protected from excessive heat or cold, moisture mud, dirt, dust, or any other damaging or deleterious condition. The geonet shall be stored in accordance with any additional requirements of the geonet Manufacturer.

PART 3: EXECUTION

3.01 HANDLING AND PLACEMENT

A. Geonet shall be installed at all locations shown on the Construction Drawings.

B. The Contractor shall handle the geonet in such a manner as to ensure the geonet is not damaged in any way.

C. Just prior to geonet placement, the geomembrane liner that will underlie the geonet shall be clean and free of dust, dirt, stones, rocks, or other obstructions that could potentially damage the geomembrane. The geomembrane shall be swept clean prior to geonet placement. At the direction of the Owner, the Contractor shall clean the geomembrane with water.

D. The Contractor shall take all necessary precautions to prevent damage to underlying layers during placement of the geonet.

E. In the presence of excessive wind, the geonet shall be weighted by the Contractor with sandbags or equivalent weight approved by the Owner.

F. On side slopes, the geonet shall be secured by the Contractor at the top of slope and then rolled down the slope.

G. If necessary, the Contractor shall position the geonet by hand after it is unrolled to minimize wrinkles.

H. Geonet shall be clean when installed. During installation, care shall be taken by the Contractor not to entrap stones and excessive dirt or moisture that could damage the underlying geomembrane or clog drains or filters.

I. Geonet shall not be welded to geomembrane liners. Geonet shall only be cut using a cutter approved by the geonet Manufacturer and the Owner.

J. Tools shall not be left on or in the geonet.

K. Geonet shall not be placed in direct contact with textured geomembrane liner unless specifically called for on the Construction Drawings.

3.02 STACKING AND JOINING

A. When two or more layers of geonets are stacked, care shall be taken to prevent the strands of one layer of geonet from penetrating the channels of an overlying or underlying layer.

B. A layer of geonet shall not be installed in a direction perpendicular to an underlying layer of geonet unless approved by the Owner.

C. In the corners of the side slopes, where overlaps between perpendicular geonet strips are required, an extra layer of geonet shall be provided on top of the previously installed geonets, from top to bottom of the slope, as shown on the Construction Drawings.

D. Adjacent rolls of geonet shall be overlapped by at least 4 inches. The overlaps shall be secured by tying.

E. Tying shall be achieved by nylon strings, plastic fasteners, or polymer braid. Metallic devices shall not be used. Tying devices shall be provided in a color different than the geonet to allow for easy inspection.

F. For slopes steeper than 5:1 (horizontal:vertical), tying shall be every 5 feet along the slope, every 2 feet across the slope, and every 6 inches in the anchor trench. For slopes flatter than 5:1 (horizontal:vertical), tying shall be every 10 feet in both directions, and every 6 inches in the anchor trench.

G. In all cases, at lease 2 ties per panel dimension shall be installed.

H. When more than one layer of geonet is installed, joints shall be staggered at least 1 foot.

I. The joints on adjacent geonet panels shall be staggered at least 1 foot.

J. No horizontal seams shall be allowed on slopes steeper than 5:1 (horizontal:vertical), unless approved by the Owner.

3.03 REPAIR

A. Any holes or tears in the geonet shall be repaired by placing a patch over the hole or tear extending 1 foot beyond the edges of the hole or tear. The patch shall be secured to the original geonet by tying every 6 inches with approved tying devices. If the hole or tear width across the roll is more than 50 percent of the width of the roll, the damaged area shall be cut out and the two portions of the geonet shall be joined in accordance with Part 3.02 of this section.

3.04 PLACEMENT OF OVERLYING MATERIALS

A. An installed layer of geonet shall be covered with an overlying layer (geotextile or geomembrane), as required by the Construction Drawings, as soon as possible after installation and approval to minimize the accumulation of dirt or dust in the geonet and the potential for damage to the geonet or the underlying geomembrane. If dust or dirt accumulates in the geonet layer prior to placement of the overlying layer, the Contractor shall clean the geonet by sweeping or washing with water. Placement of each overlying material shall be in accordance with these General Specifications.

B. Soil shall not be placed in direct contact with geonets. Geonets shall be separated from soil materials by a geotextile filter or other material, as indicated on the Construction Drawings. The only exception to this shall be at those locations shown on the Construction Drawings where sump or pipe bedding gravel directly overlies one or more layers of geonet.

C. The Contractor shall place soil above geonet layers (e.g., above a geotextile filter which overlies the geonet) in such a manner as to ensure that:

1. The geonet and underlying geomembrane are not damaged;

2. Minimal slippage occurs between the geonet and the underlying geomembrane; and,

3. Excessive stresses are not produced in the geonet.

D. Unless otherwise specified by the Owner, all equipment operating on soil material overlying a geonet shall comply with the following:

Maximum Allowable Equipment Ground Pressure (psi)	*Thickness of Soil Above Geonet (inches)*
<5	12

<10	18
<20	24
>20	36

The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the Owner at the Contractor's expense.

The equipment pressure requirements do not apply to equipment used to construct the secondary or primary clay liners; however, the Owner may restrict the use of equipment that, in the Owner's opinion, may be potentially damaging to the geonet.

E. The CQA Engineer will provide monitoring of the placement of soil materials over the geonet or overlying layer in accordance with the CQA Plan.

3.05 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all materials and partially completed and completed work of these General Specifications.

B. The CQA Engineer will identify any areas requiring repair. The Contractor shall make repairs and replacements as necessary, to the approval of the Owner and at no additional cost to the Owner.

C. The CQA Engineer will issue an approval of the geonet detection or collection layer installation to the Owner prior to placement of material over the geonet in accordance with the CQA Plan.

TABLE 02712-1
REQUIRED GEONET PROPERTIES

PROPERTIES	UNITS	SPECIFIED VALUES(2)	TEST METHOD
Polymer composition	%	95 polyethylene by weight	
Polymer specific gravity		0.92	ASTM D 1505(1)
Polymer melt index	g/10 min.	0.1 - 0.5	ASTM D 1238
Carbon black content	%	2-3	ASTM D 1603
Nominal thickness	mm	5	ASTM D 374C or D1777
Transmissivity	m^2/s	5×10^{-3}	ASTM D 4716(3)

NOTES:

(1) The specific gravity of the geonet polymer shall not exceed that of the geomembrane.

(2) Values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table). Where ranges of values are specified, the average roll values must be within the specified range.

(3) The design transmissivity is the hydraulic transmissivity of the geonet measured using water at 68°F ± 3°F with a hydraulic gradient of not less than 0.1, nor more than 0.5, under a compressive stress of not less than 1000 psf. For the test, the geonet shall be sandwiched between a 60-mil thick HDPE geomembrane on bottom, and on top, and backed with soil representative of clay liner on one side. The minimum test duration shall be 24 hours and the report for the test results shall include measurements at intervals over the entire test duration.

[END OF SECTION]

SECTION 02714
FILTER AND CUSHION GEOTEXTILE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the installation of the filter and cushion geotextile in the landfill or surface impoundment. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

B. This specification shall also apply to geotextile installation in the truck roll off area, the drum handling facility, and the truck wash facility unless otherwise indicated on the drawings.

1.02 RELATED SECTIONS

A. Section 02221 - Clay Liner
B. Section 02224 - Drainage Gravel
C. Section 02225 - Road Base
D. Section 02228 - Pipe Bedding
E. Section 02710 - Geocomposite
F. Section 02232 - Protective Soil Layer
G. Section 02775 - Geomembrane Liners

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. If CQA testing is not completed prior to delivery, the Contractor shall deliver geotextile to the site at least 14 calendar days prior to installation to allow sufficient time for testing required by the CQA Plan.

D. Any geotextile rolls that do not meet the requirements of these General Specifications will be rejected. The Contractor shall replace the rejected material with new material that conforms to the specification requirements, at no additional cost to the Owner.

E. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 GEOTEXTILE PROPERTIES

A. The Contractor shall require that the geotextile Manufacturer furnish geotextile with minimum average roll values, as defined by the Federal Highway Administration (FHWA), meeting or exceeding the criteria specified in Tables 02714-1 (for filter layers), or Table 02174-2 (for cushion layers). The Contractor shall require that the geotextile Manufacturer provide results for tests performed using the procedures in Table 02714-1, or 02714-2, as well as a certification that the material delivered to the site meets or exceeds the specified values.

B. Geotextile products shall be needle-punched, non-woven materials manufactured from continuous filaments or stapled fibers.

C. In addition to the property values listed in Table 02714-1 or 02714-2, the geotextile filter or cushion layer shall:

1. Retain its structure during handling, placement, and long-term service.

2. Be capable of withstanding outdoor (i.e., ultra-violet) light for a minimum of 30 days with no measurable degradation in the specified physical properties.

3. Meet any additional requirements of the Construction Drawings.

2.02 MANUFACTURING QUALITY CONTROL

A. The Contractor shall require that the geotextile Manufacturer sample and test the geotextile to demonstrate that the material conforms to the requirements of this General Specification. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor. Test results shall be provided to the Owner. Sampling shall, in general, be performed on sacrificial portions of the geotextile material such that repair is not required. The Contractor shall require that the geotextile Manufacturer sample and test the geotextile, at a minimum, once every 50,000 ft^2 and perform the manufacturing quality control tests as indicated in Table 02714-1 and 02714-2.

B. Any geotextile sample that does not comply with this General Specification shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected roll at no additional cost to the Owner.

C. If a geotextile sample fails to meet the quality control requirements of this General Specification, the Contractor shall require that geotextile Manufacturer sample and test each roll manufactured in the same lot, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established in accordance with the CQA Plan.

D. Additional sample testing may be performed, at the geotextile Manufacturer's discretion and expense, to more closely identify any non-complying rolls and/or to qualify individual rolls.

E. If requested by the Owner, the Contractor shall require the geotextile Manufacturer to retain a coupon of geotextile (10 feet by 2 feet) provided for the project for every 20,000 ft^2 of geotextile produced for the project until the work is accepted by the Owner.

F. The Contractor shall require that the geotextile Manufacturer comply with the certification and submittal requirements of the CQA Plan.

2.03 LABELING

A. Geotextile rolls shall be marked or tagged with the following information:

1. Name of Manufacturer;
2. Product identification;
3. Lot number;
4. Roll number; and,
5. Roll dimensions.

B. If any special handling is required, it shall be so marked on the geotextile itself, e.g., "This Side Up" or "This Side Against Soil to be Retained".

2.04 TRANSPORTATION

A. Transportation of the geotextile is the responsibility of the Contractor. The Contractor shall be liable for damage to the geotextile incurred prior to and during transportation to the site. The Contractor shall repair or replace damaged rolls at no additional cost to the Owner.

2.05 HANDLING AND STORAGE

A. Geotextile shall be shipped and stored in watertight and opaque protective covers.

B. Handling, storage, and care of the geotextile prior to and following incorporation into the work is the responsibility of the Contractor. The Contractor shall be liable for damage to the geotextile incurred prior to final acceptance by the Owner. The Contractor shall repair damage in accordance with Part 3.03 of this section and at no additional cost to the Owner.

C. The Contractor shall be responsible for storage of the geotextile at the site. The geotextile shall be stored off the ground and out of direct sunlight and precipitation, and shall be protected from puncture, cutting, excessive heat, cold, moisture, mud, dirt, dust, or any other damaging or deleterious condition. The geotextile shall be stored in accordance with any additional requirements of the geotextile Manufacturer.

PART 3: EXECUTION

3.01 HANDLING AND PLACEMENT

A. Geotextile shall be installed at the locations shown on the Construction Drawings.

B. The Contractor shall handle the geotextile in such a manner as to ensure the geotextile is not damaged in any way.

C. The Contractor shall take all necessary precautions to prevent damage to underlying layers during placement of the geotextile.

D. After placing the geotextile, the geotextile shall not be left exposed for a period in excess of 30 days unless a longer exposure period is approved by the Owner, based on a demonstration from the Manufacturer (e.g., a certification from the geotextile Manufacturer) that the geotextile is stabilized against ultra-violet light (UV) degradation for a period in excess of 30 days. This requirement does not apply to material used as sacrificial geotextile.

E. If white colored geotextile is used, precautions shall be taken against "snow blindness" of personnel.

F. Just prior to geotextile placement, the layer that will underlie the geotextile, if it is a geosynthetic, shall be clean and free of dust, dirt, stones, rocks, or other obstructions that could potentially damage the liner system. At the direction of the Owner, the Contractor shall clean the underlying layer with water.

G. In the presence of excessive wind, the geotextile shall be weighted with sandbags or equivalent weight approved by the Owner.

H. On side slopes, the geotextile shall be secured at the top of the slope and then rolled down the slope.

I. If necessary, the Contractor shall position the geotextile by hand after it is unrolled to minimize wrinkles.

J. Geotextile shall be clean when installed. During installation, care shall be taken not to entrap stones, and excessive dirt or moisture that could damage the underlying layers, clog drains or filters, or hamper subsequent seaming.

K. Tools shall not be left in or on the geotextile.

L. The Contractor shall examine the entire geotextile surface after installation to ensure that no potentially harmful foreign objects (including broken sewing needles) are present. The Contractor shall remove any such foreign objects and shall replace any damaged geotextile Broken sewing needles may need to be located using a metal detector or other method approved by the Owner.

M. Geotextile shall only be cut using a cutter approved by the geotextile Manufacturer and the Owner.

3.02 SEAMS AND OVERLAPS

A. All geotextile overlaps shall be continuously sewn (i.e., spot sewing and thermal bonding are not allowed). Geotextiles shall be overlapped a minimum 3 inches prior to sewing. No horizontal seams shall be allowed on slopes steeper than 5:1 (horizontal:vertical) (i.e., seams shall be along, not across, the slopes), except as part of a patch, unless approved by the Owner.

B. Polymeric thread shall be used for all sewing. The seam type shall be Federal Standard Type (No. 751.a) SSa. The seams shall be sewn using Stitch Type 401.

3.03 REPAIR

A. Any holes or tears in the geotextile shall be repaired as follows:

1. On slopes steeper than 5:1 (horizontal:vertical), a patch made from the same geotextile shall be overlapped a minimum three inches and double seamed into place (with each seam approximately 0.5 inches apart and no closer than 1 inch from any edge). Should a tear exceed 10 percent of the width of the roll, that roll shall be removed from the work and replaced with new material, at no additional cost to the Owner.

2. On slopes equal to or flatter than 5:1 (horizontal:vertical), a patch made from the same geotextile shall be overlapped a minimum of 3 inches and stitched into place with a single seam.

B. Care shall be taken to remove soil or other material which may have penetrated the torn geotextile.

3.04 PLACEMENT OF OVERLYING MATERIALS

A. The Contractor shall place all overlying soil materials in such manner as to ensure that:

1. The geotextile and underlying geosynthetic materials are not damaged;

2. Minimum slippage occurs between the geotextile and underlying layers; and,

3. Excessive stresses are not produced in the geotextile.

B. The CQA Engineer will monitoring the spreading of soil materials over the geotextile in accordance with the CQA Plan.

C. Unless otherwise specified by the Owner, all equipment operating on soil material overlying the geotextile shall comply with the following (Note: a greater thickness shall be required as per Sections 02710, 02712, and 02775 if the geotextile is directly underlain by a geocomposite, geonet, or geomembrane):

Maximum Allowable Equipment Ground Pressure (psi)	*Thickness of Soil Above Geotextile (inches)*

<5	6
<10	12
<20	18
>20	24

The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the Owner at the Contractor's expense.

The equipment ground pressure requirements do not apply to separator geotextiles used below road base nor to equipment used to construct the clay liners; however, the Owner may restrict the use of equipment that, in the Owner's opinion, may potentially damage the underlying geotextiles.

3.05 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all prior work, materials and partially-completed and completed work of these General Specifications.

B. The CQA Engineer will identify any areas requiring repair. The Contractor shall make repairs and replacements as necessary, to the approval of the Owner, and at no additional cost to Owner.

C. The CQA Engineer will issue an approval of geotextile filter, cushion, separator, or sacrificial layer installation in accordance with the CQA Plan prior to placement of material over the geotextile.

TABLE 02714-1
REQUIRED FILTER GEOTEXTILE PROPERTIES

Properties	Units	Specified Values (4)	Test Method
Polymer composition	%	95 [polypropylene, polyester, or polyethylene by weight]	
Mass per unit area	oz/yd^2	7	ASTM D 3776
Apparent opening size	mm	$0_{95} < 0.210$ mm	ASTM D 4751
Permitivity	sec^{-1}	1.47	ASTM D 4491
Grab strength	lb	210	ASTM D 4632(1)
Tear strength	lb	75	ASTM D 4533(2)
Puncture strength	lb	95	ASTM D 4833 (3)

Notes:

(1) Minimum values for both machine and cross machine direction with 1 inch clamp on constant rate of extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with a 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) Values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table). The specified apparent opening size is a maximum

average roll value.

TABLE 02714-2
REQUIRED CUSHION GEOTEXTILE PROPERTIES

Properties	Qualifier	Units	Specified Values (4)	Test Method
Polymer composition	minimum	%	95 [polypropylene, polyester, or polyethylene by weight]	
Mass per unit area	minimum	oz/yd^2	12	ASTM D 3776
Grab strength	minimum	lb	300	ASTM D 4632(1)
Tear strength	minimum	lb	110	ASTM D 4533(2)
Puncture strength	minimum	lb	135	ASTM D 4833 (3)

Notes:

(1) Minimum values for both machine and cross machine direction with 1 inch clamp on constant rate of extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with a 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).

[END OF SECTION]

SECTION 02718
POLYETHYLENE PIPE AND FITTINGS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the installation of all high density polyethylene (HDPE) pipes, pipe fittings, and appurtenances required for landfill or surface impoundment construction. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02221 - Clay Liner
B. Section 02224 - Pipe Bedding
C. Section 02710 - Geocomposite Detection or Collection Layer
D. Section 02714 - Filter or Cushion Geotextile
E. Section 02775 - Geomembrane Liners

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. All work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. The CQA Engineer will coordinate independent surveying as required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

D. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming materials. The nonconforming area shall be replaced by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 HDPE RESIN PROPERTIES

A. The HDPE pipe and fittings shall be manufactured from new, high molecular weight, HDPE resin conforming to ASTM D 1248 (Type III, Class C Category 5, Grade P 34), ASTM D 3350 (Cell Classification PE 345434C), and having a Plastic Pipe Institute (PPI) Rating of PE 3408. The resin shall be pre-compounded. In plant blending of non-compounded resins shall not be permitted. Pipe and fittings shall be manufactured from the same resin and by the same manufacturer.

B. The polyethylene compound shall contain a minimum of 2 percent carbon black to withstand outdoor exposure without loss of properties.

C. The polyethylene compound shall have minimum resistance of 5,000 hours when tested for environmental stress crack in accordance with requirements of GRI-GM5.

2.02 HDPE PIPE AND FITTINGS PROPERTIES

A. The Contractor shall provide pipe having the nominal diameters shown on the Construction Drawings.

B. All HDPE pipe and fittings shall have a minimum Standard Diameter Ratio (SDR) of 11 unless otherwise indicated on the Construction Drawings.

C. All HDPE pipe and fittings shall have a minimum hydrostatic design basis (HDB) of 1,600 pounds per square inch when determined in accordance with ASTM D 2837 unless otherwise indicated on the Construction Drawings.

D. All HDPE pipe and fittings shall comply with ASTM F 714.

E. HDPE pipe shall be supplied in standard laying lengths not exceeding 50 feet.

F. HDPE pipe shall be furnished non-perforated or perforated to meet the requirements of the Construction Drawings. Perforations, if required, shall be drilled into the pipe after manufacture. If approved by OWNER, perforations to pipe can be made after delivery to the project site.

G. HDPE pipes and fittings shall be homogeneous throughout and free of visible cracks, holes (other than intentional manufactured perforations), foreign inclusions, or other deleterious effects, and shall be uniform in color, density, melt index, and other physical properties.

H. Fittings at the ends of pipes shall be HDPE end caps unless otherwise indicated on the Construction Drawings.

I. Geomembrane boots shall be either field or shop-fabricated to the dimensions shown on the Construction Drawings. Pipe boots shall be fabricated from the same resin as the polyethylene geomembrane to which they are welded. Pipe boots shall be installed as indicated on the Construction Drawings.

2.03 MANUFACTURING QUALITY CONTROL

A. The Contractor shall submit to the Owner for approval within 14 days prior to the start of pipe work a complete list of materials to be furnished and the name of the pipe Manufacturer.

B. The Contractor shall submit to the Owner the pipe Manufacturer's certification of compliance with the product requirements of Part 2 of this section, including certification that stress regression testing has been performed in accordance with ASTM D 2837 on the pipe products representative of that delivered to the site. The Manufacturer's Certification must be based on a QC testing frequency of one sample per lot.

C. The Contractor shall submit to the Owner in writing the following documentation from the pipe Manufacturer on the raw materials used to manufacture the pipe and fittings:

1. Certificate identifying the specific resin used, its source, and the information required by ASTM D 1248.

2. Certificate stating that no recycled resin was used in manufacturing the pipe except for a small percentage (15 percent or less) of resin generated in the pipe Manufacturer's own plant from production using the same resin as the recycled material.

D. If requested by the Owner, the Contractor shall require the pipe manufacturer to retain one section of pipe (at least 5 feet in length) provided for the project for every 1,500 lineal feet of pipe produced for the project until the work is accepted by the Owner.

E. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

2.04 LABELING

A. The following shall be continuously indent-printed on the polyethylene pipe, or spaced at intervals not exceeding 10 feet:

1. Name and/or trademark of the pipe Manufacturer.
2. Nominal pipe size.
3. Standard dimension ratio (SDR).
4. The letters PE followed by the polyethylene grade per ASTM D 1248, followed by the hydrostatic design stress in 100's of psi (i.e., PE 3408).
5. Manufacturing Standard Reference (e.g., ASTM F 714-1).

6. A production code from which the date and place of manufacture can be determined.

2.05 TRANSPORTATION

A. Transportation of polyethylene pipe and fittings shall be the responsibility of the Contractor. The Contractor shall be liable for all damage to the polyethylene pipe and fittings incurred prior to and during transportation to the site.

2.06 HANDLING AND STORAGE

A. Handling, storage, and care of the polyethylene pipe and fittings, prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damage to the material incurred prior to final acceptance by the Owner.

B. The Contractor shall be responsible for storage of polyethylene pipe and fittings at the site. Pipe and fittings shall be stored on clean level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking shall be limited to a height that will not cause excessive deformation of the bottom layers of pipe under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers that are spaced suitably and of such width as not to allow deformation of the pipe. The pipe shall be stored to minimize bowing.

2.07 PIPE BEDDING MATERIAL

A. Pipe bedding material shall meet the requirements of Section 02228 of this General Specification as well as any other requirements of the Construction Drawings.

2.08 HDPE FLAT STOCK

A. HDPE flat stock installed below polyethylene pipe shall consist of layers of HDPE furnished at the dimensions shown on the Construction Drawings. Flat stock shall be provided from the same resin as the pipe.

PART 3: EXECUTION

3.01 HANDLING AND PLACEMENT

A. Pipe, fittings, and HDPE flat stock shall be installed as indicated on the Construction Drawings.

B. The Contractor shall exercise care when transporting, handling and placing pipe and fittings, such that they will not be cut, kinked, twisted, or otherwise damaged.

C. The Contractor shall comply with the pipe Manufacturer's recommendations for handling, storage, and installation of all polyethylene pipe fittings.

D. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipe. Slings, straps, etc. shall not be positioned at butt-fused joints. Chains, cables or hooks shall not be inserted into the pipe ends as a means of handling pipe.

E. Pipe or fittings shall not be dropped onto rocky or unprepared ground. The pipe and fittings shall not be dropped into trenches or dragged over sharp objects.

F. The maximum allowable depth of cuts, gouges, or scratches on the exterior surface of pipe or fittings is 10 percent of the wall thickness. The interior of the pipe and fittings shall be free of cuts, gouges and scratches. The CQA Engineer will inspect the pipes in accordance with the CQA Plan. Sections of pipe with excessive cuts, gouges, or scratches will be rejected and the Contractor will be required to remove and replace the rejected pipe, at no additional cost to the Owner.

G. Whenever pipe laying is not actively in progress, the open end of pipe that has been placed shall be closed using a watertight plug.

H. Where pipes penetrate through geomembranes, an effective seal shall be established in accordance with these General Specifications as well as the details shown on the Construction Drawings.

3.02 INSTALLATION

A. All pipe and fittings shall be installed in accordance with these General Specifications and the pipe Manufacturer's instructions.

B. The Contractor shall carefully examine all pipe and fittings for cracks, damage or defect before installation. Defective materials shall be removed from the site and replaced with non-defective material at no additional cost to the Owner.

C. The interior of all pipe and fittings shall be inspected, and any foreign material shall be completely removed from the pipe interior before it is moved into final position.

D. Field cutting of pipe shall be carefully made, without damage to pipe or lining system components, so as to leave a smooth end at right angles to the axis of pipe. The method and device used to cut the pipes shall be approved of by the Owner. Sharp edges of cut ends shall be filed off smooth. Flame cutting will not be allowed.

E. All pipe and fittings shall be laid or placed to the grades and elevations shown on the Construction Drawings with bedding and backfill as shown on the Construction Drawings.

F. Placement of overlying materials shall be carried out in accordance with these General Specifications.

G. No pipe shall be laid until the CQA Engineer has observed the condition of the pipe.

H. Blocking under piping shall not be permitting unless specifically accepted by the Owner.

I. The Contractor shall provide all necessary adapters and/or connection pieces required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.

3.03 JOINTS AND CONNECTIONS

A. HDPE pipe shall be joined with thermal butt-fusion joints. All joints shall be made in accordance with ASTM D 2657 and the pipe Manufacturer's recommendations, and shall be made by trained personnel authorized by the pipe Manufacturer.

B. Mechanical connections of HDPE pipe to auxiliary equipment such as valves, flow meters, pumps and tanks shall consists of the following unless indicated otherwise on the Construction Drawings:

1. An HDPE flange connection, called a stub end, shall be butt-fused to the HDPE pipe. Outside diameter and drilling shall comply with the requirements indicated on the Construction Drawings.

2. A Type 316 stainless steel back-up flange. Outside diameter and drillings shall comply with the requirements indicated on the Construction Drawings.

3. Other mechanical couplings, such as 360 degree full circle clamps, shall only be used if approved by the Owner.

4. The stub ends shall be connected with corrosion-resistant bolts and nuts of Type 316 stainless steel, as specified in ASTM A 726 and ASTM A 307.

C. Polyethylene stub ends and flanges shall be at the ambient temperature of the surrounding soil at the time they are bolted tight to prevent relaxation of the flange bolts and loosening of the joint due to thermal contraction or expansion of the polyethylene pipe. Bolts shall be drawn up evenly and in line.

D. Pipe adjacent to joints and joints themselves shall be rigidly supported for a distance of at least one pipe diameter beyond the backup flanges.

E. Pipe boot connections shall be made in the field using viton rings and stainless steel clamps, or welded directly to pipe as shown on the Construction Drawings. The viton ring material shall have a thickness of 3/16 inch and shall have an inner diameter equal to the outer diameter of the pipe on which the viton ring is to be placed. The stainless steel clamps shall be made of 3/16 inch thick, 1/2 inch wide, Type 316 stainless steel. The clamps shall be joined around the pipe boot using a Type 316 stainless steel clasp, not thicker than 3/8 inch. These materials shall be chosen by the Contractor and approved by the Owner.

3.04 SURVEY CONTROL

A. The Surveyor shall survey the location and final elevation of the invert of all polyethylene leachate collection pipes (excluding laterals). The pipe shall be surveyed at its ends and at approximate 50-foot intervals between the ends. In addition, all joints, etc. shall be located horizontally and vertically and overall length measured. Surveying shall be performed in accordance with Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing of the location and final elevation of all pipes.

3.05 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all materials and all partially-complete and completed work of these General Specifications.

B. In the event of damage, the Contractor shall make all repairs and replacements necessary, to the approval of the Owner and at no additional cost to the Owner.

C. The CQA Engineer will issue an approval of pipe installation and inspection to the Owner prior to completely covering the pipe in accordance with the CQA Plan.

[END OF SECTION]

SECTION 02720
ADS N-12 PIPE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the installation of all ADS N-12 pipe required for the landfill construction. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02224 - Drainage Gravel
B. Section 02714 - Geotextile Filter or Cushion Layer

1.03 QUALIFICATIONS AND SUBMITTALS

A. If "or equal" product is proposed, submit samples, technical data, test data, and specifications sufficient to allow evaluation by the Engineer.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. All work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. The CQA Engineer will coordinate independent surveying as required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

D. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming materials. The nonconforming materials shall be removed by the Contractor at no cost to the Owner until acceptable materials are installed.

PART 2: PRODUCTS

2.01 ADS N-12 PIPE PROPERTIES

A. Smooth interior corrugated polyethylene pipe (ADS N-12) shall be high density polyethylene with a corrugated exterior and smooth interior. Pipe and fittings shall be made of polyethylene compounds.

2.03 MANUFACTURING QUALITY CONTROL

A. The Contractor shall submit to the Owner for approval within 14 days prior to the start of ADS N-12 pipe work a complete list of materials to be furnished and the name of the pipe Manufacturer.

B. The Contractor shall submit to the Owner the Manufacturer's certification of compliance with the product requirements of Part 2.

2.04 TRANSPORTATION

A. Transportation of ADS N-12 pipe shall be the responsibility of the Contractor. The Contractor shall be liable for all damage to the ADS N-12 pipe incurred prior to and during transportation to the site.

2.05 HANDLING AND STORAGE

A. Handling, storage, and care of the ADS N-12 pipe prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damage to the material incurred prior to final acceptance by the Owner.

B. The Contractor shall be responsible for storage of the ADS N-12 pipe at the site.

PART 3: EXECUTION

3.01 HANDLING AND PLACEMENT

A. Pipe shall be installed as indicated on the Construction Drawings.

B. The Contractor shall exercise care when transporting, handling and placing pipe and fittings, such that they will not be cut, kinked, twisted, or otherwise damaged.

C. The Contractor shall comply with the pipe Manufacturer's recommendations for handling, storage, and installation of all polyethylene pipe fittings.

D. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipe. Slings, straps, etc. shall not be positioned at butt-fused joints. Chains, cables or hooks shall not be inserted into the pipe ends as a means of handling pipe.

E. Pipe or fittings shall not be dropped onto rocky or unprepared ground. The pipe and fittings shall not be dropped into trenches or dragged over sharp objects.

F. The maximum allowable depth of cuts, gouges, or scratches on the exterior surface of pipe or fittings is 10 percent of the wall thickness. The interior of the pipe and fittings shall be free of cuts, gouges and scratches. The CQA Engineer will inspect the pipes in accordance with the CQA Plan. Sections of pipe with excessive cuts, gouges, or scratches will be rejected and the Contractor will be required to remove and replace the rejected pipe, at no additional cost to the Owner.

G. Whenever pipe laying is not actively in progress, the open end of pipe that has been placed shall be closed using a watertight plug.

H. Where pipes penetrate through geomembranes, an effective seal shall be established in accordance with these General Specifications as well as the details shown on the Construction Drawings.

3.02 INSTALLATION

A. All pipe and fittings shall be installed in accordance with these General Specifications and the pipe Manufacturer's instructions.

B. The Contractor shall carefully examine all pipe and fittings for cracks, damage or defect before installation. Defective materials shall be removed from the site and replaced with non-defective material at no additional cost to the Owner.

C. The interior of all pipe and fittings shall be inspected, and any foreign material shall be completely removed from the pipe interior before it is moved into final position.

D. Field cutting of pipe shall be carefully made, without damage to pipe or lining system components, so as to leave a smooth end at right angles to the axis of pipe. The method and device used to cut the pipes shall be approved of by the Owner. Sharp edges of cut ends shall be filed off smooth. Flame cutting will not be allowed.

E. All pipe and fittings shall be laid or placed to the grades and elevations shown on the Construction Drawings with bedding and backfill as shown on the Construction Drawings.

F. Placement of overlying materials shall be carried out in accordance with these General Specifications.

G. No pipe shall be laid until the CQA Engineer has observed the condition of the pipe.

H. Blocking under piping shall not be permitting unless specifically accepted by the Owner.

I. The Contractor shall provide all necessary adapters and/or connection pieces required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.

3.04 JOINTS AND CONNECTIONS

A. HDPE pipe shall be joined with split couplers. All joints shall be made in accordance with the pipe Manufacturer's recommendations, and shall be made by trained personnel authorized by the pipe Manufacturer.

3.05 SURVEY CONTROL

A. The Surveyor shall survey the location and final elevation of the invert of all ADS N-12 pipe. The pipe shall be surveyed at its ends and at approximate 50-foot intervals between the ends. In addition, all joints, etc. shall be located horizontally and vertically and overall length measured. Surveying shall be performed in accordance with Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing of the location and final elevation of all pipes.

3.06 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all materials and all partially-complete and completed work of these General Specifications.

B. In the event of damage, the Contractor shall make all repairs and replacements necessary, to the approval of the Owner and at no additional cost to the Owner.

C. The CQA Engineer will issue an approval of pipe installation and inspection to the Owner prior to completely covering the pipe in accordance with the CQA Plan.

[END OF SECTION]

SECTION 02730
ADS SLOTTED CPT

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the installation of all ADS corrugated polyethylene tubing (CPT) required for the landfill construction. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02224 - Drainage Gravel
B. Section 02714 - Geotextile Filter or Cushion Layer

1.03 QUALIFICATIONS AND SUBMITTALS

A. If "or equal" product is proposed, submit samples, technical data, test data, and specifications sufficient to allow evaluation by the Engineer.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. All work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. The CQA Engineer will coordinate independent surveying as required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

D. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming materials. The nonconforming materials shall be removed by the Contractor at no cost to the Owner until acceptable materials are installed.

PART 2: PRODUCTS

2.01 SLOTTED CPT PROPERTIES

A. Slotted CPT shall conform to ASTM F405 and ASTM F667. Slot dimensions and locations shall be Manufacturer standard for the diameter pipe specified.

2.03 MANUFACTURING QUALITY CONTROL

A. The Contractor shall submit to the Owner for approval within 14 days prior to the start of ADS CPT work a complete list of materials to be furnished and the name of the pipe Manufacturer.

B. The Contractor shall submit to the Owner the Manufacturer's certification of compliance with the product requirements of Part 2.

2.04 TRANSPORTATION

A. Transportation of ADS CPT shall be the responsibility of the Contractor. The Contractor shall be liable for all damage to the ADS CPT incurred prior to and during transportation to the site.

2.05 HANDLING AND STORAGE

A. Handling, storage, and care of the ADS CPT prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damage to the material incurred prior to final acceptance by the Owner.

B. The Contractor shall be responsible for storage of the ADS CPT at the site.

PART 3: EXECUTION

3.01 HANDLING AND PLACEMENT

A. Pipe shall be installed as indicated on the Construction Drawings.

B. The Contractor shall exercise care when transporting, handling and placing pipe and fittings, such that they will not be cut, kinked, twisted, or otherwise damaged.

C. The Contractor shall comply with the pipe Manufacturer's recommendations for handling, storage, and installation of all polyethylene pipe fittings.

D. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipe. Slings, straps, etc. shall not be positioned at butt-fused joints. Chains, cables or hooks shall not be inserted into the pipe ends as a means of handling pipe.

E. Pipe or fittings shall not be dropped onto rocky or unprepared ground. The pipe and fittings shall not be dropped into trenches or dragged over sharp objects.

F. The maximum allowable depth of cuts, gouges, or scratches on the exterior surface of pipe or fittings is 10 percent of the wall thickness. The interior of the pipe and fittings shall be free of cuts, gouges and scratches. The CQA Engineer will inspect the pipes in accordance with the CQA Plan. Sections of pipe with excessive cuts, gouges, or scratches will be rejected and the Contractor will be required to remove and replace the rejected pipe, at no additional cost to the Owner.

G. Whenever pipe laying is not actively in progress, the open end of pipe that has been placed shall be closed using a watertight plug.

H. Where pipes penetrate through geomembranes, an effective seal shall be established in accordance with these General Specifications as well as the details shown on the Construction Drawings.

3.02 INSTALLATION

A. All pipe and fittings shall be installed in accordance with these General Specifications and the pipe Manufacturer's instructions.

B. The Contractor shall carefully examine all pipe and fittings for cracks, damage or defect before installation. Defective materials shall be removed from the site and replaced with non-defective material at no additional cost to the Owner.

C. The interior of all pipe and fittings shall be inspected, and any foreign material shall be completely removed from the pipe interior before it is moved into final position.

D. Field cutting of pipe shall be carefully made, without damage to pipe or lining system components, so as to leave a smooth end at right angles to the axis of pipe. The method and device used to cut the pipes shall be approved of by the Owner. Sharp edges of cut ends shall be filed off smooth. Flame cutting will not be allowed.

E. All pipe and fittings shall be laid or placed to the grades and elevations shown on the Construction Drawings with bedding and backfill as shown on the Construction Drawings.

F. Placement of overlying materials shall be carried out in accordance with these General Specifications.

G. No pipe shall be laid until the CQA Engineer has observed the condition of the pipe.

H. Blocking under piping shall not be permitting unless specifically accepted by the Owner.

I. The Contractor shall provide all necessary adapters and/or connection pieces required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.

3.04 JOINTS AND CONNECTIONS

A. CPT shall be joined with split couplers. All joints shall be made in accordance with the pipe Manufacturer's recommendations, and shall be made by trained personnel authorized by the pipe Manufacturer.

3.05 SURVEY CONTROL

A. The Surveyor shall survey the location and final elevation of the invert of all ADS CPT. The pipe shall be surveyed at its ends and at approximate 50-foot intervals between the ends. In addition, all joints, etc. shall be located horizontally and vertically and overall length measured. Surveying shall be performed in accordance with Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing of the location and final elevation of all pipes.

3.06 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all materials and all partially-complete and completed work of these General Specifications.

B. In the event of damage, the Contractor shall make all repairs and replacements necessary, to the approval of the Owner and at no additional cost to the Owner.

C. The CQA Engineer will issue an approval of pipe installation and inspection to the Owner prior to completely covering the pipe in accordance with the CQA Plan.

[END OF SECTION]

SECTION 02740
CORRUGATED METAL PIPE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation service necessary for the installation of all corrugated metal pipe (CMP) for construction. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. 02228 - Pipe Bedding

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) most current version:

1. AASHTO M36 - Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains

B. American Society for Testing and Materials (ASTM) most current version:

1. ASTM A27 - Specification for Steel Castings, Carbon, for General Application.
2. ASTM A36 - Specification for Structural Steel.
3. ASTM A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A536 - Specification for Ductile Iron Castings.
5. ASTM C478 - Specification for Precast Reinforced Concrete Manhole Sections.
6. ASTM D1557 - Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb (4.54 kg) Hammer and 18-in. (457 mm) Drop.
7. ASTM D3776 - Test Methods for Mass per Unit Area (Weight) of Woven Fabric.
8. ASTM D3786 - Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.
9. ASTM D4355 - Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Zenon-Arc Type Apparatus).

10. ASTM D4533 - Test Method for Trapezoid Testing Strength of Geotextiles.

11. ASTM D4632 - Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).

12. ASTM D4751 - Test Method for Determining Apparent Opening Size of a Geotextile.

13. ASTM D4833 - Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

C. State of California Department of Transportation (CALTRANS), Standard Specifications, most current version.

1.04 SUBMITTALS

A. Submit manufacturer's and supplier's specifications and test data as required to demonstrate that materials conform to the requirements of this specification.

PART 2: PRODUCTS

2.01 CORRUGATED METAL PIPE (CMP)

A. CMP shall be galvanized steel conforming to AASHTO M36 Type I, with a nominal sheet thickness of 0.079 inches or greater. Diameters shall be as shown on the Construction Drawings.

B. Coupling bands shall be galvanized steel conforming to AASHTO M36 and shall be compatible with the type of CMP provided.

2.02 TRENCH BACKFILL

A. Trench backfill shall conform to the specifications for pipe bedding described in Section 02228.

PART 3: EXECUTION

3.01 CMP CULVERT INSTALLATION

A. Excavate trenches to the lines and grades shown on the Drawings. Overexcavate trenches so that at least 6 inches of pipe bedding material can be placed below the invert of the culvert. Conduct trenching operations in accordance with the applicable provisions of Section 02110.

B. Place a minimum 6-inch-thick layer of pipe bedding material in the trench prior to laying the culvert. Compact pipe bedding material with power tamper or equivalent means. The bottom of the trench shall support the culvert uniformly along its entire length.

C. Handle culvert using methods as recommended by the manufacturer. Join culvert sections using manufacturer's recommended equipment and procedures.

D. Place backfill around culvert in lifts no greater than 1 foot thick prior to compaction. Place soil around haunches of culvert manually or by other approved means so that no voids are present. Compact each lift with power tamper or equivalent means.

[END OF SECTION]

SECTION 02775
GEOMEMBRANE LINERS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment supervision, transportation, and installation services necessary for the installation of the geomembrane liners for the landfill or surface impoundment. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

B. This specification shall also apply to geomembrane installation in the truck roll off area, the drum handling facility, the truck wash facility and the stormwater detention basin unless otherwise indicated on the drawings.

1.02 RELATED SECTIONS

A. Section 02221 - Clay Liner
B. section 02231 - Foundation Sand
C. Section 02710 - Geocomposite
D. Section 02712 - Geonet
E. Section 02714 - Geotextile Filter, or Cushion, Layer
F. Section 02232 - Protective Soil Layer
G. Section 02718 - Polyethylene Pipe and Fittings
H. Section 02780 - Geosynthetic Clay Liners

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan. The Contractor shall require the geomembrane manufacturer to comply with the submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. All work will be constructed, monitored, and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. The Contractor shall deliver geomembrane to the site at least 14 calendar days prior to installation to allow sufficient time for testing required by the CQA Plan.

~~F.~~ D. Geomembrane rolls that do not meet the requirements of this General Specification will be rejected. The Contractor shall replace rejected material with new material that conforms to the specification requirements, at no additional cost to the Owner.

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E. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 RESIN

A. Reclaimed polymer shall not be added to the resin; however, the use of polymer recycled during the manufacturing process will be permitted if the recycled polymer does not exceed 2 percent by weight of the total polymer weight. The product shall be manufactured specifically for use in geomembranes, using new, first-quality polyethylene resin.

B. The resin shall comply with the following properties for high density polyethylene (HDPE):

1. Specific Gravity: 0.94 to 0.96 (ASTM D 792 Method A or ASTM D 1505)

2. Melt Index: 0.1 - 0.3 g/10 min. (ASTM D 1238 Condition E 190/C, 2.16 kg)

3. Water absorption: 0.1% max (ASTM D 570)

2.02 GEOMEMBRANE PROPERTIES

A. Smooth or textured HDPE geomembrane shall be used based on the following schedule:

Facility	Textured/Smooth
Landfill (liner/cover)	Textured
Ditch liners	Smooth
Evaporation Pond and Collection Basin	Smooth
Truck Roll Off	Textured
Drum Storage	Smooth
Liquid Waste Storage	Smooth
Stabilization	NA
Truck Wash	Textured

B. The Contractor shall require that the geomembranes Manufacture furnish geomembrane with minimum average roll values, as defined by the Federal Highway Administration (FHWA), meeting or exceeding the criteria specified in Table 02775-1 and that meet the manufacturing quality control requirements of this section. The Contractor shall require the geomembrane Manufacturer to certify in writing as well as provide test results that demonstrate that the geomembrane delivered to the site complies with the properties listed in Table 02775-1.

C. In addition to the property values listed in Table 02775-1, the geomembrane material shall:

1. Contain a maximum of 1 percent by weight of additives, fillers, or extenders (not including carbon black).

2. Not have striations, roughness (except in the case of textured HDPE geomembranes where a roughened surface is characteristic), pinholes, or bubbles on the surface.

3. Be produced so as to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter.

4. Be manufactured in a single layer or coextruded.

2.03 MANUFACTURING QUALITY CONTROL

A. *Resin*:

1. The Contractor shall require the geomembrane Manufacturer to certify in writing that the resin used to manufacture the geomembrane delivered to the project site complies with the product specifications of this section. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor Any geomembrane manufactured from non-complying resin will be rejected.

2. The Contractor shall require the Manufacturer to supply quality control certificates from the resin Supplier that includes the origin (resin production plant), identification (brand name, number) the production date of the resin used in the manufacturer of the geomembrane shipped to the site, and the results of test conducted to verify that the resin used to manufacturer the geomembrane rolls assigned to the project meets the specifications of Part 2.01 of this section.

B. *Rolls*:

1. The Contractor shall require that the geomembrane Manufacturer continuously monitor the geomembrane during the manufacturing process for inclusions, bubbles, or other defects. Geomembrane that exhibits defects will not be accepted.

2. The Contractor shall require that the geomembrane Manufacturer monitor the geomembrane thickness during the manufacturing process. Geomembrane that fails to meet the specified minimum thickness will not be accepted.

3. The Contractor shall require that the geomembrane Manufacturer sample and test the geomembrane, at a minimum, once every 50,000 ft^2 and perform the tests indicated in Table 02775-1 to demonstrate that the geomembrane properties conform to the values specified in this section. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor. Samples shall be taken across the entire width of the roll and shall not include the first wrapping or outer layer of the roll (about 3.3 feet).

4. Geomembrane rolls that do not have acceptable manufacturing quality control test results shall be rejected by the Owner.

5. In the case of the rejection of a roll of geomembrane, the Contractor shall require that the geomembrane Manufacturer sample and test each roll manufactured in the same lot, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established in accordance with the CQA Plan.

6. Additional testing may be performed at the geomembrane Manufacturer's discretion and expense, to more closely identify the non-complying rolls and/or to qualify individual rolls.

7. If requested by Owner, one coupon of geomembrane (at least 10 feet by 2 feet) for every 40,000 ft^2 of membrane produced shall be retained intact by the geomembrane Manufacturer until construction of landfill or surface impoundment components, for which the geomembrane is used, is complete and the Owner has accepted the completed work.

C. *Manufacturing Plant Visit:*

1. The Manufacturer shall permit the Owner or Owner's representative(s) to visit the manufacturing plant. Visits may be during the manufacturing of the geomembrane rolls for the specific project.

2. During the visit, the Owner or Owner's representative(s) may:

   a. Review the manufacturing process, quality control procedures, laboratory facilities, and testing procedures;

   b. Verify that properties guaranteed by the Manufacturer comply with the specifications;

   c. Verify that the measurements of properties by the Manufacturer are properly documented and the test methods used are acceptable;

   d. Inspect select geomembrane rolls for evidence of holes, blisters, or any sign of contamination by foreign matter;

   e. Review packaging and transportation procedures;

f. Verify that roll packages are labeled in compliance with this Section; and

g. Take conformance samples from geomembrane rolls that are assigned to the project.

2.04 LABELING

A. The geomembrane shall be labeled with the following information:

1. Thickness of the material;
2. Length and width of the roll or factory panel;
3. Name of Manufacturer;
4. Product identification;
5. Lot number; and,
6. Roll or factory panel number.

2.05 TRANSPORTATION

A. Transportation of the geomembrane is the responsibility of the Contractor. The Contractor shall be liable for all damage to materials prior to and during transportation to the site. The Contractor shall replace any damaged rolls at no additional cost to the Owner.

2.06 HANDLING AND STORAGE

A. Handling, storage, and care of the geomembrane prior to and following incorporation in the work is the responsibility of the Contractor. The Contractor shall be liable for all damage to the material incurred prior to final acceptance of the installation by the Owner. The Contractor shall repair any damage in accordance with this Section and at no additional cost to the Owner.

B. The Contractor shall be responsible for storage of the geomembrane at the site. The geomembrane shall be protected from dirt, excessive heat or cold, puncture, cutting, or other damaging or deleterious conditions. The geomembrane shall also be stored in accordance with any additional requirements of the geomembrane Manufacturer.

PART 3: EXECUTION

3.01 EARTHWORK

A. *Surface Preparation*

1. Geomembrane liner shall be installed at all locations shown on the Construction Drawings.

2. The geomembrane liners and the cover geomembrane shall be installed as soon as practical after construction and CQA testing of the underlying materials. Prior to geomembrane liner installation, the Contractor shall verify, by surveying, that the elevations, thicknesses, and grades of the underlying materials conform to the requirements of the Construction

Drawings. Installation of the geomembranes shall not begin until the CQA Engineer completes conformance testing and surveying of the appropriate portions of the underlying materials in accordance with the CQA Plan.

3. Areas to receive geomembrane liner shall be smooth and even, and free of ruts, voids, and protrusions or wrinkles. Any surface features, as determined by the CQA Engineer or Owner, which could damage the geomembrane shall be removed by the Contractor. For earth slopes of 3:1 (horizontal:vertical) or flatter, the final surface prior to receiving geomembrane shall be rolled smooth using a smooth drum roller. For slopes steeper than 3H:1V, dressing of the slopes shall be accomplished by back-dragging the surface with a dozer blade or by other methods approved by the Owner (such as raking the surface by hand) until the Owner is satisfied that the surface is smooth and even, and free of ruts, voids, obstructions, etc.. No vehicles shall be allowed on the final dressed surface without the approval of the Owner.

4. The Contractor shall provide written certification that the surface on which the geomembrane will be installed is acceptable. The certificate of acceptance for each area under consideration shall be given to the Owner as part of geomembrane installation in that area.

5. Special care shall be taken to maintain the prepared surface on which the geomembrane will be installed.

6. No geomembrane shall be placed in an area which has been softened by precipitation or which has excessively cracked due to desiccation.

7. Any damage to the surface caused by weather, installation activities, or other activities shall be repaired by the Contractor at no expense to the Owner.

B. *Anchor Trenches:*

1. The anchor trench shall be excavated prior to geomembrane placement to the elevations, grades, and width shown on the Construction Drawings.

2. No loose soil shall be allowed beneath the geomembrane in the anchor trench.

3. The anchor trench shall be backfilled as shown on the Construction Drawings. Care shall be taken when backfilling the anchor trench to prevent any damage to the geomembrane or other geosynthetics.

4. Clay liner material shall be placed in the anchor trench to the limits shown on the Construction Drawings. The clay liner material shall be compacted using suitable hand-operated compaction equipment. Clay shall be compacted to the requirements in the General Specifications.

5. Slightly rounded corners shall be provided at the top in-board side of the anchor trench to avoid sharp bends in the geomembrane.

3.02 GEOMEMBRANE DEPLOYMENT

A. *Layout Drawings*:

1. The Contractor shall provide at least 2 sets of geomembrane panel layout drawings to the Owner at least 14 days prior to geomembrane deployment. Drawings shall indicate the geomembrane panel configuration, dimensions, details, seam locations, etc. Field seams shall be differentiated from factory seams (if any). The layout drawings must be approved by the Owner prior to the installation of any geomembranes. These drawings shall not be modified without the prior approval of the Owner.

B. *Field Panel Identification*:

1. A geomembrane field panel is defined as a roll or a portion of a roll cut in the field.

2. Each field panel must be given an identification code (number or letter-number) consistent with the layout plan. This identification code shall be agreed upon by the Owner, and Contractor. The field panel identification code shall be related, through a table or chart, to the original resin, and the constituent rolls and factory panels.

C. *Field Panel Placement:*

1. Field panels shall be installed at the location and positions indicated in the layout drawings.

2. Field panels shall be placed one at a time, and each field panel shall be seamed shortly after its placement.

3. Geomembrane shall not be placed when the ambient temperature is below 40°F unless the Contractor has previously submitted a geomembrane cold weather placement and seaming plan and such plan has been approved by the Owner.

4. Geomembranes shall not be placed during a precipitation event, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of excessive winds.

5. The Contractor shall employ placement methods which ensure that:

   a. No vehicular traffic shall be allowed on the geomembrane.

   b. Equipment used shall not damage the geomembrane by handling, trafficking, excessive heat, leakage of hydrocarbons, or other means.

   c. Personnel working on the geomembrane shall not smoke, consume food or beverages (except for body fluid replenishment), wear damaging shoes, have cans, glass containers, or tools not required for liner placement on the geomembrane, or engage in other activities which could damage the geomembrane.

d. The method used to unroll the panels shall not scratch or crimp the geomembrane and shall not damage the supporting soil.

e. The method used to place the panels shall minimize wrinkles (especially differential wrinkles between adjacent panels).

f. Temporary loads and/or anchors (e.g., sand bags), not likely to damage the geomembrane, shall be placed on the geomembrane to prevent uplift by wind.

6. On slopes, geomembranes shall be installed from the top of the slope to the bottom. The geomembrane shall be temporarily anchored at the top of the slope prior to deployment. Unrestrained release of the geomembrane from the top of the slope is not acceptable.

7. Any field panel or portion thereof which becomes seriously damaged (torn, twisted, or crimped) shall be replaced with new material at no expense to the Owner. Less serious damage may be repaired with the approval of the Owner. Damaged panels or portions of damaged panels which have been rejected shall be removed from the work area at no expense to the Owner.

8. Adjacent geomembrane panels shall be overlapped as described in this Section. Larger overlaps shall be used if thermal contraction of the geomembrane is anticipated prior to seaming. Adjacent panels shall be placed under similar temperature conditions, preferably early in the day when temperatures are cooler, to minimize the potential for differential contraction.

9. If a textured geomembrane is placed over GCL, geotextile, or geocomposite a slip sheet (such as 20-mil smooth HDPE) shall first be placed over it in order to allow the geomembrane to slide into its proper position. Once the overlying geomembrane is properly positioned, the slip-sheet shall be carefully removed paying close attention to avoiding any movement to the geomembrane.

3.03 FIELD SEAMING

A. *Seam Layout:*

1. In general, seams shall be oriented parallel to the line of maximum slope, i.e., oriented down, not across, the slope. In corners and at odd-shaped geometric locations, the number of field seams shall be minimized. No horizontal seam shall be permitted less than 10 feet from the toe of the slope, except where approved by the Owner. No panels shall be seamed in the field without the Owner's approval.

B. *Personnel*:

1. All personnel performing seaming operations shall be qualified as required by the CQA Plan. At least one seamer shall have a minimum of 1,000,000 ft^2 of HDPE geomembrane experience. Seamers who don't have a minimum of 1 million ft^2 HDPE geomembrane experience will be considered inexperienced. Qualifications of the seamers shall be provided to the CQA Engineer prior to the start of construction. All personnel performing field seaming shall be qualified by experience or by passing seaming tests. The seaming tests shall require all inexperienced seamers to make 5 trial seams on-site prior to any actual field seams. The trial seams shall be tested according to this section and shall be performed under the supervision of an experienced seamer. The CQA Engineer, or a designated representative, will observe and record the results of the tests. No seaming shall be performed unless a "master seamer" is present.

C. *Weather Conditions for Seaming*:

1. Seaming shall not be attempted at ambient temperatures below 40°F. At ambient temperatures between 40°F and 50°F, seaming will be allowed if the geomembrane is preheated either by the sun or a hot air device, and if there is no excessive cooling from wind. At ambient temperatures above 50°F, no preheating will be required. In all cases, the geomembrane shall be dry and protected from excessive wind.

2. If the Contractor wishes to perform seaming at ambient temperatures below 40°F, he shall demonstrate that the seam so produced is equivalent to those produced under normally approved conditions, and that the overall quality of the geomembrane is not adversely affected. The Contractor shall submit to the Owner for approval a geomembrane cold weather placement and seaming plan that details all aspects of the cold weather seaming operation.

3. To minimize geomembrane contraction stresses, seaming should ideally be carried out in the morning and late evening when the geomembrane is relatively contracted, and during the middle of the day if overcast conditions prevail. If the geomembrane is to be seamed in the middle of a sunny day, the Contractor shall ensure that there is sufficient slack in the geomembrane to prevent excessive stresses or trampolining when the geomembrane contracts as cooler temperatures prevail. The required amount of slack shall be determined by the Contractor and it should not be so much so as to cause excessive wrinkling of the geomembrane. If excessive trampolining or wrinkling of the geomembrane is observed, the Contractor will be required to make repairs to eliminate the problem at no additional cost to the Owner.

4. Ambient temperatures shall be measured near the crest of the landfill or surface impoundment.

D. *Overlapping and Temporary Bonding:*

1. Geomembrane panels shall be overlapped a minimum of 3 inches for extrusion welding and 4 inches for fusion welding or a greater amount if recommended by the geomembrane Manufacturer, but in any event,

sufficient overlap shall be provided to allow peel tests to be performed on the seam.

2. The procedure used to temporarily bond adjacent panels together shall not damage the geomembrane. The temperature of the air at the nozzle of a spot welding apparatus shall be controlled such that the geomembrane is not damaged.

3. No solvent or adhesive shall be used for cleaning or bonding of the geomembrane liner material.

E. *Seam Preparation:*

1. Prior to seaming, the seam area shall be cleaned so that it is free of moisture, dust, dirt, debris of any kind, and foreign material.

2. If seam overlap grinding is required, the process shall be completed according to the geomembrane Manufacturer's instructions and in a manner that does not damage the geomembrane.

3. Seams shall be aligned with the fewest possible number of wrinkles and "fishmouths".

F. *General Seaming Requirements:*

1. All geomembrane overlaps shall be continuously seamed using approved procedures.

2. Seaming shall extend to the outside edge of panels to be placed in the anchor trench.

3. If required, a firm substrate shall be provided by using a flat board, a conveyor belt, or similar hard surface, directly under the seam overlap to achieve proper support.

4. If seaming operations are carried out at night, adequate illumination shall be provided.

5. Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall be patched with an oval or round patch of the same geomembrane that extends a minimum of 6 inches beyond the cut in all directions.

6. At the end of each day or installation segment, all exposed geomembrane edges shall be anchored by sandbags or other approved means. Sandbags securing the geomembrane on side slopes should be connected by a rope fastened at the top of the slope by a temporary anchor. If high winds are expected, boards with weighted sand bags on top may be used to keep wind from getting under the exposed edge of the geomembrane.

G. *Seaming Process:*

1. Approved processes for field seaming are extrusion welding and fusion welding using equipment that the Owner has approved by make and model. Alternate processes shall not be used unless a plan for their use has been submitted by the Contractor and approved by the Owner. Seaming equipment shall not damage the geomembrane.
2. Extrusion Equipment and Procedures:

   a. The Contractor shall maintain at least one spare operable seaming apparatus on site.

   b. The extrusion welding apparatus shall be equipped with gauges indicating the temperature in the apparatus and at the nozzle.

   c. Prior to beginning a seam, the extruder shall be purged until all heat-degraded extrudate has been removed from the barrel. Whenever the extruder is stopped, the barrel shall be purged of all heat-degraded extrudate.

   d. The Contractor shall provide documentation regarding the extrudate to the Owner and shall certify that the extrudate is compatible with the specifications, and consists of the same resin as the geomembrane.

   e. The electric generator for the extrusion welders shall be placed either outside the area to be lined or on a smooth base or other such manner that no damage occurs to the geomembrane.

3. Fusion Equipment and Procedures:

   a. The Contractor shall maintain at least one spare operable seaming apparatus on site.

   b. The fusion welding apparatus shall be an automated vehicular mounted device equipped with gauges indicating the applicable temperatures and pressures

   c. The edges of cross seams shall be abraded to a smooth incline (top and bottom) prior to welding.

   d. A movable protective layer shall be used directly below each geomembrane overlap to be seamed if deemed necessary by the Owner.

   e. The electric generator for the fusion welders shall be placed either outside the area to be lined or on a smooth base or other such manner that no damage occurs to the geomembrane.

   f. All fusion welded seam intersections shall be patched in accordance with this Section.

H. *Trial Seams:*

1. Trial seams shall be made on fragment pieces of geomembrane to verify that seaming conditions are adequate. Such trial seams shall be made at the beginning of each seaming period (morning and afternoon). Each seamer shall make at least one trial seam each day. Trials seams shall also be made in the event that the ambient temperature varies more than 20°F since the last passing trial seam. Trial seams shall be made under the same conditions as actual seams. The trial seam sample shall be at least 5 feet long by 1 foot wide (after seaming) with the seam centered lengthwise for fusion trial seams and at least 3 feet long by 1 foot wide for extrusion trial seams. Seam overlap shall be as indicated in Part 3.03.D. of this Section.

2. Five specimens, each 1 inch wide, shall be cut from the trial seam sample by the Contractor. Two specimens shall be tested for shear strength and three specimens shall be tested for peel strength using a field tensiometer. Both tracks of double fusion welds will be tested for peel strength on each of the three specimens unless otherwise approved by the Owner. The test specimens shall not fail in the seam and shall meet or exceed the strength requirements in Table 02775-2. If a specimen fails, the entire operation shall be repeated. If the second trial seam fails, the seaming apparatus or seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are achieved. Trial seam failure is defined as failure of any one of the five specimens.

3. The CQA Engineer will observe trial seam testing procedures. Successful trial seam samples will be assigned a number and marked accordingly by the CQA Engineer, who will also log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description. The sample itself will be retained only until the construction of the liner is complete, and the liner has been accepted by the Owner.

I. *Nondestructive Seam Continuity Testing:*

1. Except as noted below the Contractor shall nondestructively test for continuity all field seams over their full length, using the vacuum test (primarily for extrusion seams),or air pressure test (for double fusion seams only) methods. All other test methods must be approved by the Owner. These tests shall be carried out as the seaming work progresses, not at the completion of all field seaming. The Contractor shall complete any required repairs in accordance with this Section at no additional cost to the Owner.

2. If the seam cannot be nondestructively tested after final installation, the following procedures shall apply:

    a. Prior to seaming, the seamer shall make a new trial seam.

    b. The seam shall be capped with the same type of geomembrane if the seams of the cap can be nondestructively tested.

c. If the seam is accessible to nondestructive testing prior to final installation but not after final installation, the seam shall be nondestructively tested prior to final installation.

d. At the discretion of the Owner, vacuum testing of fusion welded seams may be allowed in lieu of capping fusion welded seams which cannot be air pressure tested.

e. If none of the above techniques are practical the CQA Engineer will closely observe and document the seaming process.

3. Vacuum Testing

a. The equipment for vacuum box testing shall comprise the following:

i. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge.

ii. A steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections.

iii. A rubber pressure/vacuum hose with fittings and connections.

iv. A bucket and applicator.

v. A soapy solution.

b. The following procedures shall be followed:

i. Energize the vacuum pump and reduce the tank pressure to approximately 5 psi gauge.

ii. Wet a strip of geomembrane seam approximately 4 inches by one and one half times the length (minimum) of the vacuum box with the soapy solution.

iii. Place the box over the wetted area.

iv. Close the bleed valve and open the vacuum valve.

v. Ensure that a leak tight seal is created as evidenced by a negative box pressure of a minimum 5 psi gauge.

vi. Examine the geomembrane through the viewing window for the presence of soap bubbles for not less than 10 seconds.

vii. If no bubbles appear after 10 seconds, close the vacuum valve and open the bleed valve, move the box to the next adjoining area with a minimum 3 inches overlap, and repeat the process.

viii. All areas where soap bubbles appear shall be marked with a marker that will not damage the geomembrane and repaired in accordance with Part 3.03.K. of this Section with no additional cost to the Owner.

4. <u>Air Pressure Testing (For Double-Fusion Seams Only):</u>

a. The following procedures are applicable to those processes which produce a double seam with an enclosed space.

b. The equipment shall comprise the following:

i. An air pump (manual or motor driven), equipped with a pressure gauge, capable of generating and sustaining a pressure between 25 and 30 psi, and mounted on a cushion to protect the geomembrane.

ii. A rubber hose with fittings and connections.

iii. A sharp hollow needle, or other approved pressure feed device.

c. The following procedures shall be followed:

i. Seal both ends of the seam to be tested.

ii. Insert needle, or other approved pressure feed device, into the tunnel created by the fusion weld.

iii. Insert a protective cushion between the air pump and the geomembrane.

iv. Energize the air pump to a gauge pressure between 25 and 30 psi, close valve, and sustain the pressure for not less than 5 minutes.

v. If the loss of pressure exceeds 2 psi, or does not stabilize, locate faulty area and repair in accordance with Part 3.03.K. of this Section.

vi. At the end of the test, cut the air channel at the end of the seam opposite the needle and verify air flow to ensure that the entire seam length was tested.

vii. Remove the needle, or other approved pressure feed device, and repair all test penetrations in accordance with Part 3.03.K. of this Section.

J. <u>*Destructive Testing:*</u>

1. Destructive seam tests shall be performed on samples collected from selected locations to evaluate seam strength and integrity. Destructive testing shall be carried out as the seaming work progresses, not at the completion of all field seaming.

2. Sampling:

   a. Destructive test samples shall be collected at a minimum average frequency of one test location per 500 feet of seam length. Test locations shall be determined during seaming, and may be prompted by suspicion of excess crystallinity, contamination, offset seams, or any other potential cause of imperfect seaming. The CQA Engineer will be responsible for choosing the locations of destructive seam samples. The Contractor shall not be informed in advance of the locations where the seam samples will be taken. The CQA Engineer may increase the sampling frequency.

   b. Samples shall be cut by the Contractor at the locations designated by the CQA Engineer as the seaming progresses in order to obtain laboratory test results before the geomembrane is covered by another material. Each sample shall be numbered and the sample number and location identified on the panel layout drawing. All holes in the geomembrane resulting from the destructive seam sampling shall be immediately covered. The holes shall be repaired in accordance with Part 3.03.K. of this Section. The continuity of the new seams in the repaired areas shall be tested according to this Section.

   c. Two test specimens, each 1 inch wide and 6 to 12 inches long with the seam centered parallel to the width, shall be taken. The test specimens shall be spaced a clear distance of approximately 42 inches apart. These specimens shall be tested in the field in accordance with Part 3.03.J.3 of this Section. If these samples pass the field test, a laboratory sample shall be taken. The removed destructive sample shall be at least 12 inches wide by 42 inches long with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

      i. One 12-inch long portion to the Contractor.

      ii. One 18-inch long portion to the CQA Engineer for laboratory testing.

      iii. One 12-inch long portion to the CQA Engineer for archive storage.

3. Field Testing:

   a. The two 1 inch wide test specimens shall be tested in the field, using a tensiometer, for peel adhesion. Field testing shall be the responsibility of the Contractor and shall be observed by the CQA Engineer. The test specimens shall not fail in the weld more than 10 percent and shall meet the peel strength requirements of Table 02775-2. Both tracks of double fusion welded seams shall be tested in peel on each test specimen unless otherwise approved by the Owner. If any field test sample fails to pass, then the procedures outlined in Part 3.03.K. of this Section shall be followed.

4. Laboratory Testing:

   a. Laboratory testing by the CQA Engineer, in accordance with the CQA Plan, shall include seam shear strength and shear strain at yield (ASTM D 3083) and peel adhesion (ASTM D 413). The minimum acceptable values to be obtained in these tests are those indicated in Table 02775-2. At least 5 specimens shall be tested for each test method. Specimens shall be selected alternately by test from the samples (i.e., peel, shear, peel, shear). A sample passes the laboratory tests when at least 4 out of 5 of the test specimens meet or exceed all of the test criteria. Both tracks of double fusion welded seams shall be tested in peel.

5. Destructive Test Failure:

   a. The following procedures shall apply whenever a sample fails a destructive test, whether the test is conducted by the CQA Engineer's laboratory, the Contractor's laboratory, (if used) or by a field tensiometer. The Contractor shall have two options:

      i. The Contractor can reconstruct the seam(s) (e.g., remove the old seam(s) and reseam, or cap the seam(s)) between any two passed test locations.

      ii. The Contractor can trace the welding path to an intermediate location, a minimum of 10 feet from the location of the failed test (in each direction) and take test specimens for an additional field destructive tests at each location. If these field destructive tests pass, then full laboratory samples shall be taken. If these laboratory samples pass the tests, then the seam(s) shall be reconstructed between these locations. If either sample fails, then the process shall be repeated to establish the zone in which the seam shall be reconstructed. This will be done by following the chronological order in which the seaming apparatus welded the seam(s) prior to and after it welded the failing test location. In any case, all acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been obtained. In cases exceeding 150 feet of reconstructed seam(s), a sample taken from within the reconstructed zone must pass destructive testing. Whenever a sample fails, the CQA Engineer may require additional tests for seams that were formed by the same seamer and/or seaming apparatus or seamed during the same time shift at no additional cost to the Owner.

iii. Should three consecutive failing destructives be performed on a single welding apparatus, the apparatus shall not be permitted to weld until the machine has been repaired and successfully passed three consecutive trial seams.

K. *Defects and Repairs:*

1. The geomembrane will be inspected before and after seaming for evidence of defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be swept or washed by the Contractor if surface contamination inhibits inspection.

2. Each suspect location, both in seam and non-seam areas shall, at the discretion of the CQA Engineer, be either repaired or nondestructively tested using the methods described Part 3.03.I. of this section, as appropriate. Each location which fails nondestructive testing shall be marked by the CQA Engineer and repaired by the Contractor.

3. When geomembrane seaming is completed (or when seaming of a significant area of a geomembrane is completed) and prior to placing overlying materials, the CQA Engineer shall identify all excessive geomembrane wrinkles. The Contractor shall cut and reseam all wrinkles so identified. The seams thus produced shall be tested like any other seams.

4. Repair Procedures:

a. Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired by the Contractor. Repairs to the geomembrane shall be completed to the base of the anchor trench but are not required across the base of the anchor trench. Several repair procedures exist. The final decision as to the appropriate repair procedure shall be agreed upon between the CQA Engineer and the Contractor. The procedures available include:

i. Patching, used to repair holes, tears, intersections of fusion-welded seams, and undispersed raw materials;

ii. Abrading and spot extrusion welding, used to repair small sections of extruded seams and air pressure test needle holes;

iii. Spot seaming, used to repair areas where the geomembrane has been scratched, the geomembrane thickness has been reduced, or other minor, localized flaws exists;

iv. Capping, used to repair failed seams; and,

vi. Removing failing seams and replacing them with strips of new material seamed into place (used with long lengths of fusion seams).

b. In addition, the following shall be satisfied:

i. Surfaces of the geomembrane which are to be repaired shall be abraded prior to the repair;

ii. All surfaces must be clean and dry at the time of repair;

iii. All seaming equipment used in repair procedures must be approved by the Owner;

iv. The repair procedures, materials, and techniques shall be approved in advance, for the specific repair, by the CQA Engineer;

v. Patches or caps shall extend at least 6 inches beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3 inches; and,

vi. The geomembrane below large caps shall be appropriately cut to avoid water or gas collection between the two sheets.

5. Repair Verification:

a. Each repair shall be located, logged, and nondestructively tested using the methods described in Part 3.03.I. of this Section, as appropriate. Repairs which pass the nondestructive test shall be taken as an indication of an adequate repair. Failed tests will require the repair to be redone and retested until a passing test results. At the discretion of the CQA Engineer, destructive testing may be required on large repairs.

3.04 MATERIALS IN CONTACT WITH THE LINER

A. The Contractor shall not leave any tools or equipment on the geomembrane.

B. The Contractor shall take all necessary precautions to ensure that the geomembrane is not damaged during its installation or during the installation of other components of the liner system or by other construction activities. Installation on rough surfaces shall be performed carefully. If approved by the Owner, additional loosely placed geotextile sections may be used by the Contractor to protect the geomembrane.

C. The CQA Engineer will provide monitoring of the placement and spreading of soil materials over the geomembrane as required by the CQA Plan.

D. Placement of sump and pipe bedding gravel on top of a geomembrane liner shall be carried out in accordance with Section 02224 and 02228 of these General Specifications.

E. Equipment shall not be driven directly on the geomembrane. Unless otherwise specified by the Owner, all equipment operating on materials overlying the geomembrane shall comply with the following:

Maximum Allowable *Equipment Ground Pressure (psi)*	*Thickness of Soil* *Above Geomembrane (inches)*
<5	12
<10	18
<20	24
>20	36

The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the Owner at the Contractor's expense.

These equipment ground pressure requirements do not apply to any equipment used to construct the secondary or primary clay liners. The Owner may restrict the use of equipment that may potentially damage the geomembrane.

F. *Appurtenances*:

1. Installation of the geomembrane in sump areas, and connection of the geomembrane to appurtenances shall be made according to the specifications. Extreme care shall be taken while seaming around sumps and appurtenances since neither nondestructive nor destructive testing may be feasible in these areas.

2. All clamps, slips, bolts, nuts, or other fasteners used to secure the geomembrane to each appurtenance shall be at least as durable as the geomembrane.

3. Geomembrane boots for pipe penetrations shall be factory fabricated and tested where practical. Geomembrane boots shall be installed as shown on the Construction Drawings and in accordance with any geomembrane Manufacturer recommendations.

3.05 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all materials and partially completed and completed work.

B. In the event of damage, the Contractor shall make repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

C. The CQA Engineer will issue an approval of the geomembrane liner installation to the Owner in accordance with the CQA Plan prior to placement of any material over the geomembrane.

3.06 RECORD DRAWINGS

A. Within 7 days of the completion of installation of any layer of geomembrane liner and unless otherwise approved by the Owner, the Contractor shall provide 2 copies of a complete "as-built" record drawing to the Owner. This record drawing shall be prepared by the Contractor and shall be at a scale of no less than 1 inch equals 30 feet.

B. Record drawings shall include the following:

1. The surveyed locations, dimensions, and elevations of anchor trenches.

2. The identification, size, and surveyed location of all deployed field panels of geomembrane liner (with date of deployment).

3. The identification, length, and surveyed location of all seams (both factory and field seams).

4. The location, and type of all repairs to seams and field panels.

5. The destructive test sample locations and pass/fail results.

C. The Owner will review the record drawing and either approve it or return it to the Contractor for revision. If the drawing is returned to the Contractor, he shall revise the drawing as requested by the Owner. No additional construction that would cover the installed geomembrane may be performed until the record drawing is approved by the Owner. The Contractor may submit a partial record to obtain approval for a portion of work.

TABLE 02775-1
REQUIRED GEOMEMBRANE

Property	Test Method	60 mil HDPE [1]
Thickness	ASTM D1593 Para 8.1.3 (Smooth)	60 mil
	ASTM D751 (Textured)	57 mil (min)
Specific Gravity	ASTM D1505	0.940
Elongation @ Yield	ASTM D638	13%
Elongation @ Break	ASTM D638 Speed C	500% Smooth 100% Textured
Tensile Strength @ Yield	ASTM D638 Test Specimen Type IV	132 lb/in
Tensile Strength @ Break	ASTM D638	228 lb/in Smooth 132 lb/in Textured
Carbon Black Content	ASTM D1603	2% to 3%
Carbon Black Dispersion	ASTM D3015 and ASTM D2663	A-1, A-2, B-1
Environmental Stress Crack	ASTM D1693	1,500 hrs
Low Temperature Brittleness	ASTM D746 Procedure B	-103°F
Dimensional Stability	ASTM D1204	<1.5% (max)
Puncture Resistance	FTMS 101C	78 lb Smooth 78 lb Textured

Note: [1]Values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table). Where ranges of values are given, the average roll

values must be within the specified range. The specified dimensional stability is a maximum average roll value.

TABLE 02775-2
REQUIRED GEOMEMBRANE SEAM PROPERTIES[1]

ASTM D4437		**60 Mil HDPE**			
Shear	Fusion lbs/in	120	Smooth	113	Textured
	Extrusion lbs/in	120	Smooth	113	Textured
Peel	Fusion lbs/in	90	Smooth	90	Textured
	Extrusion lbs/in	80	Smooth	80	Textured
Note: (1) Specified properties are minimums.					

[END OF SECTION]

SECTION 02780
GEOSYNTHETIC CLAY LINERS

PART 1: ENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment supervision, transportation, and installation services necessary for the installation of the geosynthetic clay liner (GCL) of the landfill or surface impoundment. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02119 - Prepared Subgrade
B. Section 02221 - Clay Liner
C. Section 02710 - Geocomposite
D. Section 02775 - Geomembrane Liners

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan. The Contractor shall require the GCL manufacturer to comply with the submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. All work will be constructed, monitored, and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. The Contractor shall deliver GCL to the site at least 14 calendar days prior to installation to allow sufficient time for testing required by the CQA Plan.

D. GCL rolls that do not meet the requirements of this General Specification will be rejected. The Contractor shall replace rejected material with new material that conforms to the specification requirements, at no additional cost to the Owner.

E. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming area. The nonconforming area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 GCL PROPERTIES

The GCL material shall be in accordance with the test methods, test frequencies and material physical properties as listed in Table 02780-1.

A. In addition to the property values listed in Table 02780-1, the GCL material shall:

1. The GCL shall be manufactured by mechanically bonding the geotextiles using a needle punching or stitching process to create frictional and shear strength characteristics.

2. In order to maintain these characteristics, no glues, adhesives or other non-mechanical bonding processes shall be used in lieu of the needle punch or stitching process. Their use to enhance the physical properties of the GCL is not permitted.

3. Interface Shear Testing of Proposed Equal Materials

   Interface shear tests (ASTM D 5321) shall be performed by the Geosynthetic Laboratory under the direction of the Design Engineer. Interface shear testing will be performed on fully hydrated GCL samples using a 12 inch by 12 inch shear box under test conditions described by the Design Engineer. The number of tests to be performed is based on a ratio of one test per 100,000 ft^2 of material. All costs related to testing and evaluation of proposed equal materials are the responsibility of the Contractor.

4. Interface Shear Testing for QA Conformance Samples

   Interface shear tests (ASTM D 5321) shall be performed by the Geosynthetic Laboratory under the direction of the CQA Engineer using test procedures determined by the Design Engineer. Tests will be performed at a frequency of one test per 100,000 ft^2 of material. All costs related to testing and evaluation of conformance samples is the responsibility of the CQA Engineer.

2.02 MANUFACTURING QUALITY CONTROL

A. The Contractor shall require that the GCL Manufacturer sample and test the GCL, at the frequencies outlined in Table 02780-1 the tests shall demonstrate that the GCL properties conform to the values specified in Table 02780-1. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor. GCL rolls that do not have acceptable manufacturing quality control test results shall be rejected by the Owner.

B. Quality Control certificates shall be issued by the GCL manufacturer to the project engineer, CQA inspector or other designated party for each delivery of material. The certifications shall be signed by the quality control manager of the GCL manufacturer or other responsible party and shall include the following information:

1. *Shipment Packing List* - A list indicating the rolls shipped on a particular truckload.

2. *Bill of Lading* - A list indicating the rolls shipped on a particular truckload.

3. *Letter of Certification* - The letter indicating the material is in conformance with the physical properties specified.

4. *Physical Properties Sheet* - The material specification for the GCL supplied in accordance with this specification.

C. Quality Control submittals shall be issued by the GCL manufacturer to the project engineer, CQA inspector or other designated party for each lot of material if necessary. The submittals shall include the following information:

1. *Bentonite Manufacturer Certification* - Bentonite manufacturer quality documentation for the particular lot of clay used in the production of the rolls delivered.

2. *Geotextile Manufacturer Certification* - Geotextile manufacturer quality control documentation for the particular lots of geotextiles used in the production of the rolls delivered.

3. *GCL Manufacturer Tracking List* - Cross referencing list delineating the corresponding geotextile and bentonite lots for the materials used in the production of the rolls delivered.

4. *Manufacturing Quality Control Data* - The manufacturing quality control test data indicating the actual test values obtained when tested at the appropriate frequencies for the properties specified in Table 02780-1.

D. *Manufacturing Plant Visit*:

1. The Manufacturer shall permit the Owner or Owner's representative(s) to visit the manufacturing plant. Visits may be during the manufacturing of the GCL rolls for the specific project.

2. During the visit, the Owner or Owner's representative(s) may:

   a. Review the manufacturing process, quality control procedures, laboratory facilities, and testing procedures;

   b. Verify that properties guaranteed by the Manufacturer comply with the specifications;

   c. Verify that the measurements of properties by the Manufacturer are properly documented and the test methods used are acceptable;

d. Inspect select GCL rolls for evidence of holes, delamination, or any sign of contamination by foreign matter;

e. Review packaging and transportation procedures;

f. Verify that roll packages are labeled in compliance with this Section; and,

g. Take conformance samples from GCL rolls that are assigned to the project.

E. Any accessory bentonite used for sealing seams, penetrations, or repairs, shall be the same granular bentonite as used in the production of the GCL itself.

2.03 LABELING

A. The geomembrane shall be labeled with the following information:

1. Length and width of the roll or factory panel;
2. Name of Manufacturer;
3. Product identification;
4. Lot number; and,
5. Roll or factory panel number.

2.04 TRANSPORTATION

A. Transportation of the GCL is the responsibility of the Contractor. The Contractor shall be liable for all damage to materials prior to and during transportation to the site. The Contractor shall replace any damaged rolls at no additional cost to the Owner.

2.05 HANDLING AND STORAGE

A. Handling, storage, and care of the GCL prior to and following incorporation in the work is the responsibility of the Contractor. The Contractor shall be liable for all damage to the material incurred prior to final acceptance of the installation by the Owner. The Contractor shall repair any damage in accordance with this Section and at no additional cost to the Owner.

B. The Contractor shall be responsible for storage of the GCL at the site. The GCL shall be protected from water, dirt, puncture, cutting, or other damaging or deleterious conditions. The GCL shall also be stored in accordance with any additional requirements of the GCL Manufacturer, Owner, or CQA Engineer.

1. GCL should be stored no higher than three to four rolls high or limited to the height at which the handling apparatus may be safely handled by installation personnel. Stacks or tiers of rolls should be situated in a manner that prevents sliding or rolling by chocking the bottom layer of rolls.

2. Rolls shall not be stacked on uneven or discontinuous surfaces as this may cause bending or deformation of the rolls and in turn damage the GCL or cause difficulty inserting the core pipe.

3. An additional tarpaulin or plastic sheet shall be used over the stacked rolls to provide extra protection for GCL material stored outdoors.

4. Bagged bentonite material shall be stored and tarped next to GCL rolls unless other more protective measures are available. Bags shall be stored on pallets or other suitably dry surface which will prevent undue prehydration.

C. GCL must be supported during handling to ensure worker safety and prevent damage to the liner. Under no circumstances should the rolls be dragged, lifted from one end, lifted with only the forks of a lift truck or pushed to the ground from the delivery vehicle.

The CQA inspector shall verify that suitable handling equipment exists which does not pose any danger to installation personnel or risk of damage or deformation to the GCL material itself. Typical handling equipment is described below:

1. *Spreader Bar Assembly* - A spreader bar assembly shall include both a core pipe or bar and a spreader bar beam. The core pipe shall be used to uniformly support the roll when inserted through the GCL core while the spreader bar beam will prevent chains or straps from chafing the roll edges.

2. *Stinger* - A stinger is a rigid pipe or rod with one end directly connected to a forklift or other handling equipment. If a stinger is used, it should be fully inserted to its full length into the roll to prevent excessive bending of the roll when lifted.

3. *Roller Cradles* - Roller cradles consist of two larger diameter rollers spaced approximately 3 inches apart which both support the GCL roll and allow it to be freely unrolled. The use of roller cradles shall be permitted if the rollers support the entire width of the GCL roll.

4. *Straps* - Straps may be used to support the ends of the spreader bars *but are not recommended as the primary support mechanism*. As straps may damage the GCL where around the roll and generally do not provide sufficient uniform support to prevent roll bending or deformation, great care must be exercised when this option is used.

PART 3: EXECUTION

3.01 EARTHWORK

The surface upon which the GCL material will be installed shall be inspected by the CQA inspector and certified by the Earthwork Contractor to be in accordance with the requirements of this specification.

A. Site specific compaction requirements should be followed in accordance with the project drawings and specifications. At a minimum, the level of compaction should be such that no rutting is caused by installation equipment or other construction vehicles which traffic the area of deployment.

B. The surfaces to be lined shall be smooth and free of any debris, vegetation, roots, sticks, sharp rocks, or other deleterious materials larger than two inches as well as free of any voids, large cracks or standing water or ice.

C. Directly prior to deployment of the GCL, the subgrade shall be final graded to fill remaining voids or desiccation cracks, and smooth drum rolled to eliminate sharp irregularities or abrupt elevation changes. The surfaces to be lined shall be maintained in this smooth condition.

3.02 GEOSYNTHETIC SUBGRADE

Prior to GCL deployment on another geosynthetic surface shall be inspected and approved by the third party CQA inspector in accordance with the requirements of the project specification documents.

3.03 ANCHOR TRENCH

An anchor trench shall be excavated by the earthwork contractor or liner installer to the lines and grades shown on the project drawings.

A. The anchor trench shall be constructed free of sharp edges or corners and maintained in a dry condition. No loose soil shall be permitted beneath the GCL within the trench.

B. The anchor trench shall be inspected as well as approved by the CQA inspector prior to the GCL placement, back-filling and compaction of the anchor key material.

3.04 SUBGRADE INSPECTION

The earthen or geosynthetic subgrade shall be continuously inspected, approved and certified by the CQA inspector prior to GCL placement.

Upon approval by the CQA inspector, it shall be the installer's responsibility to indicate to the Engineer any change in the condition of the subgrade that could cause it to be out of compliance with any of the requirements of this section or the project specific specification.

3.05 GCL DEPLOYMENT

A. *GCL Orientation* - In the absence of specific guidelines, GCL panels should be placed with the non-woven side up on slopes to maximize the shear strength characteristics.

B. *GCL Panel Position* - Where possible, all slope panels should be installed parallel to the maximum slope while panels installed in flat areas require no particular orientation. No horizontal GCL panel seams shall be allowed on slopes steeper than 5%.

C. *Panel Deployment* - GCL materials shall be installed in general accordance with the procedures set forth in this section, subject to site specific conditions which would necessitate modifications.

Reinforced GCL shall be used on both slopes as well as the flat areas to ensure the GCL withstands the rigors of the installation and subsequent low load hydration.

1. Deployment should proceed from the highest elevation to the lowest to facilitate drainage in the event of precipitation.

2. The GCL may be deployed on slopes by pulling the material from a suspended roll, or securing a roll end into an anchor trench and unrolling each panel as the handling equipment slowly moves backwards.

3. Deployment on flat areas shall be conducted in the same manner as that for the slopes, however, care should be taken to minimize dragging the GCL. Slip-sheet may be used to facilitate positioning of the liner while ensuring the GCL is not damaged from underlying sources.

4. Overlaps shall be a minimum of 6 inches and be free of wrinkles, folds or fishmouths.
5. The Contractor shall only install as much GCL that can be covered at the end of the day. No GCL shall be left exposed overnight. The exposed edge of the GCL shall be covered by a temporary tarpaulin or other such water-resistant sheeting until the next working day.

D. *Anchoring* - All GCL material installed on slopes greater than 7H:1V shall be anchored to prevent potential GCL panel movement.

1. Standard Anchor - The GCL shall be placed into and across the base of the excavated trench, stopping at the back wall of the excavation as shown on the drawing.

E. *Seaming* - A 6-inch lap line and a 9-inch match line shall be imprinted on both edges of the upper geotextile component of the GCL to assist in installation overlap quality control. Lines shall be printed as continuous dashes in easily observable non-toxic ink.

1. Overlap seams shall be a minimum of six inches on panel edges and one foot on panel ends.

2. Loose granular bentonite should be placed between panels at a rate of 1/4 pound per linear foot of seam.

F. *Detailing* - Detail work, defined as the sealing of the liner to pipe penetrations, foundation walls, drainage structures, spillways, and other appurtenances, shall be performed as recommended by the Design Engineer and the GCL Manufacturer.

G. *Damage Repair* - Prior to geomembrane material placement, damage to the GCL shall be identified and repaired by the installer. Damage is defined as any rips or tears in the geotextiles, delamination of geotextiles or a displaced panel.

1. Rip and Tear Repair (Flat Surfaces) - Rips or tears may be repaired by completely exposing the affected area, removing all foreign objects or soil and by then placing a patch cut from unused GCL over the damage

(damaged material may be left in place), with a minimum of overlap of 12 inches on all edges.

2. Rip and Tear Repair (Slopes) - Damaged GCL material on slopes shall be repaired by the same procedures above. The minimum overlap of 12 inches on all edges may be increased as recommended by the CQA Engineer.

3. Displaced Panels - Displaced panels shall be adjusted to the correct position an orientation. The adjusted panel shall then be inspected for any geotextile damage or bentonite loss. Damage shall be repaired by the above procedure.

4. Premature Hydration - If the GCL is subjected to premature hydration, the GCL installer shall notify the CQA Engineer for a site specific determination as to whether the material is acceptable or if alternative measures must be taken to ensure the quality of the design-dependent upon the degree of damage.

3.06 MATERIALS IN CONTACT WITH THE GCL

A. The Contractor shall not leave any tools or equipment on the GCL.

B. The Contractor shall take all necessary precautions to ensure that the GCL is not damaged during its installation or during the installation of other components of the landfill or by other construction activities. Installation on rough surfaces shall be performed carefully.

C. The CQA Engineer will provide monitoring of the placement and spreading of soil materials over the GCL. Equipment shall not be driven directly on the GCL. Unless otherwise specified by the Owner, all equipment operating on materials overlying the GCL shall comply with the following:

Maximum Allowable Equipment Ground Pressure (psi)	*Thickness of Soil Above GCL (inches)*
<5	12
<10	18
<20	24
>20	36

The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the Owner at the Contractor's expense.

D. Installation of the overlying geosynthetic component can be accomplished through the use of *lightweight*, rubber-tired equipment such as a 4-wheel all-terrain vehicle (ATV). This vehicle can be driven directly on the GCL, provided the ATV makes no sudden stops, starts, or turns.

E. Smooth HDPE may be dragged across the GCL surface with equipment or by hand labor during positioning. Similarly, the HDPE may be unrolled with the use of low ground pressure equipment.

F. If a textured geomembrane is placed over the GCL, a slip-sheet (such as 20-mil smooth HDPE) shall first be placed over the GCL in order to allow the geomembrane to slide into its proper position. Once the overlying geomembrane is properly positioned, the slip-sheet shall be carefully removed paying close attention to avoiding any movement to the geomembrane.

3.07 PROTECTION OF THE WORK

A. The Contractor shall use all means necessary to protect all materials and partially completed and completed work.

B. In the event of damage, the Contractor shall make repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

C. The CQA Engineer will issue an approval of the GCL liner installation to the Owner in accordance with the CQA Plan prior to placement of any material over the GCL.

TABLE 02780-1
REQUIRED GCL PROPERTIES(4)

Geotextile Properties	Test Method	Manufacturer's QC Minimum Test Frequency	Value -English-	Value -SI-
Nonwoven Mass/Unit Area	ASTM D 5261	1/ 200,000 sq. ft (1/20,000 sq. m)	7.4 oz./yd^2 Typical 6.0 oz./yd^2 MARV	250 g/m^2 Typical 200 g/m^2 MARV
Woven	ASTM D 5261	1/ 200,000 sq. ft (1/20,000 sq. m)	3.4 oz./yd^2 Typical 3.1 oz./yd^2 MARV	115 g/m^2 Typical 105 g/m^2 MARV
BENTONITE				
Swell Index	ASTM D 5890	1/100,000 lbs. (50,000 kg)	24 ml/2g min.	24 ml/2g min.
Moisture Content	ASTM D 4643	1/100,000 lbs. (50,000 kg)	12% max.	12% max.
Fluid Loss	ASTM D 5891	1/100,000 lbs. (50,000 kg)	18 ml max.	18 ml max.
FINISHED GCL (4)				
Bentonite Mass Per Unit Area[1]	ASTM D 5261	1/ 50,000 sq. ft (1/5,000 sq. m)	0.90 lb./sq. Ft MARV	4.39 kg/m^2 MARV
Grab Strength[2]	ASTM D 4362	1/ 50,000 sq. ft (1/5,000 sq. m)	95 lbs MARV	422 N MARV
Grab Elongation[2]	ASTM D 4632	1/ 50,000 sq. ft (1/5,000 sq. m)	75% Typical	75% Typical
Peel Strength	ASTM D 4632	1/ 50,000 sq. ft (1/5,000 sq. m)	15 lbs. min.	66 N min.
Permeability[3]	ASTM D 5084	1/100,000 sq. ft (1/10,000 sq. m)	5 x 10^{-9} cm/sec max	5 x 10^{-9} cm/sec max
Interface Shear[5]	ASTM 5321	1/100,000 sq.ft. 1/10,000 sq. m)	ϕ=2°, C=440 psf	ϕ=2°, C=21.1 Kpa

Notes:
1. Oven-dried measurement reflecting a moisture content of zero.
2. Measured at maximum peak, in the weakest principal direction.
3. De-Aired Tap Water @ 5 psi maximum effective confining stress and 2 psi head.
~~5.~~ 4. Internal shear strength testing (ASTM D 5321) of QA conformance samples or proposed equal material will be performed by the CQA Engineer as described in this specification.
~~3.~~ 5. Residual strength values tested under saturated undrained conditions at normal loads representative of design conditions.

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[END OF SECTION]

SECTION 02900
VEGETATION AND SEEDING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services for establishing vegetation on the surface of disturbed areas.

1.02 RELATED SECTIONS

A. Section 02227 Vegetative Cover

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualifications and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION AND QUALITY ASSURANCE

A. Work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The CQA Engineer will coordinate independent surveying required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control and document the work.

C. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extend of the nonconforming area. The nonconformance area shall be reworked by the Contractor at no cost to the Owner until acceptable test results are obtained.

PART 2: PRODUCTS

2.01 MATERIALS

A. Seed mixture for planting shall be as specified by the New Mexico SCS.

PART 3: EXECUTION

3.01 SITE PREPARATION

A. Remove all weeds from areas to be planted. Roughen seed bed to a depth of 2 to 4 inches by scarifying, disking, harrowing, or equivalent methods.

3.02 PLANTING

A. Plant seed using equipment and procedures appropriate for seed type at recommended by the seed supplier.

[END SECTION]

SECTION 03100
CONCRETE FORMWORK

PART 1: GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all materials for concrete form work, bracing, shoring, and supports and shall design and construct all falsework, all in accordance with the provisions of the General Specifications, the CQA Plan, and the Construction Drawings.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Codes: All codes, as referenced herein.

B. Government Standards:

PS 1 Construction and Industrial Plywood

PS 20 American Softwood Lumber Standard

C. Commercial Standards:

ACI 117 Standard Tolerances for Concrete Construction and Materials

ACI 347 Guide to Formwork for Concrete

1.03 CONTRACTOR SUBMITTALS

A. The Contractor shall submit the following.

1. Form ties and all related accessories, including taper tie plugs, if taper ties are used.

2. Form gaskets.

1.04 QUALITY ASSURANCE

A. Tolerances: The variation from established grade or lines shall not exceed 1/4-inch in 10 feet and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be within the tolerances of ACI 117.

PART 2: PRODUCTS

2.01 GENERAL

A. Except as otherwise expressly accepted by the Engineer, all lumber brought on the job site for use as forms, shoring, or bracing shall be new material. All forms shall be smooth surface forms and shall be of the following materials:

Walls	-	Steel or plywood panel
Columns	-	Steel, plywood or fiber glass
Roof and floor	-	Plywood
All other work	-	Steel panels, plywood or tongue and groove lumber

B. Form materials which may remain or leave residues on or in the concrete shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application or use.

2.02 FORM AND FALSEWORK MATERIALS

A. Materials for concrete forms, formwork, and falsework shall conform to the following requirements:

1. Lumber shall be Douglas Fir or Southern Yellow Pine, construction grade or better, in conformance with U.S. Product Standard PS 20.

2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Yellow Pine plywood manufactured especially for concrete formwork and shall conform to the requirements of PS 1 for Concrete Forms, Class I, and shall be edge sealed.

3. Form materials shall be metal, wood, plywood, or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.

B. Unless otherwise shown, exterior corners in concrete members shall be provided with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise shown.

C. Forms and falsework to support the roof and floor slabs shall be designed for the total dead load, plus a live load of 50 psf (minimum). The minimum design load for combined dead and live loads shall be 100 psf.

2.03 FORM TIES

A. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-1/2 inches; and all such fasteners shall be such as to leave holes of regular shape for reaming. Form ties for water-retaining structures shall have integral waterstops. Integral waterstops shall tightly fit the form tie so that they cannot be moved from mid-point of the tie. Form ties shall be Burke Penta-Tie System by The Burke Company; Richmond Snap-Tys by the Richmond Screw Anchor Company; or equal.

B. Removable taper ties may be used when approved by the Engineer. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie. Use Burke Taper-Tie System by The Burke Company; Taper-Ty by the Richmond Screw Anchor Company; or equal.

PART 3: EXECUTION

3.01 GENERAL

A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The Contractor shall assume full responsibility for the adequate design of all forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed from the WORK and replaced at the Contractor's expense. Provide worker protection from protruding reinforcement bars in accordance with applicable safety codes. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable local, state and Federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by Contractor's personnel and by the Engineer and shall be in sufficient number and properly installed. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.

B. Concrete forms shall conform to the shape, lines, and dimensions of members as called for on the Drawings, and shall be substantial, free from surface defects, and sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

3.02 FORM DESIGN

A. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. The forms shall be tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1- to 1-1/2-inch diameter polyethylene rod held in position to the underside of the wall form. Adequate clean-out holes shall be provided at the bottom of each lift of forms. The size, number, and location of such clean-outs shall be as acceptable to the Engineer. Whenever concrete cannot be placed from the top of a wall form in a manner that meets the requirements of the General Specifications, form windows shall be provided in the size and spacing needed to allow placement of concrete to the requirements of Section 03300, Cast-in-Place Concrete. The size, number, and location of such form windows shall be as acceptable to the Engineer.

3.01 CONSTRUCTION

A. Vertical Surfaces: All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is shown. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

B. Construction Joints: Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to the Engineer. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.

C. Form Ties:

1. Embedded Ties: Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as specified for "Finish of Concrete Surfaces" in Section 03300 - Cast-in-Place Concrete. Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.

2. Removable Ties: Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls which are dry on both sides. Exposed faces of walls shall have the outer 2 inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

3.02 REUSE OF FORMS

A. Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the Engineer.

3.03 REMOVAL OF FORMS

A. Careful procedures for the removal of forms shall be strictly followed, and this work shall be done with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted. In the case of roof slabs and above-ground floor slabs, forms shall remain in place until test cylinders for the roof concrete attain a minimum compressive strength of 75 percent of the 28-day strength specified in Section 03300 - Cast-in-Place Concrete; provided, that no forms shall be disturbed or removed under an individual panel or unit before the concrete in the adjacent panel or unit has attained 75 percent of the specified 28-day strength and has been in place for a minimum of 7 days. The time required to establish said strength shall be as determined by the Engineer who will make several test cylinders for this purpose from concrete used in the first group of roof panels placed. If the time so determined is more than the 7-day minimum, then that time shall be used as the minimum length of time. Forms for all vertical walls of waterholding structures shall remain in place at least 36 hours after the concrete has been placed. Forms for all parts of the work not specifically mentioned herein shall remain in place for periods of time as recommended in ACI 347.

3.04 MAINTENANCE OF FORMS

A. Forms shall be maintained at all times in good condition, particularly as to size, shape, strength, rigidity, tightness, and smoothness of surface. Forms, when in place, shall conform to the established alignment and grades. Before concrete is placed, the forms shall be thoroughly cleaned. The form surfaces shall be treated with a nonstaining mineral oil or other lubricant acceptable to the Engineer. Any excess lubricant shall be satisfactorily removed before placing the concrete. Where field oiling of forms is required, the Contractor shall perform the oiling at least two weeks in advance of their use. Care shall be exercised to keep oil off the surfaces of steel reinforcement and other metal items to be embedded in concrete.

3.05 FALSEWORK

A. All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure were placed at one time.

B. Falsework shall be placed upon a solid footing, safe against undermining, and protected from softening. When the falsework is supported on timber piles, the maximum calculated pile loading shall not exceed 20 tons. When falsework is supported on any portion of the structure which is already constructed, the load imposed by the falsework shall be spread, distributed, and braced in such a way as to avoid any possibility of damage to the structure.

[END OF SECTION]

SECTION 03200
REINFORCEMENT STEEL

PART 1: GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, fabricate, and place all concrete reinforcement steel, welded wire fabric, couplers, and concrete inserts for use in reinforced concrete and masonry construction and shall perform all appurtenant work, including all the wires, clips, supports, chairs, spacers, and other accessories, all in accordance with the General Specifications, the CQA Plan, and the Construction Drawings.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Codes: All codes, as referenced herein.

B. Commercial Standards

ACI 315Details and Detailing of Concrete Reinforcement

ACI 318Building Code Requirements for Reinforced Concrete

CRSI MSP-1	Concrete Reinforcing Steel Institute Manual of Standard Practice
WRI	Manual of Standard Practice for Welded Wire Fabric
AWS D1.4	Structural Welding Code - Reinforcing Steel
ASTM A 82	Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A 185	Specification for Welded Steel Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 775	Specification for Epoxy-Coated Reinforcing Steel Bars

1.03 CONTRACTOR SUBMITTALS

A. The Contractor shall furnish shop bending diagrams, placing lists, and drawings of all reinforcement steel prior to fabrication.

B. Details of the concrete reinforcement steel and concrete inserts shall be submitted by the Contractor at the earliest possible date after receipt by the Contractor of the Notice to Proceed. Said details of reinforcement steel for fabrication and erection shall conform to ACI 315 and the requirements specified and shown. The shop bending diagrams shall show the actual lengths of bars, to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. The shop drawings shall include bar placement diagrams which clearly indicate the dimensions of each bar splice.

C. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, the Contractor shall submit manufacturer's literature which contains instructions and recommendations for installation for each type of coupler used; certified test reports which verify the load capacity of each type and size of coupler used; and shop drawings which show the location of each coupler with details of how they are to be installed in the formwork.

D. If reinforcement steel is spliced by welding at any location, the Contractor shall submit mill test reports which shall contain the information necessary for the determination of the carbon equivalent as specified in AWS D1.4. The Contractor shall submit a written welding procedure for each type of weld for each size of bar which is to be spliced by welding; merely a statement that AWS procedures will be followed is not acceptable.

1.4 QUALITY ASSURANCE

A. If requested by the Engineer, the Contractor shall provide samples from each heat of reinforcement steel delivered in a quantity adequate for testing. Costs of initial tests will be paid by the Owner. Costs of additional tests due to material failing initial tests shall be paid by the Contractor.

B. If reinforcement steel is spliced by welding at any location, the Contractor shall submit certifications of procedure qualifications for each welding procedure used and certification of welder qualifications, for each welding procedure, and for each welder performing the work. Such qualifications shall be as specified in AWS D1.4.

C. If requested by the Engineer, the Contractor shall provide samples of each type of welded splice used in the work in a quantity and of dimensions adequate for testing. At the discretion of the Engineer, radiographic testing of direct butt welded splices will be performed. The Contractor shall provide assistance necessary to facilitate testing. The Contractor shall repair any weld which fails to meet the requirements of AWS D1.4. The costs of testing will be paid by the Owner; except, the costs of all tests which fail to meet specified requirements shall be paid by the Contractor.

PART 2: PRODUCTS

2.01 MATERIAL REQUIREMENTS

A. Materials specified in this Section which may remain or leave residues on or within the concrete shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application or use.

2.02 REINFORCEMENT STEEL

A. Reinforcement Steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar reinforcement shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel Reinforcement or as otherwise shown.

2. Welded wire fabric reinforcement shall conform to the requirements of ASTM A 185 and the details shown; provided, that welded wire fabric with longitudinal wire of W4 size wire and smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches; and provided further, that welded wire fabric with longitudinal wires larger than W4 size shall be furnished in flat sheets only.

3. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A 82.

B. Accessories

1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. All bar supports shall meet the requirements of the CRSI Manual of Standard Practice including special requirements for supporting epoxy coated reinforcing bars. Wire bar supports shall be CRSI Class 1 for maximum protection with a 1/8-inch minimum thickness of plastic coating which extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.

2. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Wire ties shall be embedded in concrete block bar supports.

C. Epoxy coating for reinforcing and accessories, where specified or shown, shall conform to ASTM A 775.

2.03 MECHANICAL COUPLERS

A. Mechanical couplers shall be provided where shown and where approved by the Engineer. The couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice.

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied. This shall apply to all mechanical splices, including those splices intended for future connections.

C. The reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection. Straight threaded type couplers shall require the use of the next larger size reinforcing bar or shall be used with reinforcing bars with specially forged ends which provide upset threads which do not decrease the basic cross section of the bar.

D. Couplers shall be Lenton Form Saver as manufactured by Erico Products; Dowel Bar Splicer System as manufactured by Richmond Screw Anchor Company; or equal.

2.04 WELDED SPLICES

A. Welded splices shall be provided where shown and where approved by the Engineer. All welded splices of reinforcement steel shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars which are connected.

B. All materials required to conform the welded splices to the requirements of AWS D1.4 shall be provided.

2.05 EPOXY GROUT

A. Epoxy for grouting reinforcing bars shall be specifically formulated for such application, for the moisture condition, application temperature, and orientation of the hole to be filled.

PART 3: EXECUTION

3.01 GENERAL

A. All reinforcement steel, welded wire fabric, couplers, and other appurtenances shall be fabricated, and placed in accordance with the requirements of the Building Code and the supplementary requirements specified herein.

3.02 FABRICATION

A. General

1. Reinforcement steel shall be accurately formed to the dimensions and shapes shown, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings. Stirrups and tie bars shall be bent around a pin having a diameter not less than 1-1/2-inch for No. 3 bars, 2-inch for No. 4 bars, and 2-1/2-inch for No. 5 bars. Bends for other bars shall be made around a pin having a diameter not less than 6 times the bar diameter, except for bars larger than 1 inch, in which case the bends shall be made around a pin of 8 bar diameters. Bars shall be bent cold.

2. The Contractor shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings. Said drawings, diagrams, and lists shall be prepared by the Contractor.

B. Fabricating Tolerances: Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:

1. Sheared length: ± 1 inch

2. Depth of truss bars: + 0, - 1/2 inch

3. Stirrups, ties, and spirals: ±1/2 inch

4. All other bends: ±1 inch

3.03 PLACING

A. Reinforcement steel shall be accurately positioned as shown, and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks. For concrete over formwork, the Contractor shall furnish concrete, metal, plastic, or other acceptable bar chairs and spacers.

B. Limitations on the use of bar support materials shall be as follows.

1. Concrete Dobies: permitted at all locations except where architectural finish is required.
2. Wire Bar Supports: permitted only at slabs over dry areas, interior dry wall surfaces, and exterior wall surfaces.
3. Plastic Bar Supports: permitted at all locations except on grade.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

D. Bars additional to those shown which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at its own expense.

E. Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the Building Code.

F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be as acceptable to the Engineer.

G. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters. Slab bolsters shall be spaced not more than 30 inches on centers, shall extend continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane shown.

H. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3 feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.

I. Epoxy coated reinforcing bars shall be stored, transported, and placed in such a manner as to avoid chipping of the epoxy coating. Non-abrasive slings made of nylon and similar materials shall be used. Specially coated bar supports shall be used. All chips or cracks in the epoxy coating shall be repaired with a compatible epoxy repair material prior to placing concrete.

J. Accessories supporting reinforcing bars shall be spaced such that there is no deflection of the accessory from the weight of the supported bars. When used to space the reinforcing bars from wall forms, the forms and bars shall be located so that there is no deflection of the accessory when the forms are tightened into position.

3.04 SPACING OF BARS

A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than one inch.

B. Where reinforcement in beams or girders is placed in 2 or more layers, the clear distance between layers shall be not less than one inch.

C. In columns, the clear distance between longitudinal bars shall be not less than 1-1/2 times the bar diameter, nor less than 1-1/2 times the maximum size of the coarse aggregate, nor less than 1-1/2 inches.

D. The clear distance between bars shall also apply to the distance between a contact splice and adjacent splices or bars.

3.05 SPLICING

A. General

1. Reinforcement bar splices shall only be used at locations shown. When it is necessary to splice reinforcement at points other than where shown, the character of the splice shall be as acceptable to the Engineer.

2. Unless otherwise indicated, dowels shall match the size and spacing of the spliced bar.

B. Splices of Reinforcement

1. The length of lap for reinforcement bars, unless otherwise shown shall be in accordance with ACI 318-89, Section 12.15.1 for a Class B splice.

2. Laps of welded wire fabric shall be in accordance with the ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

3. Splices in column spiral reinforcement, when necessary, shall be made by welding or by a lap of 1-1/2 turns.

C. Bending or Straightening

1. Reinforcement shall not be straightened or rebent in a manner which will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by the Engineer. No bars partially embedded in concrete shall be field-bent except as shown or specifically permitted by the Engineer.

D. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as shown. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. Couplers intended for future connections shall be recessed a minimum of 1/2 inch from the concrete surface. After the concrete is placed, the coupler shall be plugged with plastic plugs which have an O-ring seal and the recess filled with sealant to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged .

E. Unless noted otherwise, mechanical coupler spacing and capacity shall match the spacing and capacity of the reinforcing shown for the adjacent section.

3.06 CLEANING AND PROTECTION

A. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.

B. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be reinspected and, if necessary recleaned.

3.07 EMBEDMENT OF DRILLED REINFORCING STEEL DOWELS

A. Hole Preparation

1. The hole diameter shall be as recommended by the epoxy manufacturer but shall be no larger than 0.25 inch greater than the diameter of the outer surface of the reinforcing bar deformations.

2. The depth of the hole shall be as recommended by the epoxy manufacturer to fully develop the bar but shall not be less than 12 bar diameters, unless noted otherwise.

3. The hole shall be drilled by methods which do not interfere with the proper bonding of epoxy.

4. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes to be drilled shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.

5. The hole shall be blown clean with clean, dry compressed air to remove all dust and loose particles.

6. Epoxy shall be injected into the hole through a tube placed to the bottom of the hole. The tube shall be withdrawn as epoxy is placed but kept immersed to prevent formation of air pockets. The hole shall be filled to a depth that insures that excess material will be expelled from the hole during dowel placement.

7. Dowels shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with epoxy. The bar shall be inserted slowly enough to avoid developing air pockets.

[END OF SECTION]

SECTION 03290
JOINTS IN CONCRETE

PART 1: GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall construct all joints in concrete at the locations shown on the Construction Drawings. Joints required in concrete structures are of various types and will be permitted only where shown, unless specifically accepted by the Engineer.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Federal Specifications:

TT-S-0227E(3)	Sealing Compound, elastomeric type, Multi-component for Caulking, Sealing, and Glazing Buildings and Other Structures).

B. U.S. Army Corps of Engineers Specifications:

CRD-C572	PVC Waterstop.

C. Commercial Standards:

ASTM A 775	Specification for Epoxy-Coated Reinforcing Steel Bars
ASTM C 920	Specification for Elastomeric Joint Sealants
ASTM D 412	Test Methods for Rubber Properties in Tension
ASTM D 624	Test Method for Rubber Property -- Tear Resistance
ASTM D 638	Test Method for Tensile Properties of Plastics
ASTM D 746	Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 747	Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
ASTM D 1056	Specification for Flexible Cellular Materials -- Sponge or Expanded Rubber
ASTM D 1752	Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 2240	Test Method for Rubber Property -- Durometer Hardness
ASTM D 2241	Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series)

1.03 TYPES OF JOINTS

A. **Construction Joints:** When fresh concrete is placed against a hardened concrete surface, the joint between the two pours is called a construction joint. Unless otherwise specified, all joints in water bearing members shall be provided with a waterstop and/or sealant groove of the shape specified and shown. The surface of the first pour may also be required to receive a coating of bond breaker as shown.

B. **Contraction Joints:** Contraction joints are similar to construction joints except that the fresh concrete shall not bond to the hardened surface of the first pour, which shall be coated with a bond breaker. The slab reinforcement shall be stopped 4-1/2 inches from the joint; which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the second pour. Waterstop and/or sealant groove shall also be provided when specified or shown.

C. **Expansion Joints:** To allow the concrete to expand freely, a space is provided between the two pours, the joint shall be formed as shown. This space is obtained by placing a filler joint material against the first pour, which acts as a form for the second pour. Unless otherwise specified, all expansion joints in water bearing members shall be provided with a center-bulb type waterstop as shown.

C. Premolded expansion joint material shall be installed with the edge at the indicated distance below or back from finished concrete surface, and shall have a slightly tapered, dressed, and oiled wood strip secured to or placed at the edge thereof during concrete placement, which shall later be removed to form space for sealing material.

D. The space so formed shall be filled with a joint sealant material as specified in the Paragraph in Part 2 entitled "Joint Sealant." In order to keep the two wall or slab elements in line the joint shall also be provided with a sleeve-type dowel as shown.

E. **Control Joints:** The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will probably occur. A groove, of the shape and dimensions shown, is formed or saw-cut in the concrete. This groove is afterward filled with a joint sealant material as specified in the Paragraph in Part 2 entitled "Joint Sealant."

1.04 CONTRACTOR SUBMITTALS

A. **Waterstops:** Prior to production of the material required under this contract, qualification samples shall be submitted. Such samples shall consist of extruded or molded sections of each size or shape to be used, and shall be accomplished so that the material and workmanship represents in all respects the material to be furnished under this contract. The balance of the material to be used under this contract shall not be produced until after the Engineer has reviewed the qualification samples. Waterstop manufacturer shall certify waterstop material is suitable for chemicals Berog used in containment areas.

B. **Joint Sealant:** Prior to ordering the sealant material, the Contractor shall submit to the Engineer for the Engineer's review, sufficient data to show general compliance with the requirements of the Contract Documents.

C. Certified test reports from the sealant manufacturer on the actual batch of material being supplied indicating compliance with the above requirements shall be furnished the Engineer before the sealant is used on the job.

D. **Shipping Certification:** The Contractor shall provide written certification from the manufacturer as an integral part of the shipping form, to show that all of the material shipped to this project meets or exceeds the physical property requirements of the Contract Documents. Supplier certificates are not acceptable.

E. **Joint Location:** The Contractor shall submit placement shop drawings showing the location and type of all joints for each structure.

1.05 QUALITY ASSURANCE

A. **Waterstop Inspection:** It is required that all waterstop field joints shall be subject to rigid inspection, and no such work shall be scheduled or started without having made prior arrangements with the Engineer to provide for the required inspections. Not less than 24 hours' notice shall be provided to the Engineer for scheduling such inspections.

B. All field joints in waterstops shall be subject to rigid inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which shall pass said inspection, and all faulty material shall be removed from the site and disposed of by the Contractor at its own expense.

C. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:

1. Offsets at joints greater than 1/16-inch or 15 percent of material thickness, at any point, whichever is less.

2. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16-inch or 15 percent of material thickness, at any point, whichever is less.

3. Any combination of offset or exterior crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16-inch or 15 percent of material thickness at any point, whichever is less.
4. Misalignment of joint which result in misalignment of the waterstop in excess of 1/2-inch in 10 feet.

5. Porosity in the welded joint as evidenced by visual inspection.

6. Bubbles or inadequate bonding which can be detected with a penknife test. (If, while prodding the entire joint with the point of a pen knife, the knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.)

D. **Waterstop Samples:** Prior to use of the waterstop material in the field, a sample of a fabricated mitered cross and a tee constructed of each size or shape of material to be used shall be submitted to the Engineer for review. These samples shall be fabricated so that the material and workmanship represent in all respects the fittings to be furnished under this contract. Field samples of fabricated fittings (crosses, tees, etc.) will be selected at random by the Engineer for testing by a laboratory at the Owner's expense. When tested, they shall have a tensile strength across the joints equal to at least 600 psi.

E. **Construction Joint Sealant:** The Contractor shall prepare adhesion and cohesion test specimens as specified herein, at intervals of 5 working days while sealants are being installed.

F. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:

1. Sealant specimen shall be prepared between 2 concrete blocks (1-inch by 2-inch by 3-inch). Spacing between the blocks shall be 1-inch. Coated spacers (2-inch by 1-1/2-inch by 1/2-inch) shall be used to insure sealant cross-sections of 1/2-inch by 2 inches with a width of 1-inch.

2. Sealant shall be cast and cured according to manufacturer's recommendations except that curing period shall be not less than 24 hours.

3. Following curing period, the gap between blocks shall be widened to 1-1/2-inch. Spacers shall be used to maintain this gap for 24 hours prior to inspection for failure.

1.06 GUARANTEE

A. The Contractor shall provide a 5-year written guarantee of the entire sealant installation against faulty and/or incompatible materials and workmanship, together with a statement that it agrees to repair or replace, to the satisfaction of the Owner, at no additional cost to the Owner, any such defective areas which become evident within said 5-year guarantee period.

PART 2: PRODUCTS

2.07 GENERAL

B. All joint materials specified herein shall be classified as acceptable for potable water use, by the Environmental Protection Agency, within 30 days of application.

2.08 PVC WATERSTOPS

A. **General:** Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of these Specifications. No reclaimed or scrap material shall be used. The Contractor shall obtain from the waterstop manufacturer and shall furnish to the Engineer for review, current test reports and a written certification of the manufacturer that the material to be shipped to the job meets the physical requirements as outlined in the U.S. Army Corps of Engineers Specification CRD-C572 and those listed herein.

B. **Flatstrip and Center-Bulb Waterstops:** Flatstrip and center-bulb waterstops shall be as detailed and as manufactured by: Kirkhill Rubber Co., Brea, California; Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; Greenstreak Plastic Products Co., St. Louis, Missouri; or equal; provided, that at no place shall the thickness of flat strip waterstops, including the center bulb type, be less than 3/8-inch.

C. **Multi-Rib Waterstops:** Multi-rib waterstops, where required, shall be as detailed and as manufactured by Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; Greenstreak Plastic Products Co., St. Louis, Missouri; or equal. Prefabricated joint fittings shall be used at all intersections of the ribbed-type waterstops.

D. **Other Types of Waterstops:** When other types of waterstops, not listed above are required and shown, they shall be subjected to the same requirements as those listed herein.

E. **Waterstop Testing Requirements:** When tested in accordance with the specified test standards, the waterstop material shall meet or exceed the following requirements:

PHYSICAL PROPERTY SHEET MATERIAL	VALUE	ASTM STD.
Tensile Strength-min (psi)	1750	D 638, Type IV
Ultimate elongation-min (percent)	350	D 638, type IV
Low Temp Brittleness-max (degrees F)	-35	D 746
Stiffness in flexure-min (psi	400	D 747
Accelerated Extraction (CRD-C572)		
Tensile Strength 0min (psi)	1500	D 638, Type IV
Ultimate Elongation-min (percent)	300	D 638, Type IV
Effect of Alkalies (CRD-C572)		
Change in Weight (percent)	+0.25/-0.10	-----
Change in Durometer, Shore A	+5	D 2240
Finish Waterstop		
Tensile Strength-min (psi)	1400	D 638, Type IV
Ultimate Elongation-min (percent)	280	D 638, Type IV

2.09 JOINT SEALANT

A. Joint sealant shall be polyurethane polymer designed for bonding to concrete which is continuously submerged in water. No material will be acceptable which has an unsatisfactory history as to bond or durability when used in the joints of water retaining structures.

B. Joint sealant material shall meet the following requirements (73 degrees F and 50 percent R.H.):

Work Life	45 - 180 minutes
Time to Reach 20 Shore "A" Hardness (at 77 degrees F, 200 gr quantity)	24 hours, maximum
Ultimate Hardness (ASTM D 2240)	20 - 45 Shore "A"

Tensile Strength (ASTM D 412)	175 psi, minimum
Ultimate Elongation (ASTM D 412)	400 percent, minimum
Tear Resistance (Die C ASTM D 624)	75 pounds per inch of thickness, minimum
Color	Light Gray

C. All polyurethane sealants for waterstop joints in concrete shall conform to the following requirements:

1. Sealant shall be 2-part polyurethane with the physical properties of the cured sealant conforming to or exceeding the requirements of ANSI/ASTM C 920 or Federal Specification TT-S-0227 E(3) for 2-part material, as applicable.
2. For vertical joints and overhead horizontal joints, only "non-sag" compounds shall be used; all such compounds shall conform to the requirements of ANSI/ASTM C 920 Class 25, Grade NS, or Federal Specification TT-S-0227 E(3), Type II, Class A.
3. For plane horizontal joints, the self-leveling compounds which meet the requirements of ANSI/ASTM C 920 Class 25, Grade P, or Federal Specification TT-S-0227 E(3), Type I shall be used. For joints subject to either pedestrian or vehicular traffic, a compound providing non-tracking characteristics, and having a Shore "A" hardness range of 35 to 45, shall be used.
4. Primer materials, if recommended by the sealant manufacturer, shall conform to the printed recommendations of the sealant manufacturer.

D. All sealants, wherever shown, or required hereunder shall be PSI-270 as manufactured by Polymeric Systems Inc.; Elastothane 227R as manufactured by Pacific Polymers; Sikaflex 2C, as manufactured by Sika Corporation; or equal.

E. Sealants for non-waterstop joints in concrete shall conform to the requirements of Section [07920], "Sealants and Caulking."

2.10 JOINT MATERIALS

A. **Bearing Pad:** Bearing pad to be neoprene conforming to ASTM D 2000 BC 420, 40 durometer hardness unless otherwise noted.

B. **Neoprene Sponge:** Sponge to be neoprene, closed-cell, expanded, conforming to ASTM D 1056, type 2C3-E1.

C. **Joint Filler:**

1. Joint filler for expansion joints in waterholding structures shall be neoprene conforming to ASTM D1056, type 2C5-E1.

2. Joint filler material in other locations shall be of the preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D 1752 for Type I, except as otherwise specified herein.

2.11 BACKING ROD

A. Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi. The rod shall be 1/8-inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a 3/4-inch wide joint.

2.12 BOND BREAKER

A. Bond breaker shall be Super Bond Breaker as manufactured by Burke Company, San Mateo, California; Select Cure CRB as manufactured by Select Products Co., Upland, California; or equal. It shall contain a fugitive dye so that areas of application will be readily distinguishable.

2.13 BENTONITE WATERSTOP

A. Where called for in the Contract Documents, bentonite type waterstop, which shall expand in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast, shall be provided.

B. The bentonite waterstop shall be composed of 75 percent bentonite. The balance of the material shall be butyl rubber-hydrocarbon with less than 1.0 percent volatile matter. The waterstop shall contain no asbestos fibers or asphaltics.

C. The manufacturer's rated application temperature range shall be from 5 to 125 degrees F. The service temperature range shall be from -40 to 212 degrees F.

D. The cross sectional dimensions of the unexpanded waterstop shall be one inch by 3/4-inch.

E. The waterstop shall be provided with an adhesive backing which will provide excellent adhesion to concrete surfaces.

2.14 SLIP DOWELS

A. Slip dowels in joints shall be A36 smooth epoxy-coated bars, conforming to ASTM A 775.

2.15 PVC TUBING

A. PVC tubing in joints shall be Sch. SDR 13.5, conforming to ASTM D 2241.

PART 3: EXECUTION

3.01 GENERAL

A. Waterstops of the type specified herein shall be embedded in the concrete across joints as shown. All waterstops shall be fully continuous for the extent of the joint. Splices necessary to provide such continuity shall be accomplished in conformance to printed instructions of manufacturer of the waterstops. The Contractor shall take suitable precautions and means to support and protect the waterstops during the progress of the work and shall repair or replace at its own expense any waterstops damaged during the progress of the work. All waterstops shall be stored so as to permit free circulation of air around the waterstop material.

B. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.02 SPLICES IN WATERSTOPS

A. Splices in waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations. It is essential that:

1. The material not be damaged by heat sealing.

2. The splices have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.

3. The continuity of the waterstop ribs and of its tubular center axis be maintained.

B. Butt joints of the ends of 2 identical waterstop sections may be made while the material is in the forms.

C. All joints with waterstops involving more than 2 ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of 2 dissimilar waterstop sections shall be prefabricated by the Contractor prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.

D. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.

3.03 JOINT CONSTRUCTION

A. **Setting Waterstops:** In order to eliminate faulty installation that may result in joint leakage, particular care shall be taken of the correct positioning of the waterstops during installation. Adequate provisions must be made to support and anchor the waterstops during the progress of the work and to insure the proper embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be insured by thoroughly working it in the vicinity of all joints.

B. In placing flat-strip waterstops in the forms, means shall be provided to prevent them from being folded over by the concrete as it is placed. Unless otherwise shown, all waterstops shall be held in place with light wire ties on 12-inch centers which shall be passed through the edge of the waterstop and tied to the curtain of reinforcing steel. Horizontal waterstops, with their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the waterstop shall be tacked. In placing concrete around horizontal waterstops, with their flat face in a horizontal plane, concrete shall be worked under the waterstops by hand so as to avoid the formation of air and rock pockets.

C. In placing centerbulb waterstops in expansion joints, the centerbulb shall be centered on the joint filler material.

D. Waterstop in vertical wall joints shall stop 6 inches from the top of the wall where such waterstop does not connect with any other waterstop and is not to be connected to for a future concrete placement.

E. **Joint Location:** Construction joints, and other types of joints, shall be provided where shown. When not shown, construction joints shall be provided at 25-foot maximum spacing for all concrete construction, unless noted otherwise. Where joints are shown spaced greater than 40 feet apart, additional joints shall be provided to maintain the 25-foot maximum spacing. The location of all joints, of any type, shall be submitted for acceptance by the Engineer.

F. **Joint Preparation:** Special care shall be used in preparing concrete surfaces at joints where bonding between 2 sections of concrete is required. Unless otherwise shown, such bonding will be required at all horizontal joints in walls. Surfaces shall be prepared in accordance with the requirements of Section [03300] [03310], "Cast-in-Place Concrete." Except on horizontal wall construction joints, wall to slab joints or where otherwise shown or specified, at all joints where waterstops are required, the joint face of the first pour shall be coated with a bond breaker as specified herein.

G. **Construction Joint Sealant:** Construction joints in water-bearing floor slabs, and elsewhere as shown, shall be provided with tapered grooves which shall be filled with a construction joint sealant. The material used for forming the tapered grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sand-blasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out; immediately thereafter, they shall be primed, bond breaker tape placed in the bottom of the groove, and filled with the construction joint sealant. The primer used shall be supplied by the same manufacturer supplying the sealant. No sealant will be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant fillet shall be thoroughly cleaned, as outlined for the tapered grooves, prior to application of the sealant.

H. The primer and sealant shall be placed strictly in accordance with the printed recommendations of the manufacturer, taking special care to properly mix the sealant prior to application. The sides of the sealant groove shall not be coated with bond breaker, curing compound, or any other substance which would interfere with proper bonding of the sealant. All sealant shall achieve final cure at least 7 days before the structure is filled with water.

I. All sealant shall be installed by a competent waterproofing specialty contractor who has a successful record of performance in similar installations. Before work is commenced, the crew shall be instructed as to the proper method of application by a representative of the sealant manufacturer.

J. Thorough, uniform mixing of 2-part, catalyst-cured materials is essential; special care shall be taken to properly mix the sealer before its application. Before any sealer is placed, the Contractor shall arrange to have the crew doing the work carefully instructed as to the proper method of mixing and application by a representative of the sealant manufacturer.

K. Any joint sealant which, after the manufacturer's recommended curing time for the job conditions of the work hereunder, fails to fully and properly cure shall be completely removed; the groove shall be thoroughly sandblasted to remove all traces of the uncured or partially cured sealant and primer, and shall be re-sealed with the specified joint sealant. All costs of such removal, joint treatment, re-sealing, and appurtenant work shall be at the expense of the Contractor.

L. **Bentonite Waterstop:**

1. Where a bentonite waterstop is called for, it shall be installed with the manufacturer's instructions and recommendations; except, as modified herein.

2. When requested by the Engineer, the manufacturer shall provide technical assistance in the field.

3. Bentonite waterstop shall only be used where complete confinement by concrete is provided. Bentonite waterstop shall not be used in expansion or contraction joints nor in the first 6 inches of any intersecting joint.

4. The bentonite waterstop shall be located as near as possible to the center of the joint and it shall be continuous around the entire joint. The minimum distance from the edge of the waterstop to the face of the member shall be 5 inches.

5. Where the thickness of the concrete member to be placed on the bentonite waterstop is less than 12 inches, the waterstop shall be placed in grooves formed or ground into the concrete. The groove shall be at least 3/4 inch deep and 1-1/4 inches wide. When placed in the groove, the minimum distance from the edge of the waterstop to the face of the member shall be 2.5 inches.

6. Where a bentonite waterstop is used in combination with PVC waterstop, the bentonite waterstop shall overlap the PVC waterstop for a minimum of 6 inches and shall be placed in contact with the PVC waterstop.

7. The bentonite waterstop shall not be placed when the temperature of the waterstop material is below 40 degrees F. The waterstop material may be warmed so that it shall remain above 40 degrees F during placement; however, means used to warm the material shall in no way harm the material or its properties. The waterstop shall not be installed where the air temperature falls outside the manufacturer's recommended range.

8. The concrete surface under the bentonite waterstop shall be smooth and uniform. The concrete shall be ground smooth if needed. Alternately, the bentonite waterstop shall be bonded to the surface using an epoxy grout which completely fills all voids and irregularities beneath the waterstop material. Prior to installation, the concrete surface shall be wire brushed to remove any laitance or other materials that may interfere with the bonding of epoxy.

9. The bentonite waterstop shall be secured in place with concrete nails and washers at 12-inch maximum spacing. This shall be in addition to the adhesive backing provided with the waterstop.

[END OF SECTION]

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1: GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, in accordance with the requirements of the General Specifications, the CQA Plan, and the Construction Drawings.

B. The following types of concrete are covered in this Section:

1. Structural Concrete: Concrete to be used in all cases except where indicated otherwise.

2. Sitework Concrete: Concrete to be used for curbs, gutters, catch basins, sidewalks, pavements, fence and guard post embedment, underground duct bank encasement and all other concrete appurtenant to electrical facilities unless otherwise indicated.

3. Lean Concrete: Concrete to be used for thrust blocks, pipe trench cut-off blocks and cradles that are detailed on the Drawings as unreinforced. Lean concrete shall be used as protective cover for dowels intended for future connection.

C. The term "hydraulic structure" used in these specifications means environmental engineering concrete structures for the containment, treatment, or transmission of water, wastewater, or other fluids.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Federal Specifications:**

UU-B-790A (1) (2)	Building Paper, Vegetable Fiber (Kraft, water-proofed, Water Repellent and Fire Resistant)

B. **Commercial Standards:**

ACI 117	Standard Tolerances for Concrete Construction and Materials
ACI 214	Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	Structural Concrete for Buildings

ACI 306.1	Cold Weather Concreting
ACI 309	Consolidation of Concrete
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Reinforced Concrete
ASTM C 31	Practices for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Concrete Aggregates
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94	Ready-Mixed Concrete
ASTM C 136	Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143	Test Method for Slump of Hydraulic Cement Concrete
ASTM C 150	Portland Cement
ASTM C 156	Test Methods for Water Retention by Concrete Curing Materials
ASTM C 157	Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete
ASTM C 192	Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 260	Air-Entraining Admixtures for Concrete
ASTM C 309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	Chemical Admixtures for Concrete
ASTM C 1077	Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction & Criteria for Laboratory Evaluation
ASTM D 175	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

ASTM D 2419	Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM E 119	Method for Fire Tests of Building Construction and Materials

1.03 CONTRACTOR SUBMITTALS

A. **Mix Designs:** Prior to beginning work and within 14 days of the notice to proceed, the Contractor shall submit to the Engineer, for review, preliminary concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concrete specified herein. The mix designs shall be checked by an independent testing laboratory acceptable to the Engineer. All costs related to such checking shall be borne by the Contractor. Since laboratory trial batches require 35 calendar days to complete, the Contractor may consider testing more than one mix design for each class of concrete.

B. **Delivery Tickets:** Where ready-mix concrete is used, the Contractor shall furnish delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the state certified equipment used for measuring and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate added at the batching plant, and the amount allowed to be added at the site for the specific design mix. In addition, each ticket shall state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the site, when unloading began, and when unloading was finished.

C. Furnish the following submittals in accordance with ACI 301:

1. Mill tests for cement.
2. Admixture certification. Chloride ion content must be included.
3. Aggregate gradation and certification.
4. Materials and methods for curing.

1.04 CONCRETE CONFERENCE

A. A meeting to review the detailed requirements of the Contractor's proposed concrete design mixes and to determine the procedures for producing proper concrete construction shall be held no later than 14 days after the notice to proceed.

B. All parties involved in the concrete work shall attend the conference, including the following at a minimum:

Contractor's representative
Testing laboratory representative
Concrete subcontractor
Reinforcing steel subcontractor and detailer
Concrete supplier

Admixture manufacturer's representative

C. The conference shall be held at a mutually agreed upon time and place. The Engineer shall be notified no less than 5 days prior to the date of the conference.

1.05 QUALITY ASSURANCE

A. General

1. Tests on component materials and for compressive strength and shrinkage of concrete shall be performed as indicated herein. Test for determining slump will be in accordance with the requirements of ASTM C 143.

2. The cost of all laboratory tests on cement, aggregates, and concrete, will be borne by the Owner. However, the Contractor shall pay the cost of any additional tests and investigation on work performed which does not meet the specifications. The laboratory will meet or exceed the requirements of ASTM C 1077.

3. Concrete for testing shall be supplied by the Contractor at no additional cost to the Owner, and the Contractor shall assist the Engineer in obtaining samples, and disposal and cleanup of excess material.

B. Field Compression Tests:

1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the Engineer to insure continued compliance with these specifications. Each set of test specimens will be a minimum of 5 cylinders.

2. Compression test specimens for concrete shall be made in accordance with section 9.2 of ASTM C 31. Specimens shall be 6-inch diameter by 12-inch high cylinders.

3. Compression tests shall be performed in accordance with ASTM C 39. One test cylinder will be tested at 7 days and 2 at 28 days. The remaining cylinders will be held to verify test results, if needed.

C. Evaluation and Acceptance of Concrete:

1. Evaluation and acceptance of the compressive strength of concrete will be according to the requirements of ACI 318, Chapter 5 "Concrete Quality," and as indicated herein.

2. A statistical analysis of compression test results will be performed according to the requirements of ACI 214. The standard deviation of the test results shall not exceed 640 psi, when ordered at equivalent water content as estimated by slump.

3. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected.

4. When the standard deviation of the test results exceeds 640 psi, the average strength for which the mix is designed shall be increased by an amount necessary to satisfy the statistical requirement that the probability of any test being more than 500 psi below or the average of any 3 consecutive tests being below the required compressive strength is 1 in 100. The required average strength shall be calculated by Criterion No. 3 of ACI 214 using the actual standard of deviation.

5. All concrete which fails to meet the ACI requirements and these specifications, is subject to removal and replacement at no additional cost to the Owner.

D. **Shrinkage Tests:**

1. Drying shrinkage tests shall be performed for the trial batch indicated in the Paragraph in Part 2 entitled "Trial Batch and Laboratory Tests," the first placement of each class of concrete, and during construction to insure continued compliance with these Specifications.

2. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10 inches; fabricated, cured, dried, and measured in accordance with ASTM C 157 modified as follows: specimens shall be removed from molds at an age of 23 plus or minus 1 hours after trial batching, shall be placed immediately in water at 70 degrees F plus or minus 3 degrees F for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at 73 degrees F plus or minus 3 degrees F. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity control room maintained at 73 degrees F plus or minus 3 degrees F and 50 percent plus or minus 4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

3. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004-inch, the results obtained from that specimen shall be disregarded. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part

of the normal compression tests for the project. Allowable shrinkage limitations shall be as indicated in Part 2 below.

E. **Construction Tolerances:** The Contractor shall set and maintain concrete forms and perform finishing operations to ensure that the completed work is within tolerances. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the permissible variation from lines, grades, or dimensions indicated on the Drawings. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 117.

1. The following construction tolerances apply to finished walls and slab unless otherwise indicated:

Item	*Tolerance*
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/4-inch; In 20 feet or more: 1/2-inch
Variation from the level or from the grades shown.	In 10 feet: 1/4-inch; In 20 feet or more: 1/2-inch
Variation from the plumb	In 10 feet: 1/4-inch; In 20 feet or more: 1/2-inch
Variation in the thickness of slabs and walls.	Minus 1/4-inch; Plus 1/2-inch
Variation in the locations and sizes of slabs and wall openings	Plus or minus 1/4-inch

F. Floor Slab Hardener

1. Job Mockup: In a location designated by the Engineer, the Contractor shall place a 100 square foot floor mockup using the materials and procedures proposed for the work. Materials and procedures may be revised as necessary to obtain an acceptable surface, but the same materials and procedures shall be used in the work.

2. Field Service: The Contractor shall obtain onsite proper usage advice from the surface hardener manufacturer while the job mockup is being placed and during initial placement of the work. Notify the surface hardener manufacturer at least 3 days prior to initial use of the product.

3. Installer Qualifications: Installer shall have a minimum of 3 years experience and shall be specialized in application of dry shake surface hardeners.

PART 2: PRODUCTS

2.01 CONCRETE MATERIALS

A. **General:**

1. All materials shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application.

2. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

B. All materials shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.

C. Storage of materials shall conform to the requirements of Section 205 of ACI 301.

D. Materials for concrete shall conform to the following requirements:

1. Cement shall be standard brand portland cement conforming to ASTM C 150 for Type II or Type V, including Table 2 optional requirements. A minimum of 85 percent of cement by weight shall pass a 325 screen. A single brand of cement shall be used throughout the work, and prior to its use, the brand shall be acceptable to the Engineer. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports, including fineness, for each shipment of cement to be used shall be submitted to the Engineer, if requested, regarding compliance with these Specifications.

2. Water for mixing and curing shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts, and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.

3. Aggregates shall be obtained from pits acceptable to the Engineer, shall be non-reactive, and shall conform to ASTM C 33. Maximum size of coarse aggregate shall be as indicated herein. Lightweight sand for fine aggregate will not be permitted.

   a. Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock, or a combination thereof. The coarse aggregates shall be prepared and handled in two or more size groups for combined aggregates with a maximum size greater than 3/4-inch. When the aggregates are proportioned for each batch of concrete, the two size groups shall be combined. See the Paragraph in Part 2 entitled "Trial Batch and Laboratory Tests" for the use of the size groups.

b. Fine aggregates shall be natural sand or a combination of natural and manufactured sand that are hard and durable. When tested in accordance with ASTM D 2419, the sand equivalency shall not be less than 75 percent for an average of three samples, nor less than 70 percent for an individual test. Gradation of fine aggregate shall conform to ASTM C 33. The fineness modulus of sand used shall not be over 3.00.

c. Combined aggregates shall be well graded from coarse to fine sizes and shall be uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.

d. When tested in accordance with ASTM C 33, the ratio of silica released to reduction in alkalinity shall not exceed 1.0.

e. When tested in accordance with ASTM C 33, the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution.

f. When tested in accordance with ASTM C 33, the coarse aggregate shall show a loss not exceeding 42 percent after 500 revolutions, or 10.5 percent after 100 revolutions.

g. When tested in accordance with ASTM C 33, the loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using sodium sulfate.

4. Ready-mix concrete shall conform to the requirements of ASTM C 94.

5. Admixtures: All admixtures shall be compatible and be furnished by a single manufacturer capable of providing qualified field service representation. Admixtures shall be used in accordance with manufacturer's recommendations. If the use of an admixture is producing an inferior end result, the Contractor shall discontinue use of the admixture. Admixtures shall not contain thiocyanates nor more than 0.05 percent chloride ion, and shall be non-toxic after 30 days.

a. Air-entraining agent meeting the requirements of ASTM C 260 shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 5 percent. The Owner reserves the right, at any time, to sample and test the air-entraining agent. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement. Air content shall be tested at the point of placement. Air entraining agent shall be Micro-Air by Master Builders; Daravair by W.R. Grace; Sika AEA-15 by Sika Corporation**;** or equal.

b. Set controlling and water reducing admixtures: Admixtures may be added at the Contractor’s option, subject to the Engineer’s approval, to control the set, effect water reduction, and increase workability. The addition of an admixture shall be at the Contractor's expense. Concrete containing an admixture shall be first placed at a location determined by the Engineer. Admixtures shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used.

(1) Concrete shall not contain more than one water reducing admixture.

(2) Set controlling admixture may be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently greater than 80 degrees F, a set retarding admixture such as Plastocrete by Sika Corporation; Pozzolith 300R by Master Builders; Daratard by W.R. Grace; or equal shall be used. Where the air temperature at the time of placement is expected to be consistently less than 40 degrees F, a non-corrosive set accelerating admixture such as Plastocrete 161FL by Sika Corporation; Pozzutec 20 by Master Builders; Daraset by W.R. Grace; or equal shall be used.

(3) Normal range water reducer shall conform to ASTM C 494, Type A. WRDA 79 by W.R. Grace; Pozzolith 322-N by Master Builders; Plastocrete 161 by Sika Corporation; or equal. The quantity of admixture used and the method of mixing shall be in accordance with the Manufacturer's instructions and recommendations.

(4) High range water reducer shall conform to ASTM C 494, Type F or G. Daracem 100 or WDRA 19 by W.R. Grace; Sikament FF or Sikament 86 by Sika Corporation; Rheobuild 1000 or Rheobuild 716 by Master Builders; or equal. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified. No more than 14 ounces of water reducer per sack of cement shall be used. Water reducer shall be considered as part of the mixing water when calculating water cement ratio.

(5) If the high range water reducer is added to the concrete at the job site, it may be used in conjunction with the same water reducer added at the batch plant. Concrete shall have a slump of 3 inches plus or minus 1/2-inch prior to adding the high range water reducing admixture at the job site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system.

(6) Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.

(7) **Flyash:** Flyash shall not be used.

2.02 CURING MATERIALS

A. Materials for curing concrete as indicated herein shall conform to the following requirements and ASTM C 309:

1. All curing compounds shall be white pigmented and resin based. Sodium silicate compounds shall not be allowed. Concrete curing compound shall be Kurez by Euclid Chemical Company; MB-429 as manufactured by Master Builders; L&M Cure R; or equal. Water based resin curing compounds shall be used only where local air quality regulations prohibit the use of a solvent based compound. Water based curing compounds shall be Aqua-Cure by Euclid Chemical Company; Masterkure-W by Master Builders; L&M Cure R-2; or equal.

2. Polyethylene sheet for use as concrete curing blanket shall be white and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.

3. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, have a nominal thickness of 2 mils, and be permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (1) (2). The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 gram per square centimeter of surface.

4. Polyethylene-coated burlap for use as concrete curing blanket shall be 4-mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.

5. Curing mats for use in Curing Method 6 as indicated below, shall be heavy shag rugs or carpets or cotton mats quilted at 4 inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

6. Evaporation retardant shall be a material such as Confilm as manufactured by Master Builders; Eucobar as manufactured by Euclid Chemical Company; E-CON as manufactured by L & M Construction Chemicals, Inc. or equal.

2.03 NON-WATERSTOP JOINT MATERIALS

A. Materials for non-waterstop joints in concrete shall conform to the following requirements:

1. Preformed joint filler shall be a non-extruding, resilient, bituminous type conforming to the requirements of ASTM D 1751.

2. Elastomeric joint sealer shall conform to the requirements of Section 07920 - Sealants and Caulking.

3. Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture infiltration even when the joints are subject to movement due to expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable mastic substance containing no volatile oils or lubricants and shall be capable of meeting the test requirements set forth below, if testing is required by the Engineer.

2.04 MISCELLANEOUS MATERIALS

A. Dampproofing agent shall be an asphalt emulsion, such as Hydrocide 600 by Sonneborn; Damp-proofing Asphalt Coating by Euclid Chemical Company; Sealmastic by W. R. Meadows Inc., or equal.

B. Bonding agents shall be epoxy adhesives conforming to the following:

1. For bonding freshly-mixed, plastic concrete to hardened concrete, Sikadur 32 Hi-Mod Epoxy Adhesive, as manufactured by Sika Corporation; Concresive Liquid (LPL), as manufactured by Master Builders; BurkEpoxy MV as manufactured by The Burke Company; or equal.

2. For bonding hardened concrete or masonry to steel, Sikadur 31 Hi-Mod Gel as manufactured by Sika Corporation; BurkEpoxy NS as manufactured by The Burke Company; Concresive Paste (LPL) as manufactured by Master Builders; or equal.

C. Chemical protection agent shall be a coal tar epoxy, coal CAT 97-640/641 , as manufactured by Pittsburgh Paints. Coal tar shall be used a shown on the construction Drawings. Material shall be applied as directed by the manufacturer specification.

2.05 CONCRETE DESIGN REQUIREMENTS

A. **General:** Concrete shall be composed of cement, admixtures, aggregates, and water of the qualities indicated. The exact proportions in which these materials are to be used for different parts of the work will be determined during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage, and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the Owner. All changes shall be subject to review by the Engineer.

B. **Fine Aggregate Composition:** In mix designs for structural concrete, the percentage of fine aggregate in total aggregate by weight, shall be as indicated in the following table.

FINE AGGREGATE	
Fineness Modulus	**Maximum Percent**
2.7 or less	41
2.7 to 2.8	42
2.8 to 2.9	43
2.9 to 3.0	44

For other concrete, the maximum percentage of fine aggregate of total aggregate, by weight, shall not exceed 50.

C. **Water-Cement Ratio and Compressive Strength:** Concrete shall have the following minimum properties:

TYPE OF WORK	MIN 28-DAY COMPR. STRENGTH (PSI)	MAX SIZE AGGREGATE (IN)	MINIMUM CEMENT PER CU YD (LBS)	MAX W/C RATIO (BY WEIGHT)
Structural Concrete:				
Roof, floor slabs, columns, walls and all other concrete items not specified elsewhere.	4,000	1	564	0.45
12-inch and thicker walls, slabs on grade and footings. (optional)	4,000	1-1/2	564	0.45
Pea Gravel Mix. Thin sections and areas with congested reinforcing, at the Contractor's option and with the written approval of the Engineer for the specific location. Maximum fine aggregate 50% by weight of aggregate.	4,000	3/8	752	0.40
Sitework concrete	3,000	1	470	0.50
Lean concrete	2,000	1	376	0.60
NOTE: The Contractor is cautioned that the limiting parameters above are not a mix design. Additional cement or water reducing agent may be required to achieve workability required by the Contractor's construction methods and aggregates. The Contractor is responsible for providing concrete with the required workability.				

D. **Adjustments to Mix Design:** The mixes shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish, and the Contractor shall be entitled to no additional compensation because of such changes.

2.06 CONSISTENCY

A. The quantity of water in a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation and which can be compacted by vibratory methods to give the desired density, impermeability, and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:

Part of Work *Slump (in)*

All concrete, unless indicated otherwise	3 inches plus or minus 1 inch
With high range water reducer added	7 inches plus or minus 2 inches
Pea gravel mix	7 inches plus or minus 2 inches
Ductbanks	5 inches plus or minus 1 inch

2.07 TRIAL BATCH AND LABORATORY TESTS

B. Before placing any concrete, a testing laboratory selected by the Engineer shall prepare a trial batch of each class of structural concrete, based on the preliminary concrete mixes submitted by the Contractor. During the trial batch the aggregate proportions may be adjusted by the testing laboratory using the two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments will be considered refinements to the mix design and will not be the basis for extra compensation to the Contractor. All concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the Contractor's preliminary mix design, or whether the proportions have been adjusted during the trial batch process. The trial batch shall be prepared using the aggregates, cement and admixture proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain 3 drying shrinkage, and 6 compression test specimens from each batch.

C. The determination of compressive strength will be made by testing 6-inch diameter by 12-inch high cylinders; made, cured and tested in accordance with ASTM C 192 and ASTM C 39. Three compression test cylinders will be tested at 7 days and 3 at 28 days. The average compressive strength for the 3 cylinders tested at 28 days for any given trial batch shall not be less than 125 percent of the specified compressive strength.

D. A sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements of ASTM C 136. Values shall be given for percent passing each sieve.

2.08 SHRINKAGE LIMITATION

A. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age shall be 0.036 percent or 0.042 percent, respectively. The Contractor shall only use a mix design for construction that has first met the trial batch shrinkage requirements. Shrinkage limitations apply only to structural concrete.

B. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25 percent.

C. If the required shrinkage limitation is not met during construction, the Contractor shall take any or all of the following actions at no additional cost to the Owner, for securing the specified shrinkage requirements. These actions may include changing the source or aggregates, cement and/or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.

2.09 MEASUREMENT OF CEMENT AND AGGREGATE

A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the Contractor and acceptable to the Engineer.

B. Weighing tolerances:

Material	Percent of Total Weight
Cement	1
Aggregates	3
Admixtures	3

2.10 MEASUREMENT OF WATER

E. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the Engineer and capable of measuring the water in variable amounts within a tolerance of one percent. The water feed control mechanism shall be capable of being locked in position so as to deliver constantly any specified amount of water to each batch of concrete. A positive quick-acting valve shall be used for a cut-off in the water line to the mixer. The operating mechanism shall prevent leakage when the valves are closed.

2.11 READY-MIXED CONCRETE

F. At the Contractor's option, ready-mixed concrete may be used if it meets the requirements as to materials, batching, mixing, transporting, and placing as indicated herein and is in accordance with ASTM C 94, including the following supplementary requirements.

G. Ready-mixed concrete shall be delivered to the site of the work, and discharge shall be completed within one hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first.

H. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resetable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

I. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

J. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the required slump is 3 inches or less, or if they differ by more than 2 inches when the required slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

K. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a delivery ticket furnished to the Engineer in accordance with the Paragraph in Part 1 entitled "Delivery Tickets."

L. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the Engineer.

2.11 FLOOR HARDENER (SURFACE APPLIED)

A. Surface hardener shall be a light reflective non-oxidizing metallic aggregate dry shake material that is premeasured, premixed, and packaged at the factory. Surface hardener shall be applied at the rate of 1.8 to 2.5 lbs/ft^2.

B. Curing compound shall meet the moisture retention requirements of ASTM C 309 and the manufacturer recommendations.

C. Monomolecular film shall maintain concrete moisture during the early placement stages of plastic concrete as recommended by the manufacturer.

D. Manufacturer: Floor hardener shall be "Lumiplate" by Master Builders, or equal.

PART 3: EXECUTION

3.01 PROPORTIONING AND MIXING

A. **Proportioning:** Proportioning of the mix shall conform to the requirements of Chapter 3 "Proportioning" of ACI 301.

B. **Mixing:** Mixing shall conform to the requirements of Chapter 7 of said ACI 301 Specifications.

C. **Slump:** Slumps shall be as indicated herein.

D. **Retempering:** Retempering of concrete or mortar which has partially hardened shall not be permitted.

3.02 PREPARATION OF SURFACES FOR CONCRETING

A. **General:** Earth surfaces shall be thoroughly wetted by sprinkling prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

B. **Joints in Concrete:** Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been stopped or interrupted so that, as determined by the Engineer, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bonding. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, foreign material, and be roughened to a minimum 1/4-inch amplitude. Such cleaning and roughening shall be accomplished by hydroblasting or sandblasting (exposing aggregate) followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

C. After the surfaces have been prepared, all approximately horizontal construction joints shall be covered with a 6-inch lift of a pea gravel mix. The mix shall be placed and spread uniformly. Wall concrete shall follow immediately and shall be placed upon the fresh pea gravel mix.

D. **Placing Interruptions:** When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent work; provided that construction joints shall be made only where acceptable to the ENGINEER.

E. **Embedded Items:** No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the Engineer at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from previous work shall be cleaned before the surrounding or adjacent concrete is placed.

F. All inserts or other embedded items shall conform to the requirements herein.

G. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms at locations indicated on the Drawings or shown by shop drawings and shall be acceptable to the Engineer before any concrete is placed. Accuracy of placement is the responsibility of the Contractor.

H. **Casting New Concrete Against Old:** Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydro-blasting or sandblasting (exposing aggregate). The joint surface shall be coated with an epoxy bonding agent unless indicated otherwise by the Engineer.

I. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall the Contractor allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, shall be subject to the review of the Engineer.

J. **Corrosion Protection:** Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2 inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

K. Openings for pipes, inserts for pipe hangers and brackets, and anchors shall, where practicable, be provided during the placing of concrete.

L. Anchor bolts shall be accurately set and shall be maintained in position by templates while being embedded in concrete.

M. **Cleaning:** The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.03 HANDLING, TRANSPORTING, AND PLACING

A. **General:** Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.

B. **Non-Conforming Work or Materials:** Concrete which during or before placing is found not to conform to the requirements indicated herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by the Contractor at no additional cost to the Owner.

C. **Unauthorized Placement:** No concrete shall be placed except in the presence of a duly authorized representative of the Engineer. The Contractor shall notify the Engineer in writing at least 24 hours in advance of placement of any concrete.

D. **Placement in Wall and Column Forms:** Concrete shall not be dropped through reinforcement steel or into any deep form, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, means such as hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 4 feet in walls and 8 feet in columns below the ends of ducts, chutes, or buggies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6 feet in horizontal direction. Concrete in wall forms shall be deposited in uniform horizontal layers not deeper than 2 feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in wall forms shall not exceed 5 feet of vertical rise per hour. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.

E. **Casting New Concrete Against Old:** Epoxy adhesive bonding agent shall be applied to the old surfaces according to the manufacturer's written recommendations. This provision shall not apply to joints where waterstop is provided. See Section 03290 - Joints in Concrete.

F. **Conveyor Belts and Chutes:** All ends of chutes, hopper gates, and all other points of concrete discharge throughout the Contractor's conveying, hoisting, and placing system shall be designed and arranged so that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the Engineer. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the indicated consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered.

G. **Placement in Slabs:** Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

H. **Temperature of Concrete:** The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 55 degrees F for sections less than 12 inches thick nor less than 50 degrees for all other sections. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the minimum temperature. When the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the Contractor shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The Contractor shall be entitled to no additional compensation on account of the foregoing requirements.

I. **Cold Weather Placement:**

1. Placement of concrete shall conform to ACI 306.1 - Cold Weather Concreting, and the following.

2. Remove all snow, ice, and frost from the surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6 inches. All

reinforcement and embedded items shall be warmed to above 32 degrees F prior to concrete placement.

3. Maintain the concrete temperature above 50 degrees F for at least 3 days after placement.

3.04 PUMPING OF CONCRETE

A. **General:** If the pumped concrete does not produce satisfactory end results, the Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. **Pumping Equipment:** The pumping equipment shall have 2 cylinders and be designed to operate with one cylinder in case the other one is not functioning. In lieu of this requirement, the Contractor may have a standby pump on the site during pumping.

C. The minimum diameter of the hose conduits shall be in accordance with ACI 304.2R.

D. Pumping equipment and hose conduits that are not functioning properly shall be replaced.

E. Aluminum conduits for conveying the concrete shall not be permitted.

F. **Field Control:** Concrete samples for slump, air content, and test cylinders will be taken at the placement end of the hose.

3.05 ORDER OF PLACING CONCRETE

A. The order of placing concrete in all parts of the work shall be acceptable to the Engineer. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints at the indicated locations. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 5 days for hydraulic structures and 2 days for all other structures before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the 2 adjacent wall panels have cured at least 10 days for hydraulic structures and 4 days for all other structures.

B. The surface of the concrete shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2-inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and all laitance shall be removed.

3.06 TAMPING AND VIBRATING

C. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete. Vibrators shall be Group 3 per ACI 309, high speed power vibrators (8000 to 12,000 rpm) of an immersion type in sufficient number and with at least one standby unit as required. Group 2 vibrators may be used only at specific locations when accepted by the Engineer.

D. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

E. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the required results within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall not contact the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.07 FINISHING CONCRETE SURFACES

F. **General:** Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and are indicated in Part 1, above. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.

NTS: Acceptable surface finish of basin walls is difficult to define and can vary radically from Owner to Owner. If possible, discuss the issue with the Owner to define the finish they wish to buy. It is better to get the desired finish as part of the original bid than as a change order.

G. **Formed Surfaces:** No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects. Where architectural finish is required, it shall be as indicated.

NTS: Chose one of the following:

[1. Surface holes larger than [1/2]-inch in diameter or deeper than [1/4]-inch are defined as surface defects in basins and exposed walls.]

[2. The Owner has identified an acceptable wall finish on an identified panel at an existing structure to be used as a comparative sample for formed finish without architectural treatment. This panel is located [ ]. At walls which are exposed to view or in contact with water, surface roughness or surface holes (considering both size and number per unit surface area as separate criteria) greater than the identified panel shall be considered to have surface defects and shall be repaired to match or exceed the sample finish.]

[3. Basins and exposed walls shall be given a smooth finish as indicated below.]

[4. Basins and exposed walls shall be given two coats of cement based paint as indicated.]

H. **Unformed Surfaces:** After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each work operation as necessary to prevent drying shrinkage cracks. The classes of finish specified for unformed concrete surfaces are designated and defined as follows:

1. Finish U1 - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.

2. Finish U2 - After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where indicated or as determined by the Engineer.

3. Finish U3 - After the finish U2 surface has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.

4. Finish U4 - Trowel the Finish U3 surface to remove local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise indicated. The resulting surface shall be rough enough to provide a nonskid finish.

I. Unformed surfaces shall be finished according to the following schedule:

UNFORMED SURFACE FINISH SCHEDULE

Area	Finish
Grade slabs and foundations to be covered with concrete or fill material	U1
Floors to be covered with grouted tile or topping grout	U2

Water bearing slabs with slopes 10 percent and less	U3
Water bearing slabs with slopes greater than 10 percent	U4
Slabs not water bearing	U4
Slabs to be covered with built-up roofing	U2
Interior slabs and floors to receive architectural finish	U3
Top surface of walls	U3

J. Floor Hardener (Surface Applied)

1. The following additional requirements apply to the substrate concrete in areas indicated to be under floor hardener:

   a. Slump shall be no greater than 4 inches when peak ambient temperatures are expected to exceed 65 degrees F and no greater than 3 inches when temperatures will not exceed 65 degrees F.

   b. Air content shall not exceed 3 percent.

   c. No calcium chloride or set accelerating admixture containing calcium chloride shall be used.

   d. Do not use admixtures that increase bleeding.

   e. Do not use fly ash.

2. The Contractor shall finish areas indicated to receive hardener in conformance with the manufacturer's recommendations and the following. After leveling the concrete surface and as soon as the concrete will support an operator and machine without disturbing the level or working up excessive fines, the Contractor shall float the surface of the slab with a mechanical float fitted with detachable float shoes. Then apply 1/2 to 2/3 of the total amount of dry shake surface hardener uniformly to the surface. A mechanical spreader is recommended. Float the surface once the shake has absorbed sufficient moisture, as indicated by darkening of the shake. Immediately apply the remainder of the shake and allow it to absorb moisture. Do not apply shake when bleed water is present.

3. Perform a third floating if time and setting characteristics of the concrete will allow, but do not add water to the surface.

4. As the surface stiffens further and loses sheen, trowel with blades set relatively flat, using hand or mechanical methods. Remove all marks and pinholes in a final raised trowel operation.

5. Cure the finished surface using the fill-forming curing compound recommended by the manufacturer at a coverage rate which will provide moisture retention in excess of the requirements of ASTM C 309. Maintain ambient temperatures above 50 degrees F during the curing period.

6. Keep floors covered and prohibit traffic and loads for 10 days minimum after completion.

3.08 ARCHITECTURAL FINISH

K. **General:** Architectural finishes shall be provided only where specifically indicated on the Drawings. In all other locations, the paragraph entitled Finishing Concrete Surfaces, shall apply.

7. Immediately after the forms have been stripped, the concrete surface shall be inspected and any poor joints, voids, rock pockets, or other defective areas shall be repaired and all form-tie holes filled as indicated herein.

8. Architectural finishes shall not be applied until the concrete surface has been repaired as required and the concrete has cured at least 14 days.

9. All architecturally treated concrete surfaces shall conform to the accepted sample in texture, color, and quality. It shall be the Contractor's responsibility to maintain and protect the concrete finish.

L. Smooth Concrete Finish

1. The concrete surface shall be wetted, and a grout shall be applied with a brush. The grout shall be made by mixing one part portland cement and one part of fine sand that will pass a No. 16 sieve with sufficient water to give it the consistency of thick paint. The cement used in said grout shall be 1/2 gray and 1/2 white portland cement, or other proportion as determined by the Engineer. White portland cement shall be Atlas white, or equal. Calcium chloride at 5 percent by volume of the cement shall be used in the brush coat. The freshly applied grout shall be vigorously rubbed into the concrete surface with a wood float filling all small air holes. After all the surface grout had been removed with a steel trowel, the surface shall be allowed to dry and, when dry, shall be vigorously rubbed with burlap to remove completely all surface grout so that there is no visible paint-like film of grout on the concrete. The entire cleaning operation for any area shall be completed the day it is started, and no grout shall be left on the surface overnight.

2. Cleaning operations for any given day shall be terminated at panel joints. It is required that the various operations be carefully timed to secure the desired effect which is a light-colored concrete surface of uniform color and texture without any appearance of a paint or grout film.

3. In the event that improper manipulation results in an inferior finish, the Contractor shall rub such inferior areas with carborundum bricks.

4. Before beginning any of the final treatment on exposed surfaces, the Contractor shall treat in a satisfactory manner a trial area of at least 200 square feet in some inconspicuous place selected by the Engineer and shall preserve said trial area undisturbed until the completion of the job.

M. Sandblasted Concrete Finish.

1. Sandblasting shall be done in a safe manner acceptable to local authorities and per OSHA requirements. The sandblasting shall be a light sandblast to remove laitance and to produce a uniform fine aggregate surface texture with approximately 1/32- to 1/16-inch of surface sandblasted off. Corners, patches, form panel joints, and soft spots shall be sandblasted with care.

2. A 3-sq ft sample panel of the sandblasted finish shall be provided by the Contractor for acceptance by the Engineer prior to starting the sandblasting work. The sample panel shall include a corner, plugs, and joints and shall be marked after approval. All other sandblasting shall be equal in finish to the sample panel.

3. Protection against sandblasting shall be provided on all adjacent surfaces and materials not requiring sandblasting. After sandblasting, the concrete surfaces shall be washed with clean water and excess sand removed.

3.09 CURING AND DAMPPROOFING

A. **General:** All concrete shall be cured for not less than 7 days after placing, in accordance with the methods indicated below for the different parts of the work.

Surface to be Cured or Dampproofed	Method
Unstripped forms	1
Wall sections with forms removed	6
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3
All concrete surfaces not specifically indicated in this Paragraph	4
Floor slabs on grade in hydraulic structures	5
Slabs not on grade	6

B. **Method 1:** Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removal. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 7 days of placing the concrete, curing shall be continued in accordance with Method 6 below.

C. **Method 2:** The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.

D. **Method 3:** The surface shall be covered with moist earth not less than 4 hours nor more than 24 hours after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.

E. **Method 4:** The surface shall be sprayed with a liquid curing compound.

1. It shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film which will seal thoroughly.

2. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the 7-day curing period. If the seal is damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.

3. Wherever curing compound has been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.

4. Curing compound shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces and within 2 hours after removal of forms. Repairs to formed surfaces shall be made within the 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound.

5. At all locations where concrete is placed adjacent to a panel which has been coated with curing compound, the panel shall have curing compound reapplied to an area within 6 feet of the joint and to any other location where the curing membrane has been disturbed.

6. Prior to final acceptance of the work, all visible traces of curing compound shall be removed from all surfaces in such a manner that does not damage the surface finish.

F. **Method 5:**

1. Until the concrete surface is covered with curing compound, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed. The concrete shall be given a coat of curing compound in accordance with Method 4 above. Not

less than one hour nor more than 4 hours after the curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting, or polyethylene-coated burlap. The blankets shall be laid with the edges butted together and with the joints between strips sealed with 2-inch wide strips of sealing tape or with edges lapped not less than 3 inches and fastened together with a waterproof cement to form a continuous watertight joint.

2. The curing blankets shall be left in place during the 7-day curing period and shall not be removed until after concrete for adjacent work has been placed. If the curing blankets become torn or otherwise ineffective, the Contractor shall replace damaged sections. During the first 3 days of the curing period, no traffic of any nature and no depositing, temporary or otherwise, of any materials shall be permitted on the curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets 5/8-inch minimum thickness, laid over the curing blanket. The Contractor shall add water under the curing blanket as often as necessary to maintain damp concrete surfaces at all times.

G. **Method 6:** This method applies to both walls and slabs.

1. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 7 consecutive days beginning immediately after the concrete has reached final set or forms have been removed.

2. Until the concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed.

3. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held substantially in contact with the concrete surface to prevent being dislodged by wind or any other causes. All edges shall be continuously held in place.

4. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours.

5. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed, any dry spots shall be rewetted, and curing compound shall be immediately applied in accordance with Method 4 above.

6. The Contractor shall dispose of excess water from the curing operation to avoid damage to the work.

H. **Dampproofing**

1. The exterior surface of all buried roof slabs shall be dampproofed as follows.

2. Immediately after completion of curing the surface shall be sprayed with a dampproofing agent consisting of an asphalt emulsion. Application shall be in 2 coats. The first coat shall be diluted to 1/2 strength by the addition of water and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon of dilute solution. The second coat shall consist of an application of the undiluted material, and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon. Dampproofing material shall be as indicated above.

3. As soon as the material has taken an initial set, the entire area thus coated shall be coated with whitewash. Any formula for mixing the whitewash may be used if it produces a uniformly coated white surface and remains until placing of the backfill. If the whitewash fails to remain on the surface until the backfill is placed, the Contractor shall apply additional whitewash.

3.10 PROTECTION

A. The Contractor shall protect all concrete against injury until final acceptance.

B. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. The Contractor shall provide such protection while the concrete is still plastic and whenever precipitation is imminent or occurring.

3.11 CURING IN COLD WEATHER

A. Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the Site is less than 40 degrees F; provided that, during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued.

B. Concrete cured by an application of curing compound will require no additional protection from freezing if the protection at 50 degrees F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces; otherwise the concrete shall be protected against freezing temperatures for 72 hours immediately following 72 hours protection at 50 degrees F. Concrete cured by water shall be protected against freezing temperatures for 3 days immediately following the 72 hours of protection at 50 degrees F.

C. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 degrees F for more than 3 successive days, the specified 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.

D. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these Specifications.

3.12 TREATMENT OF SURFACE DEFECTS

A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the Engineer. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall be repaired as indicated below. Concrete containing extensive voids, holes, honeycombing, or similar depression defects shall be completely removed and replaced. All repairs and replacements herein required shall be promptly executed at no increased cost to the Owner.

B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, plus not less than 1/32-inch depth of the surface film from all hard portions by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces underneath will remain moist but not so wet as to overcome the suction upon which a good bond depends. The material used for repair proposed shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white portland cement as is required to make the color of the patch match the color of the surrounding concrete.

C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. Holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section and other imperfections having a depth greater than their least surface dimension shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.

D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

E. Prior to filling any structure with water, all cracks that may have developed shall be "vee'd" as indicated and filled with sealant conforming to the requirements of Section 03290 - Joints in Concrete. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill which are not covered with a waterproofing membrane shall also have cracks repaired as indicated herein.

3.13 PATCHING HOLES IN CONCRETE

A. **Patching Small Holes:**

4. Holes which are less than 12 inches in the least dimension and extend completely through concrete members shall be filled.

5. Small holes in members which are water-bearing or in contact with soil or other fill material shall be filled with non-shrink grout. Where a face of the member is exposed to view, the non-shrink grout shall be held back 2 inches from the finished surface. The remaining 2 inches shall then be patched according to the Paragraph entitled "Treatment of Surface Defects."

6. Small holes through all other concrete members shall be filled with non-shrink grout, with exposed faces treated as above.

B. **Patching Large Holes:**

1. Holes which are larger than 12 inches in the least dimension shall have a keyway chipped into the edge of the opening all around, unless a formed keyway exists. The holes shall then be filled with concrete as indicated herein.

2. Holes which are larger than 24 inches in the least dimension and which do not have reinforcing steel extending from the existing concrete, shall have reinforcing steel set in grout in drilled holes. The reinforcing added shall match the reinforcing in the existing wall unless indicated otherwise.

3. Large holes in members which are water bearing or in contact with soil or other fill shall have a bentonite type waterstop material placed around the perimeter of the hole in accordance with Section 03290 - Joints in Concrete, unless there is an existing waterstop in place.

3.14 CARE AND REPAIR OF CONCRETE

A. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the General Specifications, the CQA Plan, and the Construction Drawings, shall be satisfactorily repaired or removed and replaced with acceptable concrete at no additional cost to the Owner.

[END OF SECTION]

SECTION 03410
STRUCTURAL PRECAST CONCRETE

PART 1: GENERAL

1.01 SUMMARY

A. Description of Work

1. This section applies to construction of the vertical riser foundation for the landfill as shown on the Drawings.

2. This section applies to precast catch basins and similar items used for surface water drainage.

B. Related Sections

1. 03100 - Concrete Form Work

2. 02718 - Polyethylene Pipe

3. 15600 - Carbon Steel Pipe

4. 15700 - Stainless Steel Pipe

1.02 REFERENCES

A. American Concrete Institute (ACI) most current version:

1. ACI 318 - Building Code Requirements for Reinforced Concrete.

B. American Society for Testing and Materials (ASTM) most current version:

1. ASTM 184 - Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

2. ASTM A307 - Specification for Carbon Steel Externally Threaded Standard Fasteners.

3. ASTM A615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

4. ASTM A775 - Specification for Epoxy-Coated Reinforcing Steel Bars.

5. ASTM C31 - Making and Curing Concrete Test Specimens in the Field.

6. ASTM C33 - Specification for Concrete Aggregates.
7. ASTM C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
8. ASTM C150 - Specification for Portland Cement.
9. ASTM C171 - Specification for Sheet Materials for Curing Concrete.
10. ASTM C185 - Test Method for Air Content of Hydraulic Cement Mortar.
11. ASTM C260 - Specification for Air-Entraining Admixtures for Concrete.
12. ASTM C309 - Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
13. ASTM C330 - Specification for Lightweight Aggregates for Structural Concrete.
14. ASTM C494 - Specification for Chemical Admixtures for Concrete.

C. Prestressed Concrete Institute (PCI) most current version:

1. PCI MNL-116 - Manual for Quality Control for Plants and Productions of Precast Prestressed Concrete Products.

1.03 SUBMITTALS

A. Shop Drawings and Product Data

1. Content:
   a. Dimensions.
   b. Details of inserts, anchors, connections, accessories, formed openings, scheduled field cut openings, anchor bolt layout plan, and fabrication detail.
   c. Lifting positions or devices.
   d. Reinforcement.
2. Manufacturer's instructions for handling, transporting, and erecting.

B. Certificates

1. Manufacturer's certificates that material and/or procedures are in compliance with specifications.

2. When requested by OWNER, evidence of certification and/or experience qualifications.

C. Test Reports: Reports of tests on concrete.

1.04 QUALITY ASSURANCE

A. Testing

1. Conduct testing in accordance with PCI (Prestressed Concrete Institute) MNL-116.

2. CQA ENGINEER to verify testing.

B. Source Quality Control: In general compliance with applicable provisions of PCI MNL-116.

1. Concrete Compression Tests:

a. ASTM C39.

b. Make one compression test for each day's production of each type of member.

2. Specimens:

a. Provide four test specimens for each compression test.

b. Obtain concrete for specimens from actual production batch.

c. Concrete Cylinders, 6 inch by 12 inch, ASTM C31.

C. Other requirements:

1. Design, fabricate, and install precast sections to meet requirements of ACI 318.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Follow manufacturer's instructions for handling and transporting.

B. Lift members at designated points only, and use lifting inserts if provided.

C. Use lifting slings or spreader bars to keep angle between lifted member and cable greater than 45°.

D. Do not place members in position which will cause overstress, warp, or twist.

E. Handle members to protect from dirt and damage.

F. Place stored items so that identification marks are discernable.

G. Separate stacked items by battens across full width of each bearing surface.

H. Stack items so that lifting points/devices are accessible and undamaged.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Firms specializing in providing precast concrete products and services normally associated with industry for at least 3 years.

B. Manufacturers meeting requirements of PCI MNL-116.

C. Manufacturers may be required to submit written evidence showing experience; qualifications; and adequacy of plant capability, facilities, and ability to perform work in accordance with these specifications.

1. Evidence shall consist of PCI plant certification or results of tests performed by independent testing laboratory to monitor conformance to provisions of PCI MNL-116 and requirements herein.

2.02 MATERIALS

A. Portland Cement

1. ASTM C150, Type II.

B. Admixtures

1. Air-Entraining: ASTM C260.
2. Water Reduction and Set Retardation: ASTM C494, Type A.
3. Super Plasticizer: ASTM C494, Type A.

C. Aggregates

1. ASTM C33 or C330.
2. Material: Natural.
3. Maximum 1 inch.

D. Water

1. Potable or free from foreign materials in amounts harmful to concrete.

E. Reinforcing Steel

1. Deformed Steel Bars: ASTM A615, including supplementary requirements S1, Grade 60.

2. Epoxy coat reinforcing steel conforming to ASTM A775.

F. Curing Materials

1. Liquid membrane forming compound, ASTM C309, or sheet materials, ASTM C171.

G. Coating

1. Coating shall be Coal Cat Coal Tar epoxy 97-6401/641 or approved equal.

2.03 MIX DESIGN

A. Mix design to be per manufacturer's recommendations.

B. Concrete properties

1. Water-Cement Ratio: Maximum 40 pounds water to 100 pounds cement.

2. Air-Entrainment: Amount produced by adding dosage of air-entraining agent providing 19% ±3% entrained air in standard 1:4 sand mortar as tested according to ASTM C185.

3. Twenty-eight-day Compressive Strength:

a. Minimum 4000 psi.

4. Do not use calcium chloride or other salts.

2.04 FABRICATION

A. Formwork

1. Securely attach anchorage devices to formwork in locations not affecting position of main reinforcement or placing of concrete.

2. Form treatments or curing compounds shall not contain any ingredients which might stain through or otherwise inure concrete or reduce bond with subsequent coatings, finishes, or caulking.

B. Reinforcement

1. Provide reinforcement necessary to resist stresses from handling and erecting stresses as required, in addition to any shown on the Drawings.

2. Place and anchor reinforcement in position.

C. Concrete Placement

1. Batch, mix, and handle concrete in accordance with ACI and PCI recommended practices.

2. Place concrete in continuous operation to prevent formation of seams.

3. Consolidate placed concrete by vibration without dislocation or damage to reinforcement and built-in items.

D. Provide permanent markings in precast units to identify pick-up point.

E. Cure units in accordance with PCI MNL-116.

F. Finishes

1. All exposed surfaces shall have PCI commercial finish.

2. Coat all exposed areas of riser pipe foundation with coal tar epoxy per Article 2-2 G and manufacturer's recommendations.

2.05 HOLES

A. Eight-inch diameter and over shall be formed during manufacture of units.

PART 3: EXECUTION

3.01 ERECTION

A. Align, place, and level units in final position on accepted bearing surfaces.

B. Place no warped, cracked, or broken units.

C. Remove lifting devices and grout surfaces flush with concrete.

D. Refinish damaged surfaces to match adjacent areas.

[END OF SECTION]

SECTION 05100
STRUCTURAL STEEL FRAMING

PART 1: GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall provide structural steel framing and appurtenant metal parts required for permanent connection of the structural steel system, complete and in place, in accordance with the General Specifications, the CQA Plan, and the Construction Drawings.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. References herein to "Building Code" or UBC shall mean the [Uniform Building Code of the International Conference of Building Officials (ICBO)]. The edition of the codes adopted as of the date of award of this contract shall apply to the work herein.

B. Federal Specifications and Commercial Standards:

AISC	Code of Standard Practice for Steel Buildings and Bridges
AISC	Structural Steel Buildings-Allowable Stress Design and Plastic Design
AISC	Allowable Stress Design Specifications for Structural Joints Using ASTM A325 and A490 Bolts approved by the Research Council on Structural Connections of the Engineering Foundation
ASTM A 36	Structural Steel
ASTM A 53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 307	Carbon Steel Bolts and Studs
ASTM A 325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
AWS D1.1	Structural Welding Code – Steel

1.03 CONTRACTOR SUBMITTALS

A. Shop drawings shall conform to AISC recommendations and specifications and shall show all holes, etc. required for other work. Drawings shall include complete details showing all members and their connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams showing the sequence of erection.

B. Testing laboratory certifications for shop and field welders shall be submitted in triplicate directly to the Engineer with copies to the Contractor and others as required.

PART 2: PRODUCTS

2.01 MATERIALS

A. All structural steel shapes, plates, bars and their products shall be ASTM A36 unless otherwise indicated.

B. Structural steel pipe shall be ASTM A501, or ASTM A53, Type E or S, Grade B.

C. Structural tubing shall be ASTM A500, Grade B. All members shall be furnished full length without splices unless otherwise indicated or approved by the Engineer.

D. Bolts for connections shall be ASTM A325, unless indicated otherwise. Bolts used to connect dissimilar metals shall be ASTM A193 and A194, Type 316 stainless steel.

E. Welded anchor studs shall be headed concrete anchor studs (HAS), or deformed bar anchors (DBA), or threaded studs (TAS), as indicated on the Drawings and as supplied by Nelson Stud Welding Company, Lorain, OH; Omark Industries, KSM Fastening Systems Division, Seattle, WA, or Portland, OR; or equal.

F. Structural steel shall be cleaned and coated in accordance with Section 09800 - Protective Coating.

G. All steel members in contact with aluminum shall be galvanized per Section 05500 - Miscellaneous Metalwork, unless indicated otherwise.

H. All structural members shall be furnished full length without splices unless otherwise indicated or approved by the Engineer.

2.02 INSPECTION AND TESTING

A. Shop inspection may be required by the Owner at its own expense. The Contractor shall give ample notice to the Engineer prior to the beginning of any fabrication work so that inspection may be provided. The Contractor shall furnish all facilities for the inspection of materials and workmanship in the shop, and inspectors shall be allowed free access to the necessary parts of the work. Inspectors shall have the authority to reject any materials or work which does not meet the requirements of these Specifications. Inspection at the shop is intended as a means of facilitating the work and avoiding errors, but it is expressly understood that it will in no way relieve the Contractor from responsibility for proper materials or workmanship under this Specification.

B. The Owner may engage inspectors to inspect welded connections and high-strength bolted connections, and to perform tests and prepare test reports.

1. Ten percent of all butt and bevel welds which extend continuously for 24 inches or less shall be completely tested in accordance with AWS D1.1, Part B, Radiographic Testing of Welds, Chapter 6. All butt and bevel welds which extend continuously for more than 24 inches shall be spot tested at intervals not exceeding 36 inches.

2. Welds that are required by the Engineer to be corrected shall be corrected or redone and retested as directed, at the Contractor's expense and to the satisfaction of the Engineer and/or approved independent testing lab.

3. The Contractor shall test to failure three bolts from each heat lot of bolts furnished to the job to verify compliance with this Specification. The testing laboratory shall be approved by the Engineer and all test reports shall be supplied to the Engineer. In addition, high-strength bolts shall be inspected using one of the methods set forth in the AISC Specification "Structural Joints Using ASTM A325 or A490 Bolts".

C. The costs for all initial testing will be paid by the Owner. However, the Contractor shall pay for all costs for any additional testing and investigation on work which does not meet Specifications. The Contractor shall supply material for testing at no cost to the Owner and shall assist the Engineer in obtaining material for test samples.

PART 3: EXECUTION

3.01 MEASUREMENT

A. The Contractor shall verify all dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of work. The Contractor shall review the Drawings, and any discrepancies shall be reported to the Engineer for clarification prior to starting fabrication.

3.02 FABRICATION

A. Structural steel shall be fabricated in accordance with the Drawings, AISC Specifications, and as shown on the shop drawings.

B. Materials shall be properly marked and match-marked for field assembly.

C. Where finishing is required, assembly shall be completed including bolting and welding of units, before start of finishing operations.

3.03 CONNECTIONS

A. Shop and field connections shall be bolted or welded as shown or specified. All connections shall develop full strength of members joined and shall conform to AISC standard connections.

3.04 WELDED CONSTRUCTION

A. The Contractor shall comply with the current AWS D1.1 Code for procedures, appearance, and quality of welds and welders, and methods used in correcting welding work. All welded architectural metal work where exposed to view shall have welds ground smooth. Shielded metal are welding method or gas metal arc welding methods shall be used for welding structural steel.

B. Unless otherwise shown, all butt and bevel welds shall be complete penetration.

3.05 HOLES FOR OTHER WORK

A. Holes shall be provided as necessary or as indicated for securing other work to structural steel framing, and for the passage of other work through steel framing members. No torch cut holes will be permitted.

3.06 SHOP PAINT PRIMER

A. Shop paint primer shall be applied in accordance with the manufacturer specification. Omit shop applied primer at field weld locations, for the portion of a member to be embedded in concrete, and where galvanizing with no further coating is required.

3.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Structural members shall be loaded in such a manner that they may be transported and unloaded without being excessively stressed, deformed, or otherwise damaged.

B. Structural steel members and packaged materials shall be protected from corrosion and deterioration. Material shall be stored in a dry area and shall not be placed in direct contact with the ground. Materials shall not be placed on the structure in a manner that might cause distortion or damage to the members or the supporting structures. Repair or replace damaged materials or structures as directed.

3.08 ERECTION

A. The Contractor shall comply with the AISC Specifications and Code of Standard Practice, and with specified requirements.

NTS: Bearing type connections are less costly than friction type connections and should be noted on the drawings wherever they are appropriate. Bearing type connections shall not be used for lateral force resisting frames and elements.

B. High-strength bolts shall be installed in accordance with the AISC Specification for Structural Joints using ASTM A325 Bolts. The connections shall be the friction type, unless noted otherwise.

C. Anchor bolts and other connectors required for securing structural steel to in-place work and templates and other devices for presetting bolts and other anchors to accurate locations shall be furnished by the Contractor.

D. The Contractor shall be responsible for designing and installing any temporary bracing required for the safe erection of all structural steel members.

3.09 SETTING BASES AND BEARING PLATES

A. Prior to the placement of non-shrink grout beneath base and bearing plates, the bottom surface of the plates shall be cleaned of all bond-reducing materials, and concrete and masonry bearing surface shall also be cleaned of all bond-reducing materials and roughened to improve bonding.

B. Loose and attached baseplates, and bearing plates for structural members shall be set on wedges, leveling nuts, or other adjustable devices.

C. Anchor bolts shall be tightened after the supported members have been positioned and plumbed and the non-shrink grout has attained its indicated strength.

D. Baseplates shall be grouted with non-shrink grout to assure full uniform bearing. Grouting shall be done prior to placing loads on the structure.

3.10 FIELD ASSEMBLY

A. Structural frames shall be set accurately to the lines and elevations indicated. The various members shall be aligned and adjusted to form a part of a complete frame or structure before permanently fastening. Bearing surfaces and other surfaces which will be in permanent contact shall be cleaned before assembly. Necessary adjustments to compensate for discrepancies in elevations and alignments shall be performed.

B. Individual members of the structure shall be leveled and plumbed within AISC tolerances.

C. Required leveling and plumbing measurements shall be established on the mean operating temperature of the structure.

3.11 MISFITS AT BOLTED CONNECTIONS

A. Where misfits in erection bolting are encountered, the Engineer shall be immediately notified. The Contractor shall submit a method to remedy the misfit for review by the Engineer. The Engineer will determine whether the remedy is acceptable or if the member must be refabricated.

B. Incorrectly sized or misaligned holes in members shall not be enlarged by burning or by the use of drift pins.

C. The Contractor shall pay for all costs associated with repairing misfits at no increased cost to the Owner.

3.12 GAS CUTTING

A. Gas cutting torches shall not be used in the field for correcting fabrication errors in the structural framing, except when approved by the Engineer. Gas-cut sections shall be finished equal to a sheared appearance.

3.13 TOUCH-UP PAINTING

A. Immediately after erection, field welds, bolted connections, and abraded areas shall be cleaned of the shop paint primer. Touch-up paint primer shall be applied by brush or spray which is the same thickness and material as that used for the shop paint. Galvanized surfaces which have been field welded or damaged shall be repaired in accordance with Section 05500 - Miscellaneous Metalwork.

[END OF SECTION]

SECTION 05500
MISCELLANEOUS METALWORK

PART 1: GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall provide miscellaneous metalwork and appurtenances, complete, in accordance with the General Specifications, the CQA Plan, and the Construction Drawings.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Federal Specifications:**

MIL-G-18015 A (3) (Ships) Aluminum Planks. (6063-T6)
MIL-A-907E Antiseize Thread Compound, High Temperature

B. **Commercial Standards:**

AA-M32C22A41	Aluminum Assn.
AASHTO HS-20	Truck Loading
AISC	Specifications and Commentary
AISI	Design of Light Gauge, Cold-Formed Steel Structural Members
ASTM A 36	Structural Steel
ASTM A 48	Gray Iron Castings
ASTM A 53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 125	Steel Springs, Helical, Heat Treated
ASTM A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 193	Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A 194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Services
ASTM A 307	Carbon Steel Bolts and Studs, 60,000 psi Tensile
ASTM A 500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 563	Carbon and Alloy Steel Nuts
ASTM A 575	Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 786	Rolled Steel Floor Plates
ASTM B 98	Copper-Silicon Alloy Rod, Bar, and Shapes
ASTM B 438	Sintered Bronze Bearings (Oil-Impregnated)
ANSI/AWS D1.1	Structural Welding Code - Steel
ANSI/AWS D1.2	Structural Welding Code - Aluminum
ANSI/AWS QC1	Qualification and Certification of Welding Inspectors
NFPA 101	Life Safety Code

NAAMM Metal Stairs Manual

1.03 CONTRACTOR SUBMITTALS

A. **Shop Drawings:** Shop drawings of all miscellaneous metalwork shall be submitted to the Engineer for review.

B. Layout drawings for grating shall be submitted showing the direction of span, type and depth of grating, size and shape of grating panels, seat angle details, and details of grating hold down fasteners. Load and deflection tables shall be submitted for each style and depth of grating used.

C. An ICBO report listing the ultimate load capacity in tension and shear for each size and type of concrete anchor used shall be submitted to the Engineer for review. Contractor shall submit manufacturer's recommended installation instructions and procedures for all adhesive anchors for Engineer's review. Upon review, by Engineer, these instructions shall be followed specifically.

D. No substitution for the indicated adhesive anchors will be considered unless accompanied with ICBO report verifying strength and material equivalency, including temperature at which load capacity is reduced to 90 percent of that determined at 75 degrees F.

1.04 QUALITY ASSURANCE

A. All weld procedures and welder qualification shall be available in the Contractors field office for Engineers review.

B. All welding shall be inspected by a Contractor-provided inspector qualified in accordance with AWS requirements and approved by the Engineer.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS

A. **Steel:**

1.	Shapes, Plates, Bars	ASTM A 36
2.	Pipe, Pipe Columns, Bollards	ASTM A 53, Type E or S, Grade B Standard weight unless noted otherwise
3.	Tubes	ASTM A 500 Grade B

B. **Corrosion Protection:** Unless otherwise indicated, miscellaneous metalwork of fabricated steel, which will be used in a corrosive environment and/or will be submerged in water/wastewater shall be coated in accordance with Section 09800 - Protective Coating and shall not be galvanized prior to coating. All other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication as specified herein.

C. **Stainless Steel:** Unless otherwise indicated, stainless steel metalwork and bolts shall be of Type 316 stainless steel and shall not be galvanized.

D. **Aluminum:** Unless otherwise indicated, aluminum metalwork shall be of Alloy 6061-T6. Aluminum in contact with concrete, masonry, wood, porous materials, or dissimilar metals shall have contact surfaces coated in accordance with the Section 09800 - Protective Coating.

E. **Cast Iron:** Unless otherwise indicated, iron castings shall conform to the requirements of ASTM A 48, Class 50B or better.

F. **Chemical protection:** Chemical protection agent shall be a coal tar epoxy, Coal Cat 97-640/641, as manufactured by Pittsburgh Parts. Coal tar epoxy shall be used as shown on the construction Drawings. Material shall be applied as directed by the manufacturer specification.

2.02 LADDERS

A. Ladders which may be partially or wholly submerged, or which are located inside a hydraulic structure, shall be entirely of Type 316 stainless steel. All other ladders shall be of [aluminum], [carbon steel, hot-dip galvanized after fabrication] or [as indicated].

B. Every ladder that does not have an exterior handhold shall be equipped with a pop-up extension. Pop-up extension device shall be manufactured of the same material and finish as the ladder with telescoping tubular section that locks automatically when fully extended. Upward and downward improvement shall be controlled by stainless steel spring balancing mechanisms. Units shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturers instructions.

2.03 METAL GRATING

A. **General:** Metal grating shall be of the design, sizes and types indicated. All grating shall be completely banded at all edges and cutouts using material and cross section equivalent to the bearing bars. Such banding shall be welded to each cut bearing bar. Grating shall be supported on all sides of an opening by support members. Where grating is supported on concrete, embedded support angles matching grating material shall be used on all sides, unless shown otherwise. Such angles shall be mitered and welded at corners.

1. All pieces of grating shall be fastened in two locations to each support.

2. Where grating forms the landing at the top of a stairway, the edge of the grating, which forms the top riser, shall have an integral non-slip nosing, width equal to that of the stairway.

3. Where grating depth is not given, grating shall be provided which will be within allowable stress levels, and which shall not exceed a deflection of 1/4 inch or the span divided by 180, whichever is less. For heavy duty grating, the loading used for determining stresses and deflections shall be AASHTO HS-20, or a 5-ton fork lift, whichever is greater.

B. **Material:**

1. Except where indicated otherwise, bar grating shall be fabricated entirely of galvanized steel.

C. **Standard-Duty Grating:**

1. No single piece of grating shall weigh more than 80 pounds, unless indicated otherwise. Standard duty grating shall be serrated bar grating.

2. Cross bars shall be welded or mechanically locked tightly into position so that there is no movement allowed between bearing and cross bars.

D. **Safety Grating:**

1. Safety grating shall be made of sheet metal punched into an open serrated diamond pattern and formed into plank sections. The open diamond shapes shall be approximately 1-7/8 inch by 11/16 inch in size. Safety grating shall be Grip Strut by Metal Products Division, United States Gypsum Company; Deck Span by IKG Industries, or equal.

E. **Heavy-Duty Grating:** Heavy-duty grating shall be of welded steel, galvanized after fabrication. Cross bars shall be welded in position.

2.04 CHECKERED PLATE

A. Checkered plate shall be not less than 1/4-inch thick, and shall have a pattern of raised lugs on one face and shall be smooth on the opposite face. Lugs shall be a minimum of one inch in length and raised a minimum of 0.050 inch above the surface. The lugs shall be located in a pattern in which the lugs are oriented at 90 degrees from the adjacent lugs in two orthogonal directions. The rows of lugs shall be oriented at 45 degrees from the edges of the plates.

B. Where no plate material is indicated on the drawings, aluminum shall be provided. Unless noted otherwise on the drawings, the minimum plate thickness shall be as required to limit deflection, resulting from a live load of 100 psf, to 1/4-inch or the span divided by 240, whichever is less.

2.05 BOLTS AND ANCHORS

A. **Standard Service (Non-Corrosive Application):** Unless otherwise indicated, bolts, anchor bolts, washers, and nuts shall be steel, galvanized after fabrication as indicated herein. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated, steel for bolts, anchor bolts and cap screws shall be in accordance with the requirements of ASTM A 193 Grade B-7.

NTS: In the list of corrosive service locations below, project-specific trouble areas are not covered, such as (1) all outdoor locations, (2) all locations subject to continuous or intermittent wetting or spraying other than weather. If stainless steel nuts, bolts, and washes are to be provided there, call these areas out on the Drawings.

B. **Corrosive Service:** All bolts, nuts, and washers in the locations listed below shall be stainless steel as indicated below.

1. All buried locations.

2. All submerged locations.

3. All locations subject to seasonal or occasional flooding.

4. Inside hydraulic structures below the top of the structure.

5. Inside buried vaults, manholes, and structures which do not drain through a gravity sewer or to a sump with a pump.

6. All chemical handling areas.

7. Inside trenches, containment walls, and curbed areas.

8. Locations indicated by the Contract Documents or designated by the Engineer to be provided with stainless steel bolts.

NTS: *In cases where the galling characteristics of stainless steel bolts and nuts would present a serious problem, use the subparagraph C in this NTS instead of the subparagraph C below the NTS. It should be recognized, however, that the bronze nuts are more expensive and more difficult to obtain in some areas.):*

C. Stainless steel bolts, nuts, anchor bolts, and washers shall be of Type 316 stainless steel, with bronze nuts, or cap screws (where screwed into stainless steel), of copper-silicon alloy, conforming to ASTM B 98, alloy C 65100, designation H04, or alloy C 65500, designation H04. Wherever stainless steel bolts and nuts are indicated, it shall refer to the above material combination, unless specifically excluded.

C. Unless otherwise indicated, stainless steel bolts, anchor bolts, nuts, and washers shall be Type 316 stainless steel, class 2, conforming to ASTM A 193 for bolts and to ASTM A 194 for nuts. All threads on stainless steel bolts shall be protected with an antiseize lubricant suitable for submerged stainless steel bolts, to meet government specification MIL-A-907E. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.

1. Antiseize lubricant shall be classified as acceptable for potable water use by the NSF.

2. Antiseize lubricant shall be "PURE WHITE" by Anti-Seize Technology, Franklin Park, IL, 60131, AS-470 by Dixon Ticonderoga Company, Lakehurst, NJ, 08733, or equal.

D. **Bolt Requirements:**

1. The bolt and nut material shall be free-cutting steel.

2. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

3. All bolts and nuts shall be installed with washers fabricated of material matching the base material of bolts, except that hardened washers for high strength bolts shall conform to the requirements of the AISC Specification. Lock washers shall be installed with washers where indicated and shall be fabricated of material matching the bolts.

4. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 1/2-inch beyond the nut.

E. **Adhesive Anchors:** Unless otherwise indicated, all drilled, concrete or masonry anchors shall be adhesive anchors. No substitutions will be considered unless accompanied with ICBO report verifying strength and material equivalency.

1. Epoxy adhesive anchors are required for drilled anchors where exposed to weather, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails, pumps, mechanical equipment, and reinforcing bars. Epoxy anchor grout shall comply with Section 03315 - Grout. Threaded rod shall be stainless steel Type 316.

2. Unless otherwise indicated, glass capsule, polyester resin adhesive anchors will be permitted in locations not indicated above and shall be Hilti HVA or Molly Parabond. Threaded rod shall be galvanized steel.

F. **Expanding-Type Anchors**: Expanding-type anchors if indicated or permitted, shall be steel expansion type ITW Ramset/Redhead "Trubolt" anchors; McCullock Industries "Kwick-Bolt;" or equal. Lead caulking anchors will not be permitted. Size shall be as indicated. Expansion type anchors which are to be embedded in grout may be steel. Non-embedded buried or submerged anchors shall be stainless steel.

2.06 POWDER-DRIVEN PINS

A. **Materials:** Powder-driven pins for installation in concrete or steel shall be heat-treated steel alloy. If the pins are not inherently sufficiently corrosion-resistant for the conditions to which they are to be exposed, they shall be protected in an acceptable manner. Pins shall have capped or threaded heads capable of transmitting the loads the shanks are required to support. Pins that are connected to steel shall have longitudinal serrations around the circumference of the shank.

2.07 IMPACT ANCHOR

A. Impact anchors shall be an expansion type anchor in which a nail type pin is driven to produce the expansive force. It shall have a zinc sleeve with a mushroom style head and stainless steel nail pin. Anchors shall be Metal Hit Anchors, manufactured by Hilti, Inc., Rawl Zamac Nailin, manufactured by the Rawlplug Company; or equal.

PART 3: EXECUTION

3.01 FABRICATION AND INSTALLATION REQUIREMENTS

A. **Fabrication and Erection:** Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."

B. **Power-Driven Pins:** Power-driven pins shall be installed by a craftsman who is certified by the manufacturer as being qualified to install the manufacturer's pins. Pins shall be driven in one initial movement by an instantaneous force that has been carefully selected to attain the required penetration. Driven pins shall conform to the following requirements where "D" = Pin's shank diameter:

Material Penetrated by Pin	Material's Minimum thickness	Pin's Shank Penetration in Supporting Material	Minimum Space from Pin's CL to Edge of Penetrated Material	Minimum Pin Spacing
Concrete	16D	6D minimum	14D	20D
Steel	¼-inch	steel thickness	4D	7D

3.02 WELDING

A. **Method:** All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

B. **Quality:** In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as indicated by the AWS Code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

3.03 GALVANIZING

C. All structural steel plates shapes, bars and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A 123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153. Field repairs to galvanizing shall be made using "Galvinox," "Galvo-Weld," or equal.

3.04 DRILLED ANCHORS

A. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dry. Drilled anchors shall not be installed until the concrete has reached the specified 28-day compressive strength. Adhesive anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

[END OF SECTION]

SECTION 07920
SEALANTS AND CAULKING

NTS: This Section has "M" status: it has been through the process of technical discipline review, manufacturer review, and construction experience feedback. Upgrading was completed in November, 1995. Bill Brumm has been a major contributor toward technical upgrading of this Section and is aware of the details of its contents. Bill Brumm may be a resource to answer questions.

The Section cross references the following sections:

Use professional care in customizing this master Section for use in project specifications. Not only are there square brackets to address, the Specifier must also consider whether the rest of the text is appropriate for the unique needs of the project, making additions and deletions if necessary to make it so.

Section 07920 specifies joint sealants and caulking, joint fillers, compressible seals and other joint sealers for a variety of applications. Moisture barrier film is also included.

PART 1: GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide caulking, sealing, and appurtenant work, complete and in place, in accordance with the Contract Documents.

1.02 REFERENCE STANDARDS

A. General: Portions of the following standards are incorporated into this Section by references below. The standards are listed here for convenience.

B. Federal Specifications:

TT-S-001543A	Sealing Compound, Silicone Rubber Base, (For Caulking, Sealing and Glazing in Buildings and Other Structures)
SS-S-200D	Sealants, Joint, Two Compound, Jet Blast Resistant, Cold Applied for Portland Cement Concrete Pavement.
TT-S-00227E	Sealing Compound, Elastomeric Type, Multi-Component, (For Caulking, Sealing and Glazing in Buildings and Other Structures).

TT-S-00230C	Sealing Compound, Elastomeric Type, Single Component, (For Caulking, Sealing, and Glazing in Buildings and Other Structures)

C. Commercial Standards:

ASTM C 557	Adhesives for Fastening Cypsum Wallboard to Wood Framing.
ASTM C 834	Latex Sealing Compounds.
ASTM C 919	Practice for Use of Sealants in Acoustical Applications.
ASTM C 920	Elastomeric Joint Sealants.
ASTM C 1056	Flexible Cellular Material-Sponge or Expanded Rubber.
ASTM D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
ASTM E 84	Surface Burning Characteristics of Building Materials.
ASTM E 814	Methods for Fire Tests of Through Penetrations: Firestops.
UL 1479	Underwriter's Laboratory Standard for Safety Fire Tests of Through Penetrations Firestops.

1.03 CONTRACTOR SUBMITTALS

D. General: Submittals shall be in accordance with Section 01300 - Contractor Submittals.

E. Technical Data: A complete materials list along with the manufacturer's technical data and literature, specifications, joint width and depth tables, and installation instructions.

F. Samples: Samples (including color samples) of all the caulking and sealant materials and other materials proposed for use on the WORK. The samples shall be clearly marked with the manufacturer's name and product identification.

G. Certificates: If requested by the ENGINEER, certificates from an independent testing laboratory approved by the ENGINEER, certifying that the submitted materials meet all the requirements of the ASTM and Federal Specifications cited.

H. Warranty: A copy of the manufacturer's warranty covering all sealants, caulking materials, and other materials against defects in materials.

PART 2: PRODUCTS

2.01 SEALANTS AND CAULKING MATERIALS

A. General:

1. Manufacturer's Standards: In addition to the standards listed below, the sealants and caulking products and application shall be in accordance with the manufacturer's published recommendations and specifications.

2. Wherever manufacturer's names and products are listed in this Section, "or equal" products will be considered in accordance with Section 01300 - Contractor Submittals.

B. Materials shall conform to the following requirements:

1. Significant Movement Sealants (plus or minus 25% movement capability)

a. For expansion wall joints; masonry and metal curtainwall joints; precast concrete joints and concrete panels; perimeter sealing (windows, doors, and panels); control joints; interior and non-traffic horizontal joints.

(1) Two component, non-sag, polyurethane or polysulfide sealant conforming to Federal Specification TT-S-227E, Class A, Type II, and ASTM C 920, Type M, Class 25, Grade NS.

Products Research & Chemical Corp. "RC-2"
Progress Unlimited "Iso-Flex 2000"

(2) One component, non-sag, low modulus, polyurethane or polysulfide sealant conforming to Federal Specification TT-S230C, Class A, Type II, and ASTM C 920, Type S, Class 25, Grade NS.

Products Research & Chemical Corp. "RC-1"
Tremco "Dymonic"

(3) One component, non-sag, medium modulus, neutral cure, silicone sealant conforming to Federal Specification TT-S-1543A, Class A, and ASTM C 920, Type S, Class 25, Grade NS.

Products Research & Chemical Corp. "PRC-4000"
Dow Corning "795"

b. For horizontal joints exposed to fuel spillage.

(4) Two component, self-leveling, fuel resistant, polyurethane or polysulfide sealant conforming to Federal Specification SS-S-200D, Type H, and ASTM C 920, Type M, Class 25, Grade P.

Products Research & Chemical Corp. "3105-S"
Pacific Polymere Inc. "ElastoThane 200"

c. For horizontal joints not exposed to fuel spillage.

(5) Two component, self-leveling, polyurethane or polysulfide sealant conforming to Federal Specification TT-S-227E, Class A, Type I, and ASTM C 920, Type M, Class 25, Grade P.

Products Research & Chemical Corp. "RC-2SL"
Bostic "Chem-Calk 550"

(6) One component, self-leveling, polyurethane or polysulfide sealant conforming to Federal Specification TT-S-230C, Class A, Type I, and ASTM C 920, Type S, Class 25, Grade P.

Products Research & Chemical Corp. "6006"
Mameco "Vulkem 45"]

2. Glazing Sealants

a. For non-structural applications

(1) One component non-sag, medium modulus, neutral cure, silicone sealant conforming to Federal Specification TT-S-1543A, Class A, and ASTM C 920, Type S, Class 25, Grade NS.

Products Research & Chemical Corp. "4000"
Dow Corning "795"

(2) One component, non-sag, high modulus, acetoxy cure, silicone sealant conforming to Federal Specification TT-S-1543A, Class A, and ASTM C 920, Type S, Class 25, Grade NS.

3. Interior Sealant and Caulking

a. For general applications

(1) One component, acrylic latex caulking conforming to ASTM C 834

Pecora Corp. "AC-20"
Bostic "Chem-Calk 600"

b. For non-exposed acoustical applications

(1) One component, non-drying, non-hardening, non-shrinking, acoustical caulking conforming to ASTM C 557 and ASTM C 919.

Inmont Company "Prestite 579.64"
Tremco, "Acoustical Sealant"
United States Gypsum, "Acoustical Sealant"

W.W. Henry, "Type 313, Acoustical Sealant"

4. Acoustic Sheet Caulking: For use on all outlet boxes including intercoms, telephone or other services that require penetrations in the walls, acoustic sheet caulking shall be resilient synthetic polymer, self-adhesive, 1/8-inch thick, 6-inch x 8-inch, sheet acoustic sealer. Pads shall be Lowry's Electrical Box Pads as manufactured by Harry A. Lowry & Associates, Inc., 11176 Penrose Street, Sun Valley, CA 91352, (818) 768-4661, (213) 875-0225; or equal.

5. Firestop Sealant: Where piping, conduit, wire, or other materials pass through fire rated walls, floors, ceilings or roofs, provide a [1] [3]-hour fire rated sealant in accordance with ASTM E 814 and UL 1479. Fire-resistant penetration sealant shall be a medium density fire-resistant foam that retains form and stability at high temperature. Fire-resistant sealant shall be Dow-Corning Corporation "3-6548 Silicone RTV" foam; 3M Corporation "Fire Barrier Caulk CP25N, No-sag "or "CP25 S/L, Self-Leveling", as appropriate for the use intended. Equivalent products of General Electric and Metalines, Inc. will also be considered.

6. Preformed Sealants: Preformed sealant shall be polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealant capable of sealing out moisture, air, and dust when installed as recommended by the manufacturer. At temperatures from minus 30 to plus 160 degrees F, the sealant shall be non-bleeding and shall have no loss of adhesion.

7. Tape sealant: Dimensions shall be as required for application conditions. Tape sealants shall be type recommended by tape manufacturer for connecting and bonding to surfaces.

8. Filler material shall be resilient, closed-cell polyethylene foam conforming to ASTM D 1752, Type II or III, and/or bond breakers of proper size for joint widths. Filler shall be compatible with sealant manufacturer's product and shall not stain the sealant nor the materials to which applied.

9. Primer: Primers shall be as recommended in the manufacturer's printed instructions for caulking and sealants, and shall not stain the sealant nor the materials to which applied. Manufacturer shall be consulted for all surfaces not specifically covered in submittal application instructions. Primer shall be used in accordance with manufacturer's instructions with all primers being applied prior to the installation of any backer rod or bond breaker tape.

10. Cleaning and cleanup solvents, agents, and accessory materials shall be as recommended in the manufacturer's printed instructions for cleaning up.

2.02 COLOR OF SEALANTS

A. Color of sealants that are visible after installation shall match adjacent building finish. If in doubt of color match, obtain color approval from ENGINEER.

2.03 SUB-SLAB MEMBRANE

A. Sub-slab membrane shall be 6-mil, odorless, nontoxic, polyethylene film without holes, complying with FHA requirements for below-slab moisture barrier, and shall be Sisalkraft "Moisture-stop"; Dampproof "XX"; or equal.

PART 3: EXECUTION

3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken packages or containers bearing the manufacturer's label. Packages or containers shall be delivered to the site with seals unbroken.

B. Shelf Life: Materials whose shelf life dates have expired shall not be used in the WORK. Such materials shall be promptly removed from the project site.

C. Storage: All materials shall be carefully stored in accordance with the manufacturer's instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the product. Materials shall be stored at temperatures between 40 and 90 degrees unless otherwise specified by the manufacturer.

3.02 INSTALLATION

A. Manufacturer's Recommendations: All work under this Section and all testing, where applicable, shall be performed in accordance with manufacturer's printed recommendations, specifications, and installation instructions except where more stringent requirements are indicated herein; and, except where project conditions require extra precautions or provisions to assure performance of the waterproofing system.

B. Authorized Installers: Caulking and sealants shall be complete systems and be installed only by installers authorized and approved by the respective manufacturers.

C. Surface Preparation

1. General: The surfaces of joints to be sealed shall be dry. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints which will be in contact with the sealant. Ferrous metal surfaces shall be cleaned of all rust, mill scale, and other coatings by wire brush, grinding, or sandblasting. Oil and grease shall be removed by cleaning in accordance with sealant manufacturer's printed recommendations. Protective coatings shall be removed from all aluminum surfaces against which caulking or sealing compound is to be placed. Bituminous or resinous materials shall be removed from surfaces to receive caulking or sealants.

2. Concrete and Masonry Surfaces: Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence, and loose mortar shall be removed from the joint cavity.

3. Steel Surfaces: Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

4. Aluminum Surfaces: Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

5. Wood Surfaces: Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

D. Joint Types and Sizes: Joint shapes and sizes shall be as indicated or as necessary for job conditions where not indicated. Joints to be caulked or sealed include through-bolt holes, door frames, louver and ventilator frames, joints between openings where items pass through exterior walls, concrete masonry, or combination of these surfaces, and as otherwise indicated or required for watertightness, weatherproofing, or airtightness. Use sealing compound at both exterior and interior surfaces of exterior wall penetrations.

3.03 SEALANT FILLED JOINTS

A. Manufacturer's Representative: The CONTRACTOR shall furnish the on-site services of the sealant manufacturer's representative prior to sealant work for inspection of the joints to be sealed and for instructing the installer in the proper use of the materials[.] [if requested by the ENGINEER.]

B. Sealant: Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Sealant shall be installed to the required depth without displacing the backing. Unless otherwise indicated or recommended by the manufacturer, the installed sealant shall be tooled so that the surface is uniformly smooth and free of wrinkles and to assure full adhesion to the sides of the joint. Sealants shall be installed free of air pockets, foreign embedded matter, ridges, and sags. Sealer shall be applied over the sealant if recommended by the sealant manufacturer.

C. Sealant Depth: Sealant depth in joints shall be 1/2 the width of joint, but not less than 1/8-inch deep and 1/4-inch wide nor more than 1/2-inch deep and 1-inch wide. All joints shall have a rigid filler material installed to proper depth prior to application of sealant.

D. Masking Tape: Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

E. Backing: Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

F. Bond-Breaker: Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

G. Primer: Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

H. Applications: A full bead of sealant shall be applied into the joint under sufficient pressure, with the nozzle drawn across sealant, to completely fill the void space and to ensure complete wetting of contact area to obtain uniform adhesion. During application, the tip of the nozzle shall be kept at the bottom of the joint thereby forcing the sealant to fill from the bottom to the top. Sealants shall be tooled immediately after exposure with a caulking tool or soft bristled brush moistened with solvent. The finished sealant-filled joint shall be slightly concave unless otherwise indicated.

I. Acoustic Partition Joints: Acoustic partition joints shall be made air and sound-tight with acoustic caulking material.

1. Partitions shall be sealed where indicated on the Drawings. Gypsum panels may have joint treatment applied in the normal manner over sealed joints, or panels may be finished with base or trim as required.

2. A 1/4-inch minimum round bead of sealant shall be applied around all cut-outs, such as at electrical boxes and air conditioning ducts, sufficient to seal the openings.

3.04 ACOUSTIC CAULKING

A. Preparation: Joints and surfaces to be sealed shall be clean, dry, and free of loose materials.

B. Concealed Joints: Concealed joints in acoustic partitions including perimeters and intersections of walls and penetrations through finish work and at conduit ends with boxes shall be sealed with acoustic caulking compound. Backs of electrical boxes shall be sealed with acoustic sheet caulking, covering all holes and knock-outs.

3.05 SUB-SLAB MEMBRANE

A. A sub-slab membrane shall be installed under floor slabs over which a finish flooring system will be installed and at other locations as indicated.

3.06 CLEANING

A. After application of sealant and caulking materials, adjacent materials which have been soiled shall be cleaned and left in a neat, clean, undamaged, or unstained condition. On porous surfaces, excess sealant shall be removed per sealant or caulking manufacturer's printed instructions.

[END OF SECTION]

SECTION 11210
LEACHATE PUMPS

PART 1: GENERAL

1.01 SUMMARY

A. Description of Work

1. This section includes supply and installation of leachate removal pumps for the Landfill. The following pumps are included:

    a. The submersible pump in the Primary Leachate Collection System. This will be the principal pump used to remove leachate from the landfill.

    b. The self-priming pump in the vertical riser of the Primary Leachate Collection System. This higher capacity pump will be used to remove storm water from the primary sump.

    c. The submersible pump in the Secondary Leachate Collection System. This pump will be used to remove leachate that leaks through the primary system into the secondary collection system.

    d. The submersible pump in the Vadose Sump. This pump will be used to remove leachate that leaks through the secondary lining system.

B. Related Sections

1. 15600 - Welded Steel Pipe

2. 15700 - Stainless Steel Pipe

1.02 SUBMITTALS

A. Submit detailed information on proposed pumps, motors, materials, connections, and electrical requirements.

B. If "or equal" product is proposed, submit technical data and specifications sufficient to allow evaluation by the ENGINEER.

1.03 QUALITY ASSURANCE

A. Prior to installing, test pumps and demonstrate their operation in accordance with manufactures recommendations

PART 2: PRODUCTS

2.01 GENERAL

A. Pumps shall be constructed such that all wetted parts are type 316 stainless steel, or other highly corrosion resistent materials.

B. Submersible pumps and their motors shall have bearings which permit the pump to be operated in continuous or intermittent service in the horizontal position.

C. The external portions of the case shall be free of sharp edges or burrs which might prevent the free sliding of the pump along the enclosing pipe.

D. Electrical characteristics of pump motors shall be compatible with power available at the site.

2.02 SUBMERSIBLE PUMPS

A. The submersible pump for the Primary and Secondary Leachate Collection System shall be a Grundfos Model 40S30-9 or equal as approved by the ENGINEER.

B. The submersible pumps for the Vadose Sump shall be Grundfos Model 25S15-9 or equal as approved by the ENGINEER.

2.03 SELF-PRIMING SUMP PUMP

A. The larger capacity sump pump to be installed in the vertical riser shall be a self-priming type, capable of drawing water 10 ft or more at sea level. The pump shall be a Gorman Rupp Model S4C18 or equal as approved by the ENGINEER.

PART 3: EXECUTION

3.01 PUMP INSTALLATION

A. The OWNER shall install all pumps and motors in accordance with manufacturers' instructions, at locations as shown on the Drawings.

B. Installation shall include all discharge piping and wiring.

C. Install pumps in side slope riser pipes prior to placing backfill over the pipes, in order to confirm pump installation location. When pump is in correct position as determined by visual inspection through holes in perforated pipe section, mark discharge tube or support cable as appropriate at top of riser pipe. Survey location (coordinates and elevation) of pump prior to trench backfilling.

[END OF SECTION]

SECTION 13205
POLYETHYLENE TANK

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the installation of all polyethylene tanks required for the landfill or surface impoundment construction. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

B. This specification shall also apply to polyethylene tank installation in the truck wash area and liquid waste storage facility, unless otherwise indicated on the construction drawings.

1.02 RELATED SECTIONS

A. Section 02718 - Polyethylene Pipe and Fittings

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. All work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. The CQA Engineer will coordinate independent surveying as required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

D. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming materials. The nonconforming materials shall be removed by the Contractor at no cost to the Owner until acceptable materials are installed.

PART 2: PRODUCTS

2.01 POLYETHYLENE TANK PROPERTIES

A. The polythylene tank shall be Model Number 10 VCT 09K manufactured by Central California Cntainer and conform to the following specifications or equal:

Item	*Primart Tank Description*	*Secondary Tank Description*
Diameter	10 feet	12 feet
Height	16 feet 1 inch	21 feet 3 inches
Material	Cross Linked Polyethylene Resin	Cross linked polyethylene resin
Type	Enclosed Top Containment Tank	Ethylene Resin
Primary Tank Volume	9,000 gallons	Enclosed top tank
Secondary Tank		15,500 gallons

2.03 MANUFACTURING QUALITY CONTROL

A. The Contractor shall submit to the Owner for approval within 14 days prior to the start of polyethylene tank work a complete list of materials to be furnished and the name of the polyethylene tank Manufacturer.

B. The Contractor shall submit to the Owner the polyethylene tank Manufacturer's certification of compliance with the product requirements of Part 2.

C. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

2.04 TRANSPORTATION

A. Transportation of polyethylene tanks shall be the responsibility of the Contractor. The Contractor shall be liable for all damage to the polyethylene tanks incurred prior to and during transportation to the site.

2.05 HANDLING AND STORAGE

A. Handling, storage, and care of the steel pipe prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damage to the material incurred prior to final acceptance by the Owner.

B. The Contractor shall be responsible for storage of the polyethylene tanks at the site. Polyethylene tanks shall be stored on clean level ground, preferably turf or sand, free of sharp objects which could damage the polyethylene tanks.

PART 3: EXECUTION

3.01 HANDLING AND PLACEMENT

A. Polyethylene tanks shall be installed as indicated on the Construction Drawings.

B. The Contractor shall exercise care when transporting, handling and placing polyethylene tanks, such that they will not be damaged.

C. The Contractor shall comply with the polyethylene tanks Manufacturer's recommendations for handling, storage, and installation of all tanks.

D. Polyethylene tanks shall not be dropped onto rocky or unprepared ground.

F. The exterior of the polyethylene tanks shall be free of cuts, gouges and scratches. The CQA Engineer will inspect the polyethylene tanks in accordance with the CQA Plan. Polyethylene tanks with excessive cuts, gouges, or scratches will be rejected and the Contractor will be required to remove and replace the rejected polyethylene tanks, at no additional cost to the Owner.

3.02 INSTALLATION

A. All polyethylene tanks shall be installed in accordance with these General Specifications and the polyethylene tanks Manufacturer's instructions.

B. The Contractor shall carefully examine all polyethylene tanks for cracks, damage or defect before installation. Defective materials shall be removed from the site and replaced with non-defective material at no additional cost to the Owner.

C. All polyethylene tanks shall be placed to the grades and elevations shown on the Construction Drawings.

3.04 SURVEY CONTROL

A. The Surveyor shall survey the location and final elevation of all polyethylene tanks. Surveying shall be performed in accordance with Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing of the location all polyethylene tanks.

3.05 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all materials and all partially-complete and completed work of these General Specifications.

B. In the event of damage, the Contractor shall make all repairs and replacements necessary, to the approval of the Owner and at no additional cost to the Owner.

C. The CQA Engineer will issue an approval of polyethylene tank installation and inspection to the Owner following installation of the polyethylene tank in accordance with the CQA Plan.

[END OF SECTION]

SECTION 15600
CARBON STEEL PIPE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the installation of all steel pipe required for landfill. The work shall be carried out in accordance with these General Specifications, the CQA Plan, and the Construction Drawings.

1.02 RELATED SECTIONS

A. Section 02222 - Sump Primary Clay Liner
B. Section 02224 - Sump and Pipe Bedding Gravel
C. Section 02225 - Road Base Aggregate
D. Section 02710 - Geocomposite Detection or Collection Layer
E. Section 02714 - Geotextile Filter or Cushion Layer
F. Section 02775 - Geomembrane Liners

1.03 QUALIFICATIONS AND SUBMITTALS

A. The Contractor shall abide by all qualification and submittal requirements of the CQA Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. All work will be monitored and tested in accordance with the requirements of the CQA Plan.

B. The Contractor shall be aware of all activities outlined in the CQA Plan, and the Contractor shall account for these activities in the construction schedule. No additional costs to the Owner shall be allowed by the Contractor as a result of the performance of the CQA activities.

C. The CQA Engineer will coordinate independent surveying as required by the CQA Plan. Surveying by the CQA Engineer does not relieve the Contractor of his responsibility to lay out, control, and document the work.

D. If the CQA Engineer's tests indicate work does not meet the requirements of the specifications, the CQA Engineer will establish the extent of the nonconforming materials. The nonconforming materials shall be removed by the Contractor at no cost to the Owner until acceptable materials are installed.

E. Qualify and certify welding procedures, welders, and operators in accordance with ANSI B31.1, Paragraph 127.5, for shop and project site welding of piping work.

PART 2: PRODUCTS

2.01 STEEL PIPE PROPERTIES

A. The steel pipe shall be Schedule 40 and conform to all requirements of ASTM A53 Grade B, or API 5L Grade B.

2.03 MANUFACTURING QUALITY CONTROL

A. The Contractor shall submit to the Owner for approval within 14 days prior to the start of pipe work a complete list of materials to be furnished and the name of the pipe Manufacturer.

B. The Contractor shall submit to the Owner the pipe Manufacturer's certification of compliance with the product requirements of Part 2.

C. If requested by the Owner, the Contractor shall require the pipe manufacturer to retain one section of pipe (at least 5 feet in length) provided for the project for every 1,500 lineal feet of pipe produced for the project until the work is accepted by the Owner.

D. All Quality Control testing required by these General Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

2.04 LABELING

A. The following shall be continuously indent-printed on the steel pipe, or spaced at intervals not exceeding 10 feet:

1. Name and/or trademark of the pipe Manufacturer.
2. Nominal pipe size.
3. Schedule.
4. Manufacturing Standard Reference (e.g., ASTM F 714-1).
5. A production code from which the date and place of manufacture can be determined.

2.05 TRANSPORTATION

A. Transportation of steel pipe shall be the responsibility of the Contractor. The Contractor shall be liable for all damage to the steel pipe incurred prior to and during transportation to the site.

2.06 HANDLING AND STORAGE

A. Handling, storage, and care of the steel pipe prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damage to the material incurred prior to final acceptance by the Owner.

B. The Contractor shall be responsible for storage of the steel pipe at the site. Pipe shall be stored on clean level ground, preferably turf or sand, free of sharp objects which could damage the pipe.

2.07 PIPE BEDDING MATERIAL

A. Pipe bedding material shall meet the requirements of Section 02228 of this General Specification as well as any other requirements of the Construction Drawings.

PART 3: EXECUTION

3.01 HANDLING AND PLACEMENT

A. Pipe shall be installed as indicated on the Construction Drawings.

B. The Contractor shall exercise care when transporting, handling and placing pipe, such that they will not be damaged.

C. The Contractor shall comply with the pipe Manufacturer's recommendations for handling, storage, and installation of all pipe.

D. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipe.

E. Pipe or fittings shall not be dropped onto rocky or unprepared ground. The pipe and fittings shall not be dropped into trenches or dragged over sharp objects.

F. The interior of the pipe and fittings shall be free of cuts, gouges and scratches. The CQA Engineer will inspect the pipes in accordance with the CQA Plan. Sections of pipe with excessive cuts, gouges, or scratches will be rejected and the Contractor will be required to remove and replace the rejected pipe, at no additional cost to the Owner.

3.02 INSTALLATION

A. All pipe shall be installed in accordance with these General Specifications and the pipe Manufacturer's instructions.

B. The Contractor shall carefully examine all pipe for cracks, damage or defect before installation. Defective materials shall be removed from the site and replaced with non-defective material at no additional cost to the Owner.

C. The interior of all pipe shall be inspected, and any foreign material shall be completely removed from the pipe interior before it is moved into final position.

D. Field cutting of pipe shall be carefully made, without damage to pipe or lining system components, so as to leave a smooth end at right angles to the axis of pipe. The method and device used to cut the pipes shall be approved of by the Owner. Sharp edges of cut ends shall be filed off smooth. Flame cutting will not be allowed.

E. All pipe and fittings shall be laid or placed to the grades and elevations shown on the Construction Drawings with bedding and backfill as shown on the Construction Drawings.

F. Placement of surrounding pipe bedding shall be carried out in accordance with Section 02228 of these General Specifications.

G. No pipe shall be laid until the CQA Engineer has observed the condition of the pipe.

H. Blocking under piping shall not be permitting unless specifically accepted by the Owner.

I. The Contractor shall provide all necessary adapters and/or connection pieces required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.

3.03 JOINTS AND CONNECTIONS

A. Welds shall be sound and free from embedded scale of slag, have tensile strength across weld not less than that of thinner of connected section, and be watertight.

B. Use buttwelds for welded joint in line pipe assemblies and fabrication of bends and other specials:

C. Conform field welding of joints and preparation of pipe ends to AWWA C206.

1. Yield point determination of field welded joint shall be made by independent testing laboratory at the beginning of installation. Costs for laboratory testing shall be paid for by the Contractor.

2. The Contractor shall provide specimens for weld tests to the CQA Engineer for testing by an independent testing laboratory if the CQA Engineer suspects unsatisfactory welding.

3. Use of back-up welding strips or rings for welds is not permitted.

3.04 SURVEY CONTROL

A. The Surveyor shall survey the location and final elevation of all steel pipe. The pipe shall be surveyed at its ends. In addition, all joints, etc. shall be located horizontally and vertically and overall length measured. Surveying shall be performed in accordance with Section 01010 of these General Specifications.

B. The Surveyor shall provide a Record Drawing of the location and final elevation of all steel pipe.

3.05 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all materials and all partially-complete and completed work of these General Specifications.

B. In the event of damage, the Contractor shall make all repairs and replacements necessary, to the approval of the Owner and at no additional cost to the Owner.

C. The CQA Engineer will issue an approval of pipe installation and inspection to the Owner prior to completely covering the pipe in accordance with the CQA Plan.

[END OF SECTION]

SECTION 15700
STAINLESS STEEL PIPE

PART 1: GENERAL

1.01 SUMMARY

A. Description of Work

1. This section describes the lower portion of the vertical riser pipe for the landfill leachate removal system.

B. Related Sections

1. 11210 - Leachate Pumps

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) most current version:

1. ASTM A312 - Specification for Seamless and Welded Austenitic Stainless Steel Pipe.

2. ASTM A403 - Specification for Wrought Austenitic Stainless Steel Piping Fittings.

3. ASTM A182 - Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service.

4. ASTM A240 - Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Fusion-Welded Unfired Pressure Vessels.

5. ASTM A193 - Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service.

6. ASTM A194 - Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service.

7. ASTM A307 - Specification for Carbon Steel Externally Threaded Standard Fasteners.

B. American Society of Mechanical Engineers (ASME) most current version:

1. ASME Boiler and Pressure Vessel Code, Section IX, Article III.

C. American National Standards Institute (ANSI) most current version:

1. ANSI B16.5 - Pipe Flanges and Flanged Fittings.

2. ANSI B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.

3. ANSI B16.25 - Buttwelding Ends.

4. ANSI B31.2 - Fuel Gas Piping.

5. ANSI B31.3 - Chemical Plant and Petroleum Refinery Piping.

D. American Welding Society (AWS) most current version:

1. AWS A5.4 - Specification for Corrosion Resisting Chromium and Chromium-Nickel Steel Covered Electrodes.

2. AWS A5.9 - Specification for Corrosion Resisting Chromium and Chromium-Nickel Steel Bare and Composite Metal Cored and Stranded Arc Welding Electrodes and Welding Rods.

1.03 SUBMITTALS

A. Welding Qualifications

1. Furnish procedure specifications and qualification records of welding procedures for pipe welding to be performed under this section in accordance with Section IX, Article III of ASME Boiler and Pressure Vessel Code.

2. Prior to start of work, submit list of welders CONTRACTOR proposes using and type of welding for which each has been qualified.

3. Submit in accordance with Section 01300.

1.04 QUALITY ASSURANCE

A. Welder's Qualifications

1. Quality welders and welding operators by approved testing laboratory or pipe supplier/manufacturer before performing welding required under this section.

a. Qualification tests in accordance with Section IX, Article III of ASME Boiler and Pressure Vessel Code.

b. Welders and welding operators to be qualified for making groove welds in Type 304 and 316 stainless steel pipe in positions 2g and 5g for each welding process to be used.

2. Qualification tests may be waived if evidence of prior qualification is deemed suitable by CQA ENGINEER.

a. The CONTRACTOR shall retest welders at any time CQA ENGINEER considers quality of welder's work substandard.

b. When CQA ENGINEER requests retest of previously qualified welder, labor costs for retest will be at OWNER'S expense if welder successfully passes test.

c. If welder fails retest, costs shall be at CONTRACTOR'S expense.

PART 2: PRODUCTS

2.01 PIPE

A. Welded Stainless Steel: Modified ASTM A312, Type 304 or 316, as shown on the Drawings.

B. 18-inch diameter (nominal) Schedule 80.

2.02 FABRICATION

A. Fabricate to sizes, dimensions, and shapes indicated on Drawings.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install in accordance with Drawings.

3.02 WELDED JOINTS

A. In accordance with latest editions of Section IX, ASME Boiler and Pressure Vessel Code and American National Standard Code for Pressure Piping, ANSI B31.2 and B31.3, as applicable.

B. Prepare pipe edges preferably by machine shaping or cutting with aluminum oxide blade.

1. Oxygen or arc cutting is acceptable if cut is smooth and true, and slag removed either by chipping or grinding.

2. Conform beveled ends for buttwelding to ANSI B16.25.

C. Clean and free surfaces of paint, oil, rust, scale, slag, or other material detrimental to welding. Prior to welding, wire brush joints to be welded with stainless steel wire brushes or stainless steel wool.

D. Align ends to be joined within existing commercial tolerances on diameter, wall thicknesses, and out-of-roundness. Root opening of joint shall be as stated in procedure specification.

E. Rejection

1. Cracks are not permitted.

2. Other reasons for rejecting welded joints will be incomplete penetration, weld undercutting, excessive weld reinforcement, porosity, and slag inclusions in excess of limits prescribed in Chapter V of ANSI B31.2 and B31.3, as applicable.

[END OF SECTION]

NEW MEXICO ENVIRONMENTAL DEPARTMENT
RCRA PART B PERMIT APPLICATION

CONSTRUCTION QUALITY ASSURANCE PLAN

FOR

LANDFILL, SURFACE IMPOUNDMENT AND ASSOCIATED FACILITIES CONSTRUCTION

TRIASSIC PARK WASTE DISPOSAL FACILITY
CHAVES COUNTY, NEW MEXICO

EPA IDENTIFICATION NUMBER NM 0001002484

FINAL

December 1997
(~~December 1997~~~~November 1999~~Revised October 2000)

Patrick Corser, P.E
New Mexico Registration 12236

Note:	This document presents a construction quality assurance plan for various elements of the Triassic Park Waste Disposal Facility landfill, surface impoundment and associated facilities. Modifications to the plan may be required prior to construction. Any revisions required will be submitted to NMED for approval prior to construction.

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SECTION I - GENERAL

1.0 INTRODUCTION

Triassic Park Waste Disposal Facility will consist of a landfill, evaporation pond, stabilization facility drum handling facility, liquid waste storage area, truck roll-off area and truck wash. This Construction Quality Assurance plan is intended to be used in conjunction with the design drawings and construction specifications.

The CQA Plan addresses the construction quality assurance of the soils, geosynthetics, and related liner system components for the facilities listed above at the Triassic Park Facility. The CQA Plan is divided into the following sections:

- Section I: General;
- Section II: Soils CQA;
- Section III: Geosynthetic Clay Liner CQA;
- Section IV: Geomembrane CQA;
- Section V: Geotextile CQA;
- Section VI: Geocomposite CQA;
- Section VII: Geonet CQA;
- Section VIII: Polyethylene Pipe and Fittings CQA; and,
- Section IX: ADS Slotted CPT CQA;
- Section X: Corrugated Metal Pipe CQA;
- Section XI: Carbon Steel and Stainless Steel Pipe CQA;
- Section XII: Polyethylene Tank CQA;
- Section XIII: Concrete Formwork CQA;
- Section XIV: Reinforcement Steel CQA;
- Section XV: Joints in Concrete CQA;
- Section XVI: Miscellaneous Metalwork CQA;
- Section XVII: Cast in Place Concrete CQA; and
- Section XVIII: CQA Documentation.

The facility will not accept waste until NMED has approved the CQA certification report.

2.0 DEFINITIONS RELATING TO CONSTRUCTION QUALITY ASSURANCE

2.1 CONSTRUCTION QUALITY ASSURANCE AND CONSTRUCTION QUALITY CONTROL

The CQA Plan is a site-specific document which addresses the following: (i) CQA personnel responsibilities, authorities, and qualifications; (ii) inspection, monitoring, and testing activities necessary to document that the facility is constructed to meet or exceed design criteria, plans, and specifications; and (iii) CQA documentation requirements.

Construction Quality Assurance (CQA) - A planned and systematic pattern of the means and actions designed to provide adequate confidence that items or services meet contractual and regulatory requirements, and will perform satisfactorily in service.

Construction Quality Control (CQC) -Those actions which provide a means to measure and control the characteristics of an item or service to meet contractual and regulatory requirements.

2.2 USE OF THE TERMS IN THIS PLAN

In the context of this document:

- Construction Quality Assurance (CQA) refers to means and actions employed by the CQA Engineer to assure conformity of liner system preparation, production, and installation with this CQA Plan, the General Specifications, and the Construction Drawings. CQA is provided by a party independent from the product Manufacturer and Contractor.

- Construction Quality Control (CQC) refers to those actions taken by Manufacturers, Suppliers, Contractors, or Owners, including their designated representatives, to ensure that the materials and the workmanship meet the requirements of the General Specifications, and the Construction Drawings. In the case of soils, and within this CQA Plan, CQC is typically made a part of the CQA requirements and is provided by the CQA Engineer. In the case of geosynthetic and other non-soil components, CQC is provided by the Manufacturers and installers of the various geosynthetics.

3.0 PARTIES TO CONSTRUCTION QUALITY ASSURANCE

3.1 ORGANIZATION CHART

A typical project organization chart for construction of landfills, surface impoundments and associated facilities is provided in Figure I-1.

3.2 DESCRIPTION OF THE PARTIES

3.2.1 Design Engineer

The Design Engineer is the individual, firm or corporation having direct responsibility for the design of the landfill or surface impoundment structure. During construction, the Design Engineer must approve any significant deviation from the design requirements of the Contract Documents. The Design Engineer may be an employee of the Owner. An individual representing the Design Engineer directly responsible for the project must be registered as a Professional Engineer in the State of New Mexico.

3.2.2 Contractor

The individual, firm, or corporation undertaking the execution of the work under the terms of the Contract Documents. The Contractor may be responsible for constructing the entire liner system (earthwork and geosynthetics), or only selected components of the liner system. The reference to Contractor refers to the General Contractor and all subcontractors which the General Contractor may employ in meeting the requirements of the Contract Documents.

3.2.3 Drainage Gravel Supplier

The drainage gravel Supplier excavates (or manufactures) and delivers drainage gravel to the Contractor at the Triassic Park Facility.

3.2.4 Road Base Material Supplier

The road base Supplier excavates (or manufactures) and road base material to the Contractor at the Triassic Park Facility.

3.2.5 Select Subbase Supplier

The select subbase Supplier excavates (or manufactures) and delivers select subbase to the contractor at the Triassic Park Facility.

3.2.6 Resin Supplier

The Resin Supplier produces and delivers resin to the Manufacturer of geosynthetic materials or polymer based products such as pipe.

3.2.7 Manufacturer

The Manufacturer manufactures a specific component (e.g., geomembrane, geosynthetic clay liner, geotextile, geocomposite, geonet or pipe) of the proposed liner system and delivers the component to the Contractor at the site. In the General Specifications, the term Manufacturer may refer to the geomembrane Manufacturer, geotextile Manufacturer, geocomposite/geonet Manufacturer, GCL Manufacturer, or pipe Manufacturer.

3.2.8 Construction Quality Assurance Engineer

The CQA Engineer is an individual, firm, or corporation, independent from the Owner, Contractor, and Manufacturer, that observes, tests, and documents activities related to the CQA of the earthworks at the site, and observes, tests, and documents activities related to the CQA of the installation of the geosynthetic components of the liner system. The CQA Engineer observes, tests, and documents activities related to the CQA of pipes and other liner system components. The CQA Engineer must provide an engineer which directly manages the CQA activities who is a Professional Engineer registered in the State of New Mexico. The CQA Engineer may be the same as the Design Engineer, but must be independent from the Owner.

3.2.9 Soils Construction Quality Assurance Laboratory

The Soils CQA Laboratory is independent from the Owner, Gravel Supplier, Granular Material Supplier, and Contractor. The Soils CQA Laboratory conducts tests in the laboratory (which may be on site or off site) on samples of soil taken from the borrow pits, stockpiles, or the liner system.

3.2.10 Geosynthetic CQA Laboratory

The Geosynthetics CQA Laboratory is independent from the Owner, Resin Supplier, Manufacturer, and Contractor. The Geosynthetics CQA Laboratory conducts tests on samples of geosynthetics taken from the site. The Geosynthetics CQA Laboratory may also conduct tests on pipes or other liner system components. The Geosynthetics CQA Laboratory service cannot be provided by any party involved with the manufacture or installation of any of the geosynthetic components.

3.2.11 Owner

The Owner owns and operates the landfill or surface impoundment. In this CQA Plan, the term "Owner" refers specifically to the Triassic Park Waste Disposal Facility.

3.3 QUALIFICATIONS OF THE PARTIES

3.3.1 Design Engineer

The representative of the Design Engineer, who is directly responsible for the project, will be a qualified Professional Engineer registered in the State of New Mexico. The Design Engineer will have a history which demonstrates familiarity with all liner system components, including detailed design methods and procedures.

3.3.2 Geomembrane Installer

The Geomembrane Installer (who may be either the Contractor or a subcontractor to the Contractor) will be trained and qualified to install geosynthetics, as well as other liner system components such as pipe, if necessary.

All personnel performing seaming operations will be qualified by experience (i.e., each seamer will have installed no less than 100,000 square feet of geomembrane using the same methods of seaming that will be used on this project). At least one seamer will have experience seaming a minimum of 1,000,000 square feet of geomembrane using the same method of seaming that will be used on this project. The most experienced seamer, the "master seamer", will provide direct supervision, as required, over less experienced seamers. Field seaming may not take place without an approved master seamer being present.

The Contractor will provide the Owner and CQA Engineer with a list of proposed seaming personnel and their professional records. Any proposed seaming personnel deemed insufficiently experienced will not be accepted by the Owner or will be required to pass a seaming test prior to working on the Project.

3.3.3 Construction Quality Assurance Engineer Personnel

Personnel representing the CQA Engineer shall be properly trained and qualified to test and inspect soils, including high- and low-permeability soils, geosynthetics, including geomembranes, geotextiles, geocomposites, GCLs, and pipe. The CQA Engineer will predominately be represented by a Resident Engineer who has direct responsibility for management of the CQA activities. The CQA Resident Engineer will be experienced in construction, CQA of soils; CQA of geosynthetics and pipe; and preparation of CQA documentation including CQA forms, reports, and plans.

As a minimum, CQA Monitors will have a high school diploma and at least two years of construction related experience and one year of experience conducting CQA monitoring for landfill construction involving both soil and geosynthetic components, or a Bachelor of Science degree from a four year college or university and one year of experience conducting CQA monitoring for landfill construction involving both soil and geosynthetic components. In additions, the lead CQAM's shall be certified in geosynthetic by the National Institute for certification in Engineering technologies (NICET). The number of NICET certified monitors assigned to the work shall comply with the recommendation of EPA as indicated in Table I-1.

TABLE I-1 RECOMENDED IMPLEMENTATION PROGRAM FOR CONSTRUCTION QUALITY ASSURANCE (CQA) FOR GEOSYNTHETICS* (Beginning January 1, 1993)		
No. of Field Crews at Each Site	**End of 18 Months (i.e., June 30, 1994)**	**End of 36 Months (i.e., January 1, 1996)**
1-2	1 - Level II	1 - Level III ***
3-4	1 - Level II 1 - Level I	1 - Level III *** 1 - Level I
≥5	1 - Level II 2 - Level I	1 - Level III*** 1 - Level II 1 - Level I
* Certification for natural materials is under development as of this writing ** Performing a Critical Operation; Typically 4 to 6 People/Crew *** Or PE with applicable experience		
Reference: EPA Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities. EPA/600/R-93/182, September 1993.		

Qualification of CQA Personnel shall be documented by training records and professional resumes, shall be reviewed by the Project Manager.

3.3.4 Soils Construction Quality Assurance Laboratory

The Soils CQA Laboratory will have experience with the physical testing of soils, meet all applicable regulatory requirements, and be familiar with ASTM and other required test standards. The Soils CQA Laboratory will be capable of providing test results in accordance with the specifications.

3.3.5 Geosynthetics Construction Quality Assurance Laboratory

The Geosynthetics CQA Laboratory will have experience in testing geosynthetics and other relevant liner system components and be familiar with ASTM and other applicable test standards.

3.4 DUTIES OF CONSTRUCTION QUALITY ASSURANCE ENGINEER

The overall responsibility of the CQA Engineer is to perform those activities specified in the CQA Plan (e.g., inspection, sampling, testing and documentation final certification). At a minimum, the CQA Engineer will be represented by a CQA Resident Engineer and the necessary supporting CQA inspection personnel. Specific responsibilities of the CQA Resident Engineer may include:

- Reviewing design criteria, plans, and specifications for clarity and completeness so that the CQA Plan can be implemented.

Educating CQA personnel on CQA requirements and procedures.

- Scheduling and coordinating CQA activities.

- Directing and supporting the CQA personnel in performing observations and tests by:

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Figure I-1 Typical Project Organization

- confirming that regular calibration of testing equipment is properly conducted and recorded;

- confirming that the testing equipment, personnel, and procedures do not change adversely over time and verifying that changes do not adversely impact the inspection process;

- confirming that the test data are accurately recorded and maintained; and,

- verifying that the raw data are properly recorded, validated, reduced, summarized, and interpreted.

- Providing to the Owner reports on the observation results including:

  - review and interpretation of data sheets and reports;

  - identification of work that the CQA Resident Engineer believes should be accepted, rejected, or uncovered for observation, or that may require special testing, observation, or approval; and,

  - rejection of defective work and verification that corrective measures are implemented.

- Verifying that the Contractor's construction quality control plan, if required, is in accordance with the site-specific CQA Plan.

- At the Owner's request, reporting to the Contractor results of observations and tests as the work progresses and interacting with the Contractor to provide assistance in modifying the materials and work to comply with the specified design.

- Providing the final report and certifications required by the CQA Plan.

For the supporting CQA personnel, specific responsibilities may include:

- Performing independent on-site observation of the work in progress to verify conformance with the facility design criteria, plans, and specifications;

- Verifying that the equipment used in testing meets the test requirements and that the tests are conducted according to the standardized procedures defined by the CQA plan; and,

- Reporting to the CQA Resident Engineer results of all observation including work that is not of acceptable quality or that fails to meet the specified design.

4.0 SCOPE OF CONSTRUCTION QUALITY ASSURANCE

The scope of this CQA Plan includes the CQA of the subgrade, preparation and soil, pipe, concrete and geosynthetic components of the liner and cover system. This CQA Plan does not address design guidelines, installation specifications, or selection of soils, geosynthetics, pipe or other liner system components, which are all described in the General Specifications.

The CQA Plan does not provide for Construction Quality Control which the Contractor may independently undertake to facilitate the Contractor's achieving his requirements under the General Specifications.

5.0 UNITS

In this CQA Plan, all properties and dimensions are expressed in customary U.S. units.

6.0 REFERENCES

6.1 APPLICABLE ORGANIZATIONS

Organizations whose standards are referenced in the CQA Plan and the General Specifications are as follows:

- NMSH - New Mexico State Highway and Transportation Department of Highways (Standard Specifications for Road and Bridge Construction);
- ASTM - American Society for Testing and Materials;
- GRI - Geosynthetic Research Institute;
- OSHA - Occupational Safety and Health Administration; and,
- USEPA - United States Environmental Protection Agency.

6.2 APPLICABLE STANDARDS

Any reference to standards of any society, institute, association, or governmental agency will pertain to the edition in effect as of the date of this CQA Plan, unless stated otherwise.

6.3 SPECIFIC STANDARDS

Specific test standards which may be cited in the CQA Plan and the General Specifications are given in Table I-2. These standards may be modified due to technological advances since compilation of Table I-2. All such modifications are to be approved by the Owner.

TABLE I-2
TEST METHODS CITED IN GENERAL SPECIFICATIONS AND CQA PLAN

AMERICAN SOCIETY OF TESTING AND MATERIALS		
1.	ASTM A 307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
2.	ASTM A 726	Standard Specification for Cold-Rolled Carbon Steel sheet, Magnetic Laminated Quality, types 1, 2, and 2S
3.	ASTM C 88	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
4.	ASTM C 131	Resistance to Degradation of Small-size coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
5.	ASTM D 374C or D 1777	Method for Measuring Thickness of Geotextile Materials.
6.	ASTM D 413	Standard Test Method for Rubber Property Adhesion to Flexible Substrate.
7.	ASTM D 422	Standard Method for Particle-Size Analysis of Soils.
8.	ASTM D 570	Standard Test Method for Water Absorption of Plastics.

TABLE I-2
TEST METHODS CITED IN GENERAL SPECIFICATIONS AND CQA PLAN

9.	ASTM D 638	Standard Test Method for Tensile Properties of Plastics.
10.	ASTM D 698	Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop.
11.	ASTM D 746	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
12.	ASTM D 751	Standard Methods of Testing Coated Fabrics.
13.	ASTM D 792	Standard Test Methods for Specific Gravity (Relative density) and Density of Plastics by Displacement.
14.	ASTM D 882	Standard Test Methods for Tensile Properties of Thin Plastic Sheeting.
15.	ASTM D 1004	Standard Test Method of Initial Tear Resistance of Plastic film and Sheeting.
16.	ASTM D 1204	Standard Plastics Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
17.	ASTM D 1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
18.	ASTM D 1248	Standard Specification for Polyethylene Plastic Molding and extrusion Metals.
19.	ASTM D 1505	Standard Test Methods for Density of Plastics by Density-Gradient Technique.
20.	ASTM D 1556	Standard Test Method for Density of Soil In Place by the Sand-Cone Method.
21.	ASTM D 1593	Standard Specification for Nonrigid Vinyl Chloride Plastic Sheeting.
22.	ASTM D 1603	Standard Test Method for Carbon Black in Olefin Plastics.
23.	ASTM D 2167	Standard Test Method for Density and Unit Weight of Soils in Place by Rubber Balloon Method.
24.	ASTM D 2216 or D 4643	Standard Method for Laboratory Determination of water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
25.	ASTM D 2434	Standard Test Method for Permeability of Granular Soils (Constant Head).
26.	ASTM D 2487	Standard Test Method for Classification of Soils for Engineering Purposes.
27.	ASTM D 2657	Standard Practice for Heat-Joining for Polyolefin Pipe and Fittings.
28.	ASTM D 2663	Carbon-Black Dispersion in Rubber.
29.	ASTM D 2837	Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
30.	ASTM D 2922	Standard Test Method for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth).
31.	ASTM D 3015	Recommended Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds.
32.	ASTM D 3017	Standard Test Method for Moisture Content of Soil and Rock In Place by Nuclear Methods (Shallow Depth).
33.	ASTM D 3083	Standard Specification for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining.
34.	ASTM D 3350	Standard Specifications for Polyethylene Plastic Pipe and Fittings Materials.
35.	ASTM D 3776	Mass Per Unit Area (Weight) of Woven Fabric.
36.	ASTM D 4253	Standard Test Method for Maximum Index Testing of Soils Using a Vibratory Table.
37.	ASTM D 4254	Standard test Method for Minimum Index Density of Soils and Calculations of Relative Density.
38.	ASTM D 4318	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
39.	ASTM D 4373	Standard Test Method for Calcium Carbonate Content of Soils.
40.	ASTM D 4437	Standard Test Methods for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Geomembranes.
41.	ASTM D 4491	Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method.
42.	ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
43.	ASTM D 4632	Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Elongation Method and Peel Strength).
44.	ASTM D 4643	Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.
45.	ASTM D 4716	Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products.

TABLE I-2 TEST METHODS CITED IN GENERAL SPECIFICATIONS AND CQA PLAN		
46.	ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile
47.	ASTM D 4833	Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
48.	ASTM D 5084	Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
49.	ASTM D 5261	Measuring Mass Per Unit Area of Geotextile
50.	ASTM D 5321	Coefficient of Soil and Geosynthetics or Geosynthetics and Geosynthetics Friction by Direct Shear.
51.	ASTM D 5890	Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.
52.	ASTM 5891	Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.
53.	ASTM E 11	Specification for Wire-Cloth Sieves for Testing Purposes.
54.	ASTM F 714	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
55.	ASTM F 904	Standard Test Method for Comparison of Bond Strength or Ply Adhesion of Similar Laminates Made from Flexible Materials.
GEOSYNTHETIC RESEARCH INSTITUTE		
1.	GRI-GMI	Standard Test Method for Ductile/Brittle Transition Time for Notched Polyethylene Specimen under Constant Stress.
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY		
1.	USEPA Method 9090 Compatibility Test for Wastes and Membrane Liners.	

SECTION II - SOILS CONSTRUCTION QUALITY ASSURANCE

1.0 INTRODUCTION

This section of the CQA Plan addresses the soils components of the liner and cover systems and specifies the soils CQA program to be implemented with regard to materials selection and evaluation, laboratory test requirements, field test requirements, and treatment of problems.

This section of the CQA Plan also addresses for construction of the foundation subgrade, clay liners, clay covers, granular drainage layers, sump and pipe bedding gravel, the protective soil layer, and cover soil.

2.0 EXCAVATED SUBGRADE

2.1 VERIFICATION OF SUBGRADE CONTINUITY

When the excavation of the landfill or surface impoundment is completed, the CQA Engineer will:

- Inspect the subgrade on the side slopes and base of the landfill or surface impoundment and note areas of weak or excessively weathered subgrade materials; and,
- Observe the proof rolling of the base of the landfill or surface impoundment and note areas that exhibit excessive rutting, heaving, or softening.

Backfill material in the excavation will be structural fill or clay liner material that will be placed and compacted. The CQA Engineer will observe any excavation and backfilling operations.

The CQA Engineer will report any problems or deviations from the above requirements to the Owner.

2.2 STRUCTURAL FILL PLACEMENT AND COMPACTION

The General Specifications will be followed for the placement and compaction of structural fill. The CQA Engineer will monitor the fill placement and compaction to verify and document the following:

- The soil being placed meets the General Specification requirements for fill as determined by the test methods and frequencies specified within this CQA Plan;
- The compacted lift thickness is in accordance with the requirements of the General Specifications;
- The previous lift is scarified as specified in the General Specifications before placing the next lift;
- Fill is moisture conditioned, as required in the General Specifications; and,
- The compacted moisture content and dry unit weight of the fill meets specifications as determined by the test methods and frequencies described below.

2.3 CONSTRUCTION QUALITY ASSURANCE EVALUATION

The minimum frequency of soils testing for CQA purposes will conform to the minimum frequencies presented in Table II-1.

Nuclear density meter test methods will be used for the field testing of the in-situ dry unit weight and moisture content of the in-place, compacted fill. Standard Count Calibration, Sand Cone tests and/or Rubber Balloon tests and oven moisture content tests will be conducted to calibrate the results of the nuclear density meter and in cases of uncertainty with the nuclear density meter test results. Any conflict over the test results will be resolved by the CQA Engineer and the Owner. All perforations in the fill will be backfilled in accordance with the General Specifications.

If an in-place density test result fails to meet specifications, a confirmatory test will be performed immediately adjacent to the failed test. If the confirmatory test meets or exceeds specifications then a second confirmatory test will be performed at a second location immediately next to the failed test. If the second confirmatory test also meets or exceeds specifications then the area will be declared as meeting project specifications and the confirmatory tests will be reported. In the event that either confirmatory test fails to meet specifications, then additional testing will be performed to identify the limits of the area that does not meet project specifications.

If a defective area is discovered in the fill, the CQA Engineer will determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Engineer will determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Engineer deems appropriate. If the defect is related to adverse site conditions, such as excessively wet soils or surface desiccation, the CQA Engineer will define the limits and nature of the defect by testing or observation. After the extent and nature of a defect is determined, the CQA Engineer will notify the Owner, and verify that the deficiency is corrected by the Contractor before any additional work is performed in the area of the deficiency.

2.4 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will perform the CQA survey. The CQA Surveyor will independently survey the excavation to confirm that the grades and elevations in the field agree with those shown on the Construction Drawings. CQA Surveys will be conducted in accordance with the requirements described in Part 14 of Section II.

The results of the survey conducted by the CQA Surveyor will be compiled in a report signed by the CQA Surveyor and the CQA Engineer. The CQA Engineer and the Owner will review and approve the survey results before the next phase of the lining system is constructed.

3.0 PREPARED SUBGRADE

3.1 PREPARED SUBGRADE PLACEMENT AND COMPACTION

The CQA Engineer will verify and document that the prepared subgrade is constructed to the elevations, grades, and thicknesses shown on the Construction Drawings, with material meeting the requirements of the General Specifications as determined by the test methods and frequencies specified within this CQA Plan.

Prior to the placement of the prepared subgrade, the CQA Engineer will verify and document that:

- All or an approved portion of the excavation are complete, and that a survey has been conducted to verify that the subgrade grades and elevations conform to the Construction Drawings;
- The subgrade meets specifications as determined by the test requirements of this CQA Plan;
- The surface of the subgrade is free of debris, wet and soft areas, ponded water, vegetation, mud, ice or frozen material; and,
- If frozen subgrade material is encountered, it is removed and replaced in accordance with the General Specifications.

During placement and compaction of the prepared subgrade, the CQA Engineer will verify and document that:

- Close inspection of the placement and compaction of the prepared subgrade with earthmoving equipment is performed by the CQA Engineer;
- The prepared subgrade material meets the requirements of the General Specifications as determined by the CQA testing methods and frequency in Table II-2;
- The prepared subgrade is placed in accordance with the conditions and minimum requirements of the General Specifications;
- Each lift is compacted to the required thickness and minimum dry unit weight within the range of moisture contents established by the General Specifications as determined by the CQA testing methods and frequency in Table II-2;
- The Contractor uses the compaction equipment and the number of passes specified in the General Specifications;
- Perforations in the prepared subgrade at testing and sampling locations are backfilled in accordance with the General Specifications; and,
- The CQA Engineer will document the properties of the prepared subgrade as determined by the test methods and frequency prescribed by this CQA Plan and will report any nonconformance with the General Specifications to the Owner.

3.2 CONSTRUCTION QUALITY ASSURANCE EVALUATION

Construction quality assurance testing is required of the prepared subgrade, and the Contractor must take quality assurance testing into account when planning his construction schedule. Nuclear density meter test methods will be used for testing the in-situ compacted dry unit weight and moisture content of the materials. Standard Count Calibration, Sand Cone and/or Rubber Balloon tests and oven moisture content tests will be used to calibrate the reading of the nuclear density meter and in cases of uncertainty with the nuclear density meter readings. Any discrepancies between test results will be resolved by the CQA Engineer and the Owner. The CQA Engineer will conduct moisture, and density tests as specified in Table II-2.

The testing frequency during prepared subgrade construction may be increased or modified at the discretion of the CQA Engineer when visual observations of construction performance indicate potential problems.

During construction, the frequency of testing may be increased by the CQA Engineer during adverse weather conditions, if equipment breaks down, at the start and finish of grading, if the material fails to meet the requirements of the General Specifications, or the extent of the work area is reduced.

If an in-place density test result fails to meet specifications, a confirmatory test will be performed immediately adjacent to the failed test. If the confirmatory test meets or exceeds specifications then a second confirmatory test will be performed at a second location immediately next to the failed test. If the second confirmatory test also meets or exceeds specifications then the area will be declared as meeting project specifications and the confirmatory tests will be reported. In the event that either confirmatory test fails to meet specifications, then additional testing will be performed to identify the limits of the area that does not meet project specifications.

If a defective area is discovered in the prepared subgrade, the CQA Engineer will determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Engineer will determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Engineer deems appropriate. If the defect is related to adverse site conditions, such as excessively wet soils or surface desiccation, the CQA Engineer will define the limits and nature of the defect by testing or observation. After the extent and nature of a defect is determined and has been remedied by the Contractor, the CQA Engineer will verify that the deficiency is corrected by retesting repaired areas before any additional work is performed by the Contractor in the area of the deficiency.

Based on the requirements of the General Specifications, the Contractor will be required to use all means necessary to protect all prior work, as well as all materials and completed work of other Sections. In the event of damage, the Contractor will be required to immediately make all repairs and replacements necessary. The CQA Engineer will verify and document that all damages are repaired.

3.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will perform the CQA surveys. The CQA Surveyor will independently survey the elevations and grades of the clay liner surfaces, and to confirm that the lines and elevations in the field agree with those shown on the Construction Drawings. CQA surveys will be conducted in accordance with the requirements described in Part 14 of Section II.

The results of the survey conducted by the CQA Surveyor will be compiled in a report signed by the CQA Surveyor and the CQA Engineer, and will be reviewed by the Owner. The owner and the CQA Engineer will approve the survey results before the next phase of the liner system (geomembrane installation) is constructed.

4.0 CLAY LINERS

4.1 CLAY LINER PLACEMENT AND COMPACTION

The CQA Engineer will verify and document that the clay liner is constructed to the elevations, grades, and thicknesses shown on the Construction Drawings, with material meeting the requirements of the General Specifications as determined by the test methods and frequencies specified within this CQA Plan.

Prior to the placement of the clay liner, the CQA Engineer will verify and document that:

- That a test fill has been constructed with the proposed liner material and production scale equipment to confirm processing and placement procedures. In addition, field and laboratory testing shall be completed on the test fill to confirm clay placement specifications will achieve the specified permeability. A test fill plan is presented in Appendix A.

- All or an approved portion of the excavation are complete, and that a survey has been conducted to verify that the subgrade grades and elevations conform to the Construction Drawings;

- The subgrade meets specifications as determined by the test requirements of this CQA Plan;

- The surface of the subgrade is free of debris, wet and soft areas, ponded water, vegetation, mud, ice or frozen material; and,

- If frozen subgrade material is encountered, it is removed and replaced in accordance with the General Specifications.

During placement and compaction of the clay liner, the CQA Engineer will verify and document that:

- Close observation of the placement and compaction of clay liner material with earthmoving equipment is performed by the CQA Engineer;

- The clay liner material meets the requirements of the General Specifications as determined by the CQA testing methods and frequency in Table II-3;

- The clay liner is placed in accordance with the conditions and minimum requirements of the General Specifications;

- Each lift is compacted to the required thickness and minimum dry unit weight within the range of moisture contents established by the General Specifications as determined by the CQA testing methods and frequency in Table II-3;

- The Contractor uses the compaction equipment and the number of passes specified in the General Specifications;

- Thin-walled (i.e., Shelby tube) samples of clay liner material are collected and laboratory permeability testing is performed at the frequency specified in Table II-3;

- Perforations in the clay liner at testing and sampling locations are backfilled in accordance with the General Specifications; and,

- Excessive wrinkles in the geosynthetic components underlying the clay have been "worked" out.

The CQA Engineer will document the properties of the clay soil as determined by the test methods and frequency prescribed by this CQA Plan and will report any nonconformance with the General Specifications to the Owner.

4.2 CONSTRUCTION QUALITY ASSURANCE EVALUATION

Extensive construction quality assurance testing is required of the clay liners, and the Contractor must take quality assurance testing into account when planning his construction schedule. Nuclear density meter test methods will be used for testing the in-situ compacted dry unit weight and moisture content of the clay materials. Standard Count Calibration, Sand Cone and/or Rubber Balloon tests and oven moisture content tests will be used to calibrate the reading of the nuclear density meter and in cases of uncertainty with the nuclear density meter readings. Any discrepancies between test results will be resolved by the CQA Engineer and the Owner. Thin-walled (i.e., Shelby) tube samples will be collected for hydraulic conductivity testing. At the request of the CQA Engineer, on-site construction equipment operated by the Contractor will be used to slowly push the sample tube through the clay layer. The CQA Engineer will conduct moisture, density, and hydraulic conductivity tests as specified in Table II-3.

The testing frequency during clay liner construction may be increased or modified at the discretion of the CQA Engineer when visual observations of construction performance indicate potential problems or when field experience with the proposed soil liner material have been obtained.~~.~~

During construction, the frequency of testing may be increased by the CQA Engineer during adverse weather conditions, if equipment breaks down, at the start and finish of grading, if the material fails to meet the requirements of the General Specifications, or the extent of the work area is reduced.
All perforations in the clay liner at nuclear density test probe locations will be backfilled by the CQA Engineer with clay liner material and compacted by hand tamping. All perforations at sand cone or rubber balloon test locations, Shelby tube sample locations, and test pit locations will be backfilled by the Contractor with clay liner material and compacted in accordance with the specifications for clay liner.

If an in-place density test results fail to meet specifications, a confirmatory test will be performed immediately adjacent to the failed test. If the confirmatory test meets or exceeds specifications then a second confirmatory test will be performed at a second location immediately next to the failed test. If the second confirmatory test also meets or exceeds specifications then the area will be declared as meeting project specifications and the confirmatory tests will be reported. In the event that either confirmatory test fails to meet specifications, then additional testing will be performed to identify the limits of the area that does not meet project specifications.

If a defective area is discovered in the clay liner, the CQA Engineer will determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Engineer will determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Engineer deems appropriate. If the defect is related to adverse site conditions, such as excessively wet soils or surface desiccation, the CQA Engineer will define the limits and nature of the defect by testing or observation. After the extent and nature of a defect is determined and has been remedied by the Contractor, the CQA Engineer will verify that the deficiency is corrected by retesting repaired areas before any additional work is performed by the Contractor in the area of the deficiency.

Based on the requirements of the General Specifications, the Contractor will be required to use all means necessary to protect all prior work, as well as all materials and completed work of other Sections. In the event of damage, the Contractor will be required to immediately make all repairs and replacements necessary. The CQA Engineer will verify and document that all damages are repaired.

4.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will perform the CQA surveys. The CQA Surveyor will independently survey the elevations and grades of the clay liner surfaces, and to confirm that the lines and elevations in the field agree with those shown on the Construction Drawings. CQA surveys will be conducted in accordance with the requirements described in Part 14 of Section II.

The results of the survey conducted by the CQA Surveyor will be compiled in a report signed by the CQA Surveyor and the CQA Engineer, and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the survey results before the next phase of the liner system (geomembrane installation) is constructed.

5.0 DRAINAGE GRAVEL

5.1 SUPPLIER

The Contractor will require that the drainage gravel Supplier provide the CQA Engineer with quality control test results and a written certification signed by a responsible party of the Supplier that the tests required by the General Specifications have been performed on the material to be delivered to the site.

The CQA Engineer will examine the tests results and report any deviations to the Owner. If the drainage gravel supplier cannot provide test results required by the general specifications, then the CQA Engineer may perform or arrange to perform the tests.

5.2 CONFORMANCE EVALUATION

The test methods and frequency for CQA conformance testing of the drainage gravel are specified in Table II-4.

If the material fails to meet the requirements of the General Specifications, the CQA Engineer will perform sufficient sampling and testing to identify the extent of the nonconforming material at the expense of the Contractor. Nonconforming material will be removed from the site.

5.3 PLACEMENT AND COMPACTION

The CQA Engineer will verify and document that the drainage gravel is constructed to the elevations, grades, and thicknesses shown on the Construction Drawings, with material meeting the requirements of the General Specifications as determined by the test methods and frequencies specified within this CQA Plan.

Prior to the placement of the drainage gravel, the CQA Engineer will verify and document that:

- The underlying geosynthetic layers are free of holes, tears, excessive wrinkles, or foreign objects; and,
- All work on underlying layers is complete and accepted by the Owner.

During placement and compaction of the drainage gravel, the CQA Engineer will verify and document that:

- Drainage gravel material satisfies the requirements of the General Specifications as determined by the testing prescribed within the CQA Plan;
- Drainage gravel material is spread before 12:00 noon, unless otherwise approved by the Owner;
- The equipment wheel ground pressure versus the material thickness requirements given in the General Specifications are complied with;
- The drainage gravel is placed in a manner so that the maximum material drop height is in accordance with the General Specifications;
- Close observation of the placement and compaction of drainage gravel with earth moving equipment is performed; and,
- The drainage gravel is compacted utilizing the equipment and number of passes specified in the General Specifications.

5.4 CONSTRUCTION QUALITY ASSURANCE EVALUATION

No density tests will be conducted on the drainage gravel. If the CQA Engineer suspects damage to pipes or underlying geosynthetic, the contractor will be required to expose the potentially damaged materials and repair any observed damage.

5.5 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will perform CQA surveys. The CQA surveyor will independently survey the elevations and grades of the top of the drainage gravel, and to confirm that the grades and elevations in the field agree with those shown on the Construction Drawings. The CQA surveys will be performed in accordance with the requirements described in Part 14 of Section II.

The results of the survey conducted by the CQA Surveyor will be compiled in a report signed by the CQA Surveyor and the CQA Engineer, and will be reviewed by the Owner. The Owner and CQA Engineer will approve the survey results before the next phase of the lining system is constructed.

6.0 ROAD BASE

6.1 SUPPLIER

The Contractor will provide the CQA Engineer with quality control test results and a written certification signed by a responsible party of the road base Supplier that the tests required by the

General Specifications have been performed on material representative of that which is to be delivered to the site.

The CQA Engineer will examine the tests results and report any deviations from the General Specifications to the Owner. If the road base Supplier cannot provide test results required by the General Specifications, then the CQA Engineer may perform or arrange to perform the tests.

6.2 CONFORMANCE EVALUATION

The test methods and frequency for CQA testing of the road base is specified in Table II-5.

If the gravel fails to meet the requirements of the General Specifications, the CQA Engineer will perform sufficient sampling and testing to identify the extent of the nonconforming material with the cost of such tests borne by the Contractor. Nonconforming material will be removed from the site.

6.3 PLACEMENT

The CQA Engineer will verify and document that the road base is constructed to the elevations, grades, and thicknesses shown on the Construction Drawings, with material meeting the requirements of the General Specifications as determined by the test methods and frequencies specified within this CQA Plan.

Prior to the placement of the road base, the CQA Engineer will verify and document that:

- The underlying geotextile is free of holes, tears, excessive wrinkles, or foreign objects; and,
- All work on underlying layers is complete and accepted by the Owner.

During placement of the road base, the CQA Engineer will verify and document that:

- Close observation of the placement of road base with earth-moving equipment is performed;
- The road base is suitable and meets the requirements of the General Specifications as determined by the test methods and frequency prescribed within this CQA Plan; and,
- The road base is placed in accordance with the General Specifications.

6.4 CONSTRUCTION QUALITY ASSURANCE EVALUATION

Nuclear density tests will be used for testing the in-situ dry unit weight and moisture content of the road base. If the CQA Engineer suspects damage to underlying geosynthetics, the Contractor will be required to expose the potentially damaged materials and repair any observed damage.

7.0 COVER SOIL

7.1 PLACEMENT AND COMPACTION

The CQA Engineer will verify and document that the cover soil is constructed to the elevations, grades, and thicknesses shown on the Construction Drawings, with material meeting the requirements of the General Specifications as determined by the test methods and frequencies specified within this CQA Plan.

Prior to the placement of the cover soil, the CQA Engineer will verify and document that:

- All or an approved portion of the waste filling plan is complete, and that a survey has been conducted to verify that the waste grades and elevations conform to the Construction Drawings;
- The surface of the subgrade is free of debris, wet and soft areas, ponded water, vegetation, mud, ice or frozen material; and,

During placement and compaction of the cover soil, the CQA Engineer will verify and document that:

- Close observation of the placement and compaction of cover soil with earthmoving equipment is performed by the CQA Engineer;
- The cover soil meets the requirements of the General Specifications as determined by the CQA testing methods and frequency in Table II-6;
- The cover soil is placed in accordance with the conditions and minimum requirements of the General Specifications;
- Each lift is compacted to the required thickness and minimum dry unit weight within the range of moisture contents established by the General Specifications as determined by the CQA testing methods and frequency in Table II-6;
- The Contractor uses the compaction equipment and the number of passes specified in the General Specifications; and,
- The CQA Engineer will document the properties of the cover soil as determined by the test methods and frequency prescribed by this CQA Plan and will report any nonconformance with the General Specifications to the Owner.

7.2 CONSTRUCTION QUALITY ASSURANCE EVALUATION

Nuclear density tests will be used for testing the in-situ unit weight and moisture content of the cover soil.

The Contractor will be required to use all means necessary to protect all prior work, as well as all material and completed work of other Sections. In the event of damage, the Contractor will be required to immediately make all repairs and replacements necessary. The CQA Engineer will verify and document that all damages are repair.

7.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will perform the CQA surveys. The CQA Surveyor will independently survey the elevations and grades of the cover soil to confirm that the lines and elevations in the field agree with those shown on the Construction Drawings. CQA surveys will be conducted in accordance with the requirements described in Part 14 of Section II.

The results of the survey conducted by the CQA Surveyor will be compiled in a report signed by the CQA Surveyor and the CQA Engineer, and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the survey results before the next phase of construction.

8.0 VEGETATIVE COVER

8.1 PLACEMENT AND COMPACTION

The CQA Engineer will verify and document that the vegetative cover is constructed to the elevations, grades, and thicknesses shown on the Construction Drawings, with material meeting the requirements of the General Specifications as determined by the test methods and frequencies specified within this CQA Plan.

Prior to the placement of the vegetative cover, the CQA Engineer will verify and document that:

- All work on underlying layers is complete and accepted by Owner; and,
- The underlying geocomposite is free of holes, team, excessive wrinkles, or foreign objects.

During placement and compaction of the vegetative cover, the CQA Engineer will verify and document that:

- Close observation of the placement and compaction of vegetative cover with earthmoving equipment is performed;
- The vegetative cover meets the requirements of the General Specifications as determined by the CQA testing methods and frequency in Table II-7;
- The vegetative cover is placed in accordance with the conditions and minimum requirements of the General Specifications;
- The Contractor uses the compaction equipment and the number of passes specified in the General Specifications; and,
- The CQA Engineer will document the properties of the vegetative cover as determined by the test methods and frequency prescribed by this CQA Plan and will report any nonconformance with the General Specifications to the Owner.

8.2 CONSTRUCTION QUALITY ASSURANCE EVALUATION

The Contractor will be required to use all means necessary to protect all prior work, as well as all material and completed work of other Sections. In the event of damage, the Contractor will be required to immediately make all repairs and replacements necessary. The CQA Engineer will verify and document that all damages are repair.

8.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will perform the CQA surveys. The CQA Surveyor will independently survey the elevations and grades of the vegetative cover to confirm that the lines and elevations in the field agree with those shown on the Construction Drawings. CQA surveys will be conducted in accordance with the requirements described in Part 14 of Section II.

The results of the survey conducted by the CQA Surveyor will be compiled in a report signed by the CQA Surveyor and the CQA Engineer, and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the survey results before the next phase of construction.

9.0 PIPE BEDDING SAND

9.1 PLACEMENT AND COMPACTION

The CQA Engineer will verify and document that the pipe bedding is constructed to the elevations, grades, and thicknesses shown on the Construction Drawings, with material meeting the requirements of the General Specifications as determined by the test methods and frequencies specified within this CQA Plan.

Prior to the placement of the pipe bedding sand, the CQA Engineer will verify and document that:

- All work on underlying layers is complete and accepted by the Owner; and,
- The underlying geotextile is free of holes, tears, excessive wrinkles, or foreign objects.

During placement and compaction of the pipe bedding sand, the CQA Engineer will verify and document that:

- Close observation of the placement and compaction of pipe bedding with earthmoving equipment is performed;
- The pipe bedding sand meets the requirements of the General Specifications as determined by the CQA testing methods and frequency in Table II-8;
- The pipe bedding sand is placed in accordance with the conditions and minimum requirements of the General Specifications;
- The Contractor uses the compaction equipment and the number of passes specified in the General Specifications; and,
- The CQA Engineer will document the properties of the pipe bedding sand as determined by the test methods and frequency prescribed by this CQA Plan and will report any nonconformance with the General Specifications to the Owner.

9.2 CONSTRUCTION QUALITY ASSURANCE EVALUATION

The Contractor will be required to use all means necessary to protect all prior work, as well as all material and completed work of other Sections. In the event of damage, the Contractor will be required to immediately make all repairs and replacements necessary. The CQA Engineer will verify and document that all damages are repair.

9.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will perform the CQA surveys. The CQA Surveyor will independently survey the elevations and grades of the pipe bedding sand to confirm that the lines and elevations in the field agree with those shown on the Construction Drawings. CQA surveys will be conducted in accordance with the requirements described in Part 14 of Section II.

The results of the survey conducted by the CQA Surveyor will be compiled in a report signed by the CQA Surveyor and the CQA Engineer, and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the survey results before the next phase of construction.

10.0 SELECT SUBBASE

10.1 PLACEMENT AND COMPACTION

Prior to the placement of the select subbase, the CQA Engineer will verify and document that:

- All work on underlying layers is complete and accepted by the Owner; and,
- The underlying geocomposite is free of holes, tears, excessive wrinkles, or foreign objects.

During placement and compaction of the select subbase, the CQA Engineer will verify and document that:

- Close observation of the placement and compaction of select subbase with earthmoving equipment is performed by the CQA Engineer;
- The select subbase meets the requirements of the General Specifications as determined by the CQA testing methods and frequency in Table II-9;
- The select subbase is placed in accordance with the conditions and minimum requirements of the General Specifications;
- Each lift is compacted to the required thickness and minimum dry unit weight within the range of moisture contents established by the General Specifications as determined by the CQA testing methods and frequency in Table II-9;
- The Contractor uses the compaction equipment and the number of passes specified in the General Specifications; and,

- The CQA Engineer will document the properties of the select subbase as determined by the test methods and frequency prescribed by this CQA Plan and will report any nonconformance with the General Specifications to the Owner.

10.2 CONSTRUCTION QUALITY ASSURANCE EVALUATION

Nuclear density tests will be used for testing the in-situ unit weight and moisture content of the select subbase.

The Contractor will be required to use all means necessary to protect all prior work, as well as all material and completed work of other Sections. In the event of damage, the Contractor will be required to immediately make all repairs and replacements necessary. The CQA Engineer will verify and document that all damages are repair.

10.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will perform the CQA surveys. The CQA Surveyor will independently survey the elevations and grades of the select subbase to confirm that the lines and elevations in the field agree with those shown on the Construction Drawings. CQA surveys will be conducted in accordance with the requirements described in Part 14 of Section II.

The results of the survey conducted by the CQA Surveyor will be compiled in a report signed by the CQA Surveyor and the CQA Engineer, and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the survey results before the next phase of construction.

11.0 SUBBASE

11.1 PLACEMENT AND COMPACTION

The CQA Engineer will verify and document that the subbase is constructed to the elevations, grades, and thicknesses shown on the Construction Drawings, with material meeting the requirements of the General Specifications as determined by the test methods and frequencies specified within this CQA Plan.

Prior to the placement of subbase, the CQA Engineer will verify and document that:

- All work on underlying layers is complete and accepted by the Owner.

During placement and compaction of the subbase, the CQA Engineer will verify and document that:

- Close observation of the placement and compaction of subbase with earthmoving equipment is performed by the CQA Engineer;
- The subbase meets the requirements of the General Specifications as determined by the CQA testing methods and frequency in Table II-10;
- The subbase is placed in accordance with the conditions and minimum requirements of the General Specifications;

- Each lift is compacted to the required thickness and minimum dry unit weight within the range of moisture contents established by the General Specifications as determined by the CQA testing methods and frequency in Table II-10; and,

- The Contractor uses the compaction equipment and the number of passes specified in the General Specifications;

- The CQA Engineer will document the properties of the subbase as determined by the test methods and frequency prescribed by this CQA Plan and will report any nonconformance with the General Specifications to the Owner.

11.2 CONSTRUCTION QUALITY ASSURANCE EVALUATION

Nuclear density tests will be used for testing the in-situ unit weight and moisture content of the subbase.

The Contractor will be required to use all means necessary to protect all prior work, as well as all material and completed work of other Sections. In the event of damage, the Contractor will be required to immediately make all repairs and replacements necessary. The CQA Engineer will verify and document that all damages are repair.

11.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will perform the CQA surveys. The CQA Surveyor will independently survey the elevations and grades of the subbase to confirm that the lines and elevations in the field agree with those shown on the Construction Drawings. CQA surveys will be conducted in accordance with the requirements described in Part 14 of Section II.

The results of the survey conducted by the CQA Surveyor will be compiled in a report signed by the CQA Surveyor and the CQA Engineer, and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the survey results before the next phase of construction.

12.0 FOUNDATION SAND

12.1 PLACEMENT AND COMPACTION

The CQA Engineer will verify and document that the foundation sand is constructed to the elevations, grades, and thicknesses shown on the Construction Drawings, with material meeting the requirements of the General Specifications as determined by the test methods and frequencies specified within this CQA Plan.

Prior to the placement of the foundation sand, the CQA Engineer will verify and document that:

- All work on underlying layers is complete and accepted by the Owner; and,

- The underlying geomembrane is free of holes, tears, excessive wrinkles, or foreign objects.

During placement and compaction of the foundation sand, the CQA Engineer will verify and document that:

- Close observation of the placement and compaction of foundation sand with earthmoving equipment is performed;
- The foundation sand meets the requirements of the General Specifications as determined by the CQA testing methods and frequency in Table II-11;
- The foundation sand is placed in accordance with the conditions and minimum requirements of the General Specifications;
- Each lift is compacted to the required thickness and minimum dry unit weight within the range of moisture contents established by the General Specifications as determined by the CQA testing methods and frequency in Table II-11;
- The Contractor uses the compaction equipment and the number of passes specified in the General Specifications; and,
- The CQA Engineer will document the properties of the foundation sand as determined by the test methods and frequency prescribed by this CQA Plan and will report any nonconformance with the General Specifications to the Owner.

12.2 CONSTRUCTION QUALITY ASSURANCE EVALUATION

Nuclear density tests will be used for testing the in-situ unit weight and moisture content of the foundation sand.

The Contractor will be required to use all means necessary to protect all prior work, as well as all material and completed work of other Sections. In the event of damage, the Contractor will be required to immediately make all repairs and replacements necessary. The CQA Engineer will verify and document that all damages are repair.

12.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will perform the CQA surveys. The CQA Surveyor will independently survey the elevations and grades of the foundation sand to confirm that the lines and elevations in the field agree with those shown on the Construction Drawings. CQA surveys will be conducted in accordance with the requirements described in Part 14 of Section II.

The results of the survey conducted by the CQA Surveyor will be compiled in a report signed by the CQA Surveyor and the CQA Engineer, and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the survey results before the next phase of construction.

13.0 PROTECTIVE SOIL LAYER

13.1 PLACEMENT AND COMPACTION

The CQA Engineer will verify and document that the protective soil layer is constructed to the elevations, grades, and thicknesses shown on the Construction Drawings, with material meeting the requirements of the General Specifications as determined by the test methods and frequencies specified within this CQA Plan.

Prior to the placement of the protective soil layer, the CQA Engineer will verify and document that:

- The underlying geocomposite is free of holes, tears, excessive wrinkles, or foreign objects; and,
- All work on underlying layers is complete and accepted by the Owner.

During placement of the protective soil layer, the CQA Engineer will verify and document that:

- The soil is suitable and satisfies the requirements of the General Specifications as determined by the test methods and frequencies prescribed in Table 11-12;
- The protective soil is placed in accordance with the General Specifications;
- The lift thicknesses and total thickness of the protective soil layer agree with the requirements of the General Specifications;
- If excessive wrinkles begin to develop in the underlying geosynthetics during material placement or spreading, the wrinkles are worked out prior to continued placement operations;
- The protective soil layer is lightly compacted as described in the General Specifications;
- The protective soil is placed on the side slopes to the limits shown on the construction drawings; and,
- No protective soil layer material is placed or compacted during periods of unfavorable weather conditions.

13.2 CONFORMANCE EVALUATION

There are no CQA testing requirements for the protective soil layer, other than thickness requirements.

If damage to underlying geosynthetics is expected, the CQA Engineer will require that the overlying protective soil layer material be removed to expose the geosynthetics.

The Contractor will be required to use all means necessary to protect all prior work, as well as all materials and completed work of other Sections. In the event of damage, the Contractor will be required to immediately make all repairs and replacements necessary. The CQA Engineer will verify and document that all damages are repaired.

13.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will perform the CQA surveys. The CQA surveyor will independently survey the elevations and grades of the top of the protective soil layer on the base and side-slopes of the landfill, and to confirm that the grades and elevations in the field agree with those shown on the Construction Drawings. The CQA surveys will be performed in accordance with the requirements described in Part 14 of Section II. The results of the survey conducted by the CQA Surveyor will be compiled in a report signed by the CQA Surveyor and the CQA Engineer, and will be reviewed by the Owner.

14.0 SURVEYING

The Surveyor will be required to survey each soil layer of the liner system and cover system (except the vegetative soil cover) for the landfill or surface impoundment in accordance with the requirements of the General Specifications. If required by the Owner, a Record Drawing will be submitted by the Surveyor before the placement of the next liner system layer. The surveys will be conducted at a 100 foot grid for slopes greater than 25 percent and at 50 foot grid for slopes less than 25 percent. All pipes for leachate detection, collection and/or removal will be surveyed at start and end points and at 50 foot intervals in between. The CQA survey will include enough information to confirm that the following features of the landfill or surface impoundment are constructed in accordance with the Construction Drawings:

- Toe of slope;
- Crest of slope;
- Grade breaks;
- Anchor trench;
- Leachate collection sump Leak detection sump;
- Permanent sump (landfills only); and,
- Perimeter drainage ditches.

The CQA results will be submitted to the Owner for final approval to proceed on the liner system construction.

TABLE II-1
MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF STRUCTURAL FILL

Test	Frequency	Standard Test Method
Material Properties		
Modified Proctor	1 per 5,000 cy placed (minimum 1 per source)	ASTM D 1557
Sieve Analysis	1 per 5,000 cy placed (minimum 1 per source)	ASTM D 422
Atterberg Limits	1 per 5,000 cy placed (minimum 1 per source)	ASTM D 4318
IN PLACE		
Nuclear Density Meter (50 ft. Grid)		
In-Situ Moisture Content	1 per 2,500 ft^2 per lift	ASTM D 3017
In-Situ Dry Unit Weight	1 per 2,500 ft^2 per lift	ASTM D 2922
Calibration And Check		
Standard Count Calibration or Sandstone	1 per day of fill placement	ASTM D 1556/D2922
Oven Moisture Contents (In-Situ Moisture Content)	1 per day of fill placement	ASTM D 2216

TABLE II-2 MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF PREPARED SUBGRADE		
Test	**Frequency**	**Standard Test Method**
Modified Proctor	**1 per 250,000 SF**	**ASTM D 1557**
IN PLACE		
Nuclear Density Meter (50 ft. Grid)		
In-Situ Moisture Content	1 per 2,500 ft^2 per lift	ASTM D 3017
In-Situ Dry Unit Weight	1 per 2,500 ft^2 per lift	ASTM D 2922
Calibration and Check		
Sand Cone (In-Situ Density)	1 per day of fill placement	ASTM D 1556
Oven Moisture Content (In-Situ Moisture Content)	1 per day of fill placement	ASTM D 2216
Material Properties		
Sieve Analysis	1 per 125,000 ft^2	ASTM D 422
Atterberg Limits	1 per 125,000 ft^2	ASTM D 4318

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TABLE II-3 MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF CLAY LINER		
Test	**Frequency**	**Standard Test Method**
Material Properties		
Recompacted Permeability (moisture content and dry density inside placement window)	1 per 5,000 cy placed (minimum 1 per source)	ASTM D 5084
Sieve Analysis	1 per 1,053 ~~3,000~~ cy placed (minimum 1 per source)	ASTM D 422
Atterberg Limits	1 per 1,053 cy placed (minimum 1 per source)	ASTM D 4318
Compaction~~Atterberg Limits~~	1 per 5,263 cy placed (minimum 1 per source)~~1 per 3,000 cy placed (minimum 1 per source)~~	ASTM D 1557~~ASTM D 4318~~
IN PLACE		
Lift Thickness Before Compaction	1 per 2,500 ft^2 per lift	Field Measurement
Nuclear Density Meter(1) (50 ft. Grid)		
In-Situ Moisture Content	5/ac/lift~~1 per 300 ccy~~	ASTM D 3017
In-Situ Dry Unit Weight	5/ac/lift~~1 per 300 ccy~~	ASTM D 2922
Calibration and Check		
~~Standard Count Calibration,~~ Sand Cone or Rubber Balloon (In-Situ Density)	1 per 20 ~~day~~nuclear densities ~~of fill placement~~	ASTM D 1556/D 2167~~/D2922~~
Oven Moisture Contents (In-situ Moisture Content)	1 per 10 nuclear moisture ~~day of fill placement~~	ASTM D 2216
Permeability		
Shelby tube Samples	1/acre/lift~~for every 1,000 cu. yd. placed~~	ASTM D 5084

TABLE II-4
MINIMUM FREQUENCY OF TESTING
FOR CQA EVALUATION OF DRAINAGE GRAVEL

Test	Frequency	Standard Test Method
Material Properties		
Sieve Analysis	1 per 500 cy placed (minimum 1 per source)	ASTM D 422
Permeability	1 per source	ASTM D 2434

TABLE II-5
MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF ROAD BASE

Test	Frequency	Standard Test Method
Material Properties		
Sieve Analysis	1 per 1000 cy placed (minimum 1 per source)	ASTM D 422
Modified Proctor	1 per 1000 cy placed (minimum 1 per source)	ASTM D 1557
IN PLACE		
In-Situ Moisture Content	1 per 300 cy	ASTM D 3017
In-Situ Dry Unit Weight	1 per 300 cy	ASTM D 2922

TABLE II-6
MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF SOIL COVER

Test	Frequency	Standard Test Method
Material Properties		
Sieve Analysis	1 per 3000 cy placed (minimum 1 per source)	ASTM D 422
Atterberg Limits	1 per 3000 cy placed (minimum 1 per source)	ASTM D 4318
IN PLACE		
In-Situ Moisture Content	1 per 300 ft^2 per lift	ASTM D 3017
In-Situ Dry Unit Weight	1 per 300 ft^2 per lift	ASTM D 2922

TABLE II-7
MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF VEGETATIVE COVER

Test	Frequency	Standard Test Method
Material Properties		
Sieve Analysis	1 per 3000 cy placed (minimum 1 per source)	ASTM D 422
Atterberg Limits	1 per 3000 cy placed (minimum 1 per source)	ASTM D 4318

TABLE 11-8
MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF PIPE BEDDING SAND

Test	Frequency	Standard Test Material
Material Properties		
Sieve Analysis	1 per 500 cy placed	ASTM D 422
Atterberg Limits	1 per 500 cy placed	ASTM D 4318

TABLE II-9
MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF SELECT SUBBASE

Test	Frequency	Standard Test Method
Material Properties		
Sieve Analysis	1 per 1,000 cy placed (minimum 1 per source)	ASTM D 422
Modified Proctor	1 per 1,000 cy placed (minimum 1 per source)	ASTM D 1557
IN PLACE		
In-Situ Moisture Content	1 per 300 cy	ASTM D 3017
In-Situ Dry Unit Weight	1 per 300 cy	ASTM D 2922

TABLE II-10
MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF SUBBASE

Test	Frequency	Standard Test Method
Material Properties		
Sieve Analysis	1 per 1,000 cy placed (minimum 1 per source)	ASTM D 422
Modified Proctor	1 per 1,000 cy placed (minimum 1 per source)	ASTM D 1557
IN PLACE		
In-Situ Moisture Content	1 per 300 cy	ASTM D 3017
In-Situ Dry Unit Weight	1 per 300 cy	ASTM D 2922

TABLE II-11
MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF FOUNDATION SAND

Test	Frequency	Standard Test Method
Material Properties		
Sieve Analysis	1 per 1000 cy placed (minimum 1 per source)	ASTM D 422
Modified Proctor	1 per 1000 cy placed(minimum 1 per source)	ASTM D 1557
IN PLACE		
In-Situ Moisture Content	1 per 300 cy	ASTM D 3017
In-Situ Dry Unit Weight	1 per 300 cy	ASTM D 2922

TABLE II-12
MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF PROTECTIVE SOIL

Test	Frequency	Standard Test Method
Material Properties		
Sieve Analysis	1 per 5,000 cy placed (minimum 1 per source)	ASTM D 422
Atterberg Limits	1 per 5,000 cy placed (minimum 1 per source)	ASTM D 4318

SECTION III - GEOSYNTHETIC CLAY LINER CONSTRUCTION QUALITY ASSURANCE

1.0 GEOSYNTHETIC CLAY LINER MANUFACTURE AND DELIVERY

1.1 MANUFACTURE AND QUALITY CONTROL

Prior to the installation of the Geosynthetic Clay Liner (GCL), the Contractor will be required to provide the CQA Engineer with the following information from the GCL Manufacturer:

- The certification required by the General Specifications signed by a responsible party employed by the GCL Manufacturer based on sampling interval of 1/ 50,000 ft^2; and,
- The manufacturing quality control certificates for each shift's production of GCL, signed by a responsible party employed by the GCL Manufacturer (such as the production manager). The quality control certificates will include:
  - Roll numbers and identification; and,
  - Sampling procedures and results of quality control tests specified by the General Specifications including descriptions of the test methods used for GCL rolls assigned to the Triassic Park project.

The CQA Engineer will verify and document that:

- The property values certified by the GCL Manufacturer meet all of the specified values listed in the General Specifications;
- The measurements of properties by the GCL Manufacturer are properly documented and the test methods used are in accordance with the General Specifications; and,
- The quality control certificates have been provided at the specified frequency for GCL rolls, and each certificate identifies the rolls or batch number related to that certificate.

The CQA Engineer will report deviations from the above requirements to the Owner prior to installation of the GCL.

1.2 LABELING

The CQA Engineer will verify and document that the GCL Manufacturer has labeled each roll of GCL as specified in the General Specifications.

The CQA Engineer will examine GCL rolls upon delivery and deviation from the above requirements will be reported to the Owner prior to installation of the GCL.

1.3 TRANSPORTATION AND HANDLING

The CQA engineer will observe and document the type of GCL handling equipment used by the installer is consistent with handling equipment identified in the general specifications.

Upon delivery at the site, the CQA Engineer will conduct a visual inspection of all rolls for defects and for damage. This examination will be conducted without unrolling rolls unless visible defects or damages are found. The CQA Engineer will indicate to the Owner:

- Any rolls that should be unrolled to allow for their inspection;

- Any rolls, or portions thereof, which should be rejected and removed from the site because they have severe flaws; and,

- Any rolls which include minor repairable flaws.

1.4 STORAGE

The CQA Engineer will verify and document that storage of the GCL is in accordance with the General Specifications.

1.5 QUALITY ASSURANCE CONFORMANCE TESTING

Either at the Manufacture's plant or upon delivery of the rolls of GCL, the CQA Engineer will ensure that samples are removed at the specified frequency and forwarded to the Geosynthetics CQA Laboratory for testing to verify and document conformance with the General Specifications.

Unless otherwise specified, samples will be taken at a rate of one per lot or one per 100,000 ft^2 whichever is greater. These samples will be tested for:

- Bentonite Moisture Content ASTM D 4643
- GCL Grab Strength, Elongation, Per Strength ASTM D 4632
- GCL Permeability ASTM D 5084
- GCL Interface Shear Strength ASTM D 5321

Conformance samples will be taken across the entire width of the roll and will not include the first 3 feet along the length of the roll. Unless otherwise specified, samples will be 1.5 feet (minimum) long by the roll width. The CQA Engineer will mark the machine direction on the samples with an arrow.

The CQA Engineer will examine all results from laboratory conformance testing and will compare the results to the specifications presented in Table 02780-1 of the Specifications. In addition, the CQA Engineer will report any nonconformance to the Owner as soon as practical after the test results become available.

The following procedure will apply whenever a sample fails a conformance test that is conducted by the Geosynthetics CQA Laboratory:

- The Contractor will be required to replace the roll (or rolls) of GCL that is not in conformance with the specifications with a roll that meets the requirements of the General Specifications.

- The CQA Engineer will ensure that conformance samples are removed for testing by the Geosynthetics CQA Laboratory from the closest numerical roll on both sides of the roll from which the failing sample was obtained. These two samples must pass the above conformance tests. If either of these samples fail to meet the requirements, samples will be collected from the five numerically closest untested rolls on both sides of the failed samples and tested by the Geosynthetics CQA Laboratory. These ten samples must pass the above conformance tests. If any of these samples fail, a sample from every roll of GCL on site and a sample from every roll that is subsequently delivered from the same Manufacturer must be conformance tested by the Geosynthetics CQA Laboratory. The cost of all such tests are to be borne by the Contractor.

The CQA Engineer will document actions taken in conjunction with conformance test failures and report all actions to the Owner.

2.0 GEOSYNTHETIC CLAY LINER INSTALLATION

2.1 EARTHWORKS

2.1.1 Surface Preparation

The Contractor or subcontractor responsible for GCL installation will be required to certify in writing that the surface on which the GCL will be installed is acceptable. The certificate of acceptance will be required to be given by the Contractor to the CQA Engineer, who will then verify to the Owner that the subgrade and/or clay liner installation is accepted immediately prior to commencement of GCL installation in the area under consideration.

After the surface on which the GCL is to be installed has been accepted by the Contractor responsible for GCL installation, it will be the CQA Engineer's responsibility to indicate to the Owner any change in the underlying layer that may, in accordance with the General Specifications, require repair work. If the Owner requires repair work, then it will be the responsibility of the Contractor to repair the underlying layer.

2.1.2 Anchor Trenches

The CQA Engineer will verify and document that the anchor trench backfill meets the requirements of the General Specifications and that the backfill is placed in accordance with the General Specifications.

2.2 GEOSYNTHETIC CLAY LINER DEPLOYMENT

2.2.1 Field Panel Identification

A field panel is the unit area of GCL which is to be placed in the field, i.e., a field panel is a roll or a portion of roll cut in the field.

The CQA Engineer will verify that each field panel is given an identification code (number or letter-number) consistent with the layout plan. This identification code will be agreed upon by the Owner, and the Contractor. This field panel identification code should be as simple and logical as possible. (Note: manufacturing plant roll numbers are usually cumbersome and are not related to location in the field.) It will be the responsibility of the Contractor to ensure that each field panel placed is marked with the manufacturing plant roll number. The roll number will be marked in the center of the panel in a color to allow for easy inspection.

The CQA Engineer will establish a table or chart showing correspondence between manufacturing plant roll numbers and field panel identification codes. The field panel identification code will be used for all CQA records.

2.2.2 Field Panel Placement

2.2.2.1 Installation Schedule

The CQA Engineer will evaluate significant changes in the schedule proposed by the Contractor and advise the Owner on the acceptability of that change. The CQA Engineer will verify and document that the condition of the underlying layer has not changed detrimentally during installation. Any damage to the surface of the underlying layer will be repaired by the Contractor in accordance with the General Specifications.

The CQA Engineer will record the identification code, location, and date of installation of each field panel.

2.2.2.2 Weather Conditions

The CQA Engineer will verify and document that GCL is not placed during inclement weather conditions as specified within the General Specifications.

Additionally, the CQA Engineer will verify and document that the underlying layer has not been damaged by weather conditions.

2.2.2.3 Damage

The CQA Engineer will visually observe each panel, after placement, for damage. The CQA Engineer will advise the Owner which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected by the Owner will be marked, and their removal from the work area will be documented by the CQA Engineer.

2.2.2.4 Seam Overlap and Bentonite Seal

The CQA engineer will observe and document that the seam overlaps and bentonite material placed between panels along the seams meet specification guidelines. The CQA engineer will verify overlap width and will observe bentonite seal placement.

2.3 DEFECTS AND REPAIRS

2.3.1 Identification

All seams and non-seam areas of the GCL will be inspected by the CQA Engineer for evidence of defects, holes, contamination of geotextiles, displaced panels, premature hydration, and any sign of contamination by foreign matter. The CQA Engineer will observe and document repair procedures described below.

2.3.2 Repair Procedures

Prior to cover material placement, damage to the GCL shall be identified and repaired by the installer.

2.3.2.1 Rip and Tear Repair (Flat Surfaces)

Rips or tears may be repaired by completely exposing the affected area, removing all foreign objects or soil, and by then placing a patch cut from unused GCL over the damage (damaged material may be left in place), with a minimum overlap of 12 inches on all edges.

Accessory bentonite should be placed between the patch edges and the repaired material at a rate of a quarter pound per lineal foot of edge spread in a continuous six inch fillet.

2.3.2.2 Rip and Tear Repair (Slopes)

Damaged GCL material on slopes shall be repaired by the same procedures above, however, the overlapped edges of the patch should be wide enough to ensure the patch will keep its position during backfill or cover operations.

2.3.2.3 Displaced Panels

Displaced panels shall be adjusted to the correct position and orientation. The adjusted panel shall then be inspected for any geotextile damage or bentonite loss. Damage shall be repaired by the above procedure.

2.3.2.4 Premature Hydration

If the GCL is subjected to premature hydration, the GCL installer shall notify the CQA Engineer and Design Engineer for a site specific determination as to whether the material is acceptable or if alternative measures must be taken to ensure the quality of the design dependent upon the degree of damage.

SECTION IV - GEOMEMBRANE CONSTRUCTION QUALITY ASSURANCE

1.0 GEOMEMBRANE MANUFACTURE AND DELIVERY

1.1 RESIN

Prior to the installation of the HDPE geomembrane material, the Contractor will be required to provide the CQA Engineer with the following information from the geomembrane Manufacturer:

- A copy of the quality control certificates issued by the resin Supplier that includes the origin (resin Supplier's name and resin production plant), identification (brand name, number) the production date of the resin used in the manufacture of the geomembrane shipped to the site, and the results of tests conducted to verify that the quality of the resin used to manufacture the geomembrane rolls assigned to the project meets the General Specifications; and

- Certification from the geomembrane Manufacturer that no reclaimed polymer is added to the resin during the manufacture of the geomembrane to be used in this project; the use of polymer recycled during the manufacturing process is permitted if the recycled polymer does not exceed 2 percent by weight of the total polymer weight.

The CQA Engineer will review these documents and report any discrepancies with the above requirements to the Owner.

1.2 GEOMEMBRANE MANUFACTURING QUALITY CONTROL

Prior to the installation of the HDPE geomembrane, the Contractor will be required to provide the CQA Engineer with the following information from the geomembrane Manufacturer:

- The certification required by the General Specifications signed by a responsible party employed by the geomembrane Manufacturer based on sampling interval of 1/50,000 ft^2; and,

- The manufacturing quality control certificates for each shift's production of geomembrane, signed by a responsible party employed by the geomembrane Manufacturer (such as the production manager). The quality control certificates will include:
  - Roll numbers and identification; and,
  - Sampling procedures and results of quality control tests specified by the General Specifications including descriptions of the test methods used for geomembrane rolls assigned to the Triassic Park project.

The CQA Engineer will verify and document that:

- The property values certified by the geomembrane Manufacturer meet all of the specified values listed in the General Specifications;

- The measurements of properties by the geomembrane Manufacturer are properly documented and the test methods used are in accordance with the General Specifications; and,

- The quality control certificates have been provided at the specified frequency for geomembrane rolls, and each certificate identifies the rolls or batch number related to that certificate.

The CQA Engineer will report deviations from the above requirements to the Owner prior to installation of the geomembrane.

1.3 LABELING

The CQA Engineer will verify and document that the geomembrane Manufacturer has labeled each roll of geomembrane as specified in the General Specifications.

The CQA Engineer will examine geomembrane rolls upon delivery and deviation from the above requirements will be reported to the Owner prior to installation of the geomembrane.

1.4 TRANSPORTATION AND HANDLING

Upon delivery at the site, the CQA Engineer will conduct a visual inspection of all rolls for defects and for damage. This examination will be conducted without unrolling rolls unless visible defects or damages are found. The CQA Engineer will indicate to the Owner:

- Any rolls that should be unrolled to allow for their inspection;

- Any rolls, or portions thereof, which should be rejected and removed from the site because they have severe flaws; and,

- Any rolls which include minor repairable flaws.

1.5 STORAGE

The CQA Engineer will verify and document that storage of the geomembrane is in accordance with the General Specifications.

1.6 QUALITY ASSURANCE CONFORMANCE TESTING

Either at the Manufacture's plant or upon delivery of the rolls of geomembrane, the CQA Engineer will ensure that samples are removed at the specified frequency and forwarded to the Geosynthetics CQA Laboratory for testing to verify and document conformance with the General Specifications.

Conformance samples will be taken by the CQA Engineer across the entire width of the roll and will not include the first 3 feet. Unless otherwise specified, samples will be 1.5 feet (minimum) long by the roll width. The CQA Engineer will mark the direction of the machine used to cut the samples with an arrow.

Unless otherwise specified, samples will be taken at a rate of one per lot or one per 100,000 ft^2 whichever is greater. These samples will be tested for:

- Specific gravity
- Thickness
- Yield strength and yield elongation
- Tensile strength and tensile elongation at break
- Carbon black content
- Carbon black dispersion
- Puncture Resistance

Test shall be conducted in accordance with the test procedure presented in the specification.

The CQA Engineer will examine all results from laboratory conformance testing and will report any nonconformance to the Owner as soon practical after the test results become available.

The following procedure will apply whenever a sample fails a conformance test that is conducted by the CQA Engineer:

- The Contractor will be required to replace the roll (or rolls) of geomembrane that is in nonconformance with the General Specifications with a roll that meets the General Specifications.
- The CQA Engineer will ensure that conformance samples are removed for testing by the Geosynthetics CQA Laboratory from the closest numerical roll on both sides of the failed roll. These two samples must pass the above conformance tests. If either of these samples fail, samples will be collected from the five numerically closest untested rolls on both sides of the failed sample and tested by the Geosynthetics CQA Laboratory. These ten samples must pass the above conformance tests. If any of these samples fail, a sample from every roll of geomembrane on site and every roll subsequently delivered from the same Manufacturer must be conformance tested by the Geosynthetics CQA Laboratory; the cost of all such additional tests are to be borne by the Contractor.

The CQA Engineer will document actions taken in conjunction with conformance test failures and report all actions to the Owner.

2.0 GEOMEMBRANE INSTALLATION

2.1 EARTHWORK

2.1.1 Surface Preparation

The Contractor or subcontractor responsible for geomembrane installation will be required to certify in writing that the surface on which the geomembrane will be installed is acceptable.

The certificate of acceptance will be required to be given by the Contractor to the CQA Engineer, who will then verify to the Owner that the subgrade is accepted immediately prior to commencement of geomembrane installation in the area under consideration.

After the surface on which the geomembrane is to be installed has been accepted by the Contractor responsible for geomembrane installation, it will be the CQA Engineer's responsibility to indicate to the Owner any change in the underlying layer that may, in accordance with the General Specifications, require repair work. If the Owner requires repair work, then it will be the responsibility of the Contractor to repair the underlying layer.

2.1.2 Anchor Trenches

The CQA Engineer will verify and document that the anchor trench backfill meets the requirements of the General Specifications and that the backfill is placed in accordance with the General Specifications.

2.2 GEOMEMBRANE DEPLOYMENT

2.2.1 Layout Drawing

The Contractor will be required to produce layout drawings which show the geomembrane panel configuration, dimensions, details, seam locations, etc. The layout drawings must be approved by the Owner prior to the installation of the geomembrane. The layout drawings, as modified and/or approved by the Owner will be part of the specifications, and a copy will be furnished to the CQA Engineer. The CQA Engineer will become familiar with the layout drawings.

2.2.2 Field Panel Identification

A field panel is the unit area of geomembrane which is to be seamed in the field, i.e., a field panel is a roll or a portion of roll cut in the field.

The CQA Engineer will verify that each field panel is given an identification code (number or letter-number) consistent with the layout plan. This identification code will be agreed upon by the Owner, and the Contractor. This field panel identification code should be as simple and logical as possible. (Note: manufacturing plant roll numbers are usually cumbersome and are not related to location in the field.) It will be the responsibility of the Contractor to ensure that each field panel placed is marked with the manufacturing plant roll number. The roll number will be marked in the center of the panel in a color to allow for easy inspection.

The CQA Engineer will establish a table or chart showing correspondence between manufacturing plant roll numbers and field panel identification codes. The field panel identification code will be used for all CQA records.

2.2.3 Field Panel Placement

2.2.3.1 Location

The CQA Engineer will verify and document that field panels are installed at the locations and positions indicated in the Contractor's layout plan, as approved or modified by the Owner.

2.2.3.2 Installation Schedule

The CQA Engineer will evaluate significant changes in the schedule proposed by the Contractor and advise the Owner on the acceptability of that change. The CQA Engineer will verify and document that the condition of the underlying layer has not changed detrimentally during installation. Any damage to the surface of the underlying layer will be repaired by the Contractor in accordance with the General Specifications.

The CQA Engineer will record the identification code, location, and date of installation of each field panel.

2.2.3.3 Weather Conditions

The CQA Engineer will verify and document that geomembrane is not placed during inclement weather conditions as specified within the General Specifications.

Additionally, the CQA Engineer will verify and document that the underlying layer has not been damaged by weather conditions.

2.2.3.4 Damage

The CQA Engineer will visually observe each panel, after placement and prior to seaming, for damage (e.g., holes, blisters, creases). The CQA Engineer will advise the Owner which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected by the Owner will be marked, and their removal from the work area will be documented by the CQA Engineer.

2.3 FIELD SEAMING

2.3.1 Seam Layout

The CQA Engineer will verify and document that the seam layout shown on the Panel Layout Drawing (Part 2.2.1) is consistent with the General Specifications. No panels may be seamed in the field without the Owner's approval. In addition, seams not specifically shown on the seam layout drawing may not be made without the Owner's prior approval.

A seam numbering system compatible with the panel numbering system will be agreed upon by the Contractor, the Owner, and CQA Engineer.

2.3.2 Seaming Equipment and Products

Processes approved by the General Specifications for field seaming are: (i) extrusion seaming; and (ii) fusion seaming. Proposed alternate processes will be required to be documented and submitted to the Owner for approval. Only seaming apparatus which the Owner has specifically approved by make and model will be used. The Contractor will be required to use a pyrometer to ensure that accurate temperatures of the extrudate and seamer nozzle are being achieved.

The extrusion seaming apparatus will be equipped with gauges indicating the temperatures of the extrudate and nozzle. The Contractor will be required to provide to the CQA Engineer the

Manufacturer's certification that the extrudate is compatible with the General Specifications and is comprised of the same resin as the geomembrane.

The CQA Engineer will log ambient temperatures, seaming apparatus temperatures, and extrudate temperatures or fusion seaming apparatus speeds. Ambient temperatures will be measured as specified in the General Specifications.

2.3.3 Seam Preparation

The CQA Engineer will verify and document that:

- Prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris, and foreign material; and,
- Preparation of seams is in accordance with the General Specifications.

2.3.4 Weather Conditions for Seaming

The CQA Engineer will verify and document that weather conditions for seaming are within the limits specified in the General Conditions.

2.3.5 Trial Seams

The Contractor will be required to make trial seams on fragment pieces of geomembrane liner to verify that seaming conditions are adequate. The Contractor will be required to make and test trial seams at the frequency and in accordance with the methods specified in the General Specifications.

The CQA Engineer will observe all trial seam procedures. The successful trial seam sample will be assigned a number and marked accordingly by the CQA Engineer, who will log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description. The sample itself will be retained only until the construction of the liner is complete and the liner has been accepted by the Owner.

2.3.6 Nondestructive Seam Continuity Testing

2.3.6.1 Introduction

Except as otherwise noted in the General Specifications, the Contractor will nondestructively test all field seams over their full length in accordance with the General Specifications. The purpose of nondestructive tests is to check the continuity of seams. Continuity testing will be carried out as the seaming work progresses, not at the completion of all field seaming. Nondestructive testing will not be permitted before sunrise or after sunset unless the Contractor demonstrates to the Owner that the Contractor has the capabilities to perform continuity testing under reduced light conditions.
The CQA Engineer will:

- Observe the continuity testing;
- Record location, date, test unit number, name of tester, and outcome of all testing; and,
- Document and inform the Contractor of any required repairs.

The Contractor will be required to complete any required repairs in accordance with the General Specifications.

The CQA Engineer will:

- Observe the repair and re-testing of the repair;

- Mark on the geomembrane that the repair has been made; and,

- Document the results.

The CQA Engineer will verify and document the procedures specified in the General Specifications where seams cannot be nondestructively tested.

The location, date of visual observation, name of tester, and outcome of the test or observation will be recorded by the CQA Engineer and reported to the Owner.

2.3.7 Destructive Seam Testing

2.3.7.1 Concept

Destructive seam tests will be performed at selected locations. The purpose of these tests is to evaluate seam strength and integrity. Seam strength testing will be done as the seaming work progresses, not at the completion of all field seaming.

2.3.7.2 Location and Frequency

The CQA Engineer will select locations where seam samples will be cut out for laboratory testing. The test frequency and locations will be established as follows:

- Samples will be collected at a minimum frequency of one test location per 500 ft of seam length (this minimum frequency is to be determined as an average taken throughout the entire landfill or surface impoundment project); and,

- Test locations will be determined during seaming at the CQA Engineer's discretion; selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset seams, or any other potential cause of imperfect seaming.

The Contractor will not be informed in advance of the locations where the seam samples will be taken.

2.3.7.3 Sampling Procedure

The Contractor will be required to cut samples as directed by the CQA Engineer as the seaming progresses in order to have laboratory test results before the geomembrane is covered by another material. The CQA Engineer will:

- Observe sample cutting;
- Assign a number to each sample and mark it accordingly;
- Record the sample number and location on the panel layout drawing; and,

- Record the reason for taking the sample at this location (e.g., routine testing, suspicious feature of the geomembrane, etc.).

All holes in the geomembrane resulting from destructive seam sampling will be covered by the Contractor immediately after sampling and repaired in accordance with the repair procedures described in the General Specifications. The continuity of the new seams in the repaired area will be nondestructively tested according to the General Specifications.

2.3.7.4 Size of Samples

At a given sampling location, two types of samples will be required to be taken by the Contractor.

First, two specimens for field testing will be taken. Each of these specimens will be 1 inch wide by 6 to 12 inches long, with the seam centered parallel to the width. The distance between these two specimens will be approximately 42 inches. If both specimens pass the field test described in the General Specifications, a sample for laboratory testing will be taken.

The sample for laboratory testing will be required to be taken between the two specimens for field testing. The destructive sample will be 12 inches wide by 42 inches long with the seam centered lengthwise. The sample will be cut into three parts and distributed as follows:

- One portion to the Contractor, 12 inches long;
- One portion to the CQA Engineer for archive storage, 12 inches long; and,
- One portion to the CQA Engineer for CQA Laboratory testing, 18 inches long.

Final determination of the sample sizes will be made at the preconstruction meeting.

2.3.7.5 Field Testing

The two 1-inch wide specimens specified above will be required to be tested in the field, by the Contractor, by tensiometer for peel and should not fail in the seam. If any field test sample fails to pass, then the procedures outlined in the General Specifications will be required to be followed.

The CQA Engineer will observe field tests and mark all samples and portions with their number, date, and time.

2.3.7.6 Geosynthetic Construction Quality Assurance Laboratory Testing

Laboratory destructive test samples will be packaged and shipped to the CQA Laboratory by the CQA Engineer in a manner which will not damage the test sample. The CQA Engineer will store the archive samples until the completion of the project. Laboratory destructive test samples will be tested by the Geosynthetics CQA Laboratory.

Testing will include "Shear Strength", and "Peel Strength", (ASTM D 443) with 1-inch wide strip, tested at 2 inches per minute). The minimum acceptable values to be obtained in these tests are those indicated in Table 02775-2 of Section 02775 of the General Specifications. At least 5 specimens will be tested for each test method. Specimens will be selected alternately by test from the samples (i.e., peel, shear, peel, shear). At least 4 out of 5 of the specimens must pass.

The Geosynthetics CQA Laboratory will provide test results verbally to the CQA Engineer in a timely manner after they receive the samples. The CQA Engineer will review laboratory test results as soon as they become available, and inform the Owner of the test results.

2.3.7.7 Procedures for Destructive Test Failure

The procedures specified within the General Specifications will be required whenever a sample fails a destructive test, whether that test is conducted by the Geosynthetics CQA Laboratory, the Contractor's laboratory (if required), or by field tensiometer. The CQA Engineer will verify and document that one of the options specified within the General Specifications is followed.

The CQA Engineer will document all actions taken in conjunction with destructive test failures.

2.4 DEFECTS AND REPAIRS

2.4.1 Identification

All seams and non-seam areas of the geomembrane will be inspected by the CQA Engineer for evidence of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane will be required to be clean at the time of examination. The geomembrane surface will be required to be broomed or washed by the Contractor if the amount of dust or mud inhibits examination.

2.4.2 Evaluation

Each suspect location both in seam and non-seam areas will be required to be either non-destructively tested using the methods described in the General Specifications, or repaired as appropriate as determined by the CQA Engineer. Each location which fails the non-destructive testing will be marked by the CQA Engineer and will be required to be repaired by the Contractor. Materials should not be placed over geomembrane locations that have been repaired until the CQA Engineer has approved the repair.

2.4.3 Large Wrinkles

When seaming of the geomembrane is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying materials, the CQA Engineer will visually inspect the geomembrane for wrinkles. The CQA Engineer will indicate to the Contractor which wrinkles, if any, should be cut and reseamed. The seam thus produced will be tested like any other seam.

2.4.4 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test will be repaired by the Contractor in accordance with the applicable method specified within the General Specifications.

2.4.5 Testing of Repairs

Each repair will be located and logged by the CQA Engineer. Each repair will be non-destructively tested using the methods described in the General Specifications as appropriate. Repairs which pass the non-destructive test will be considered as an adequate repair. Large caps may be of sufficient extent to require destructive testing, at the discretion of the CQA Engineer. Failed tests will require the repair to be redone and retested until passing test results are obtained. The CQA Engineer will observe the non-destructive testing of repairs and will document the date of the repair and test outcome.

2.5. APPURTENANCES

The CQA Engineer will verify and document that:

- Installation of the geomembrane around, and connection of geomembrane to appurtenances have been made according to the General Specifications;
- Extreme care is taken while seaming around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas; and,
- The geomembrane has not been visibly damaged while being connected to appurtenances.

The CQA Engineer will inform the Owner if the above conditions are not fulfilled.

3.0 SURVEYING

The CQA Engineer, in conjunction with the Surveyor, will be required to prepare an "as-built" Record Drawing for geomembrane installations. It will include the surveyed location of field panels, seams (factory and field), repairs, and test locations.

The CQA results (Record Drawing and certification of Contractor's work) will be submitted to the Owner for final review and approval prior to proceeding with construction of any subsequent liner system components.

SECTION V - FILTER OR CUSHION GEOTEXTILE CONSTRUCTION QUALITY ASSURANCE

1.0 GEOTEXTILES

1.1 MANUFACTURING

The Geosynthetics Contractor will be required to provide the CQA Engineer with the following information from the geotextile Manufacturer:

- Certification required by the General Specifications signed by a responsible party employed by the geotextile Manufacturer; and,
- The manufacturing quality control certificates for each shift's production of geotextile rolls, which include geotextile roll numbers and identification, sampling procedures, and descriptions and results of the quality control tests specified in the General Specifications signed by a responsible party employed by the geotextile Manufacturer.

The CQA Engineer will examine all geotextile Manufacturer's certifications to verify and document that the property values listed on the certifications meet or exceed those specified within the General Specifications and that proper and complete documentation has been provided by the geotextile Manufacturer for all geotextile used at the site. The CQA Engineer will report any deviations from the above requirements to the Owner prior to installation of the geotextile.

1.2 LABELING

The CQA Engineer will verify and document that the geotextile Manufacturer has labeled all rolls of geotextile with the information specified in the General Specifications.

The CQA Engineer will examine rolls upon delivery and any deviation from the above requirements will be reported to the Owner prior to installation of the geotextile.

1.3 SHIPMENT AND STORAGE

The CQA Engineer will observe rolls of geotextile upon delivery at the site and any deviation from the requirements specified within the General Specifications will be reported to the Owner. Any damaged rolls will be rejected by the CQA Engineer and required to be repaired or replaced by the Contractor.

1.4 CONFORMANCE TESTING

Either at the Manufacturer's factory or upon delivery of the geotextile rolls, the CQA Engineer will ensure that samples are removed and forwarded to the Geosynthetics CQA Laboratory for testing to verify and document conformance with the requirements of the General Specifications.

Conformance samples will be taken across the entire width of the roll and will not include the first 3 feet along the length of the roll. Unless otherwise specified, samples will be 1.5 feet (minimum) long by the roll width. The CQA Engineer will mark the machine direction on the samples with an arrow.

Samples will be taken at a rate of one per lot or one per 100,000 ft^2, whichever is greater. These samples will be tested for:

- Mass per unit area
- Grab strength
- Tear strength
- Puncture strength
- Permittivity

(Note: All tests should be conducted in accordance with the test methods listed in the specification.)

If the geotextile is being used as a filter, cushion or separator, the samples will also be tested for apparent opening size.

The CQA Engineer will examine all results of laboratory conformance testing and report any nonconformance to the Owner as soon as results become available.

The following procedure will apply whenever a sample fails a conformance test that is conducted by the Geosynthetics CQA Laboratory:

- The Contractor will be required to replace the roll (or rolls) of geotextile that is not in conformance with the specifications with a roll that meets the requirements of the General Specifications.

- The CQA Engineer will ensure that conformance samples are removed for testing by the Geosynthetics CQA Laboratory from the closest numerical roll on both sides of the roll from which the failing sample was obtained. These two samples must pass the above conformance tests. If either of these samples fail to meet the requirements, samples will be collected from the five numerically closest untested rolls on both sides of the failed sample and tested by the Geosynthetics CQA Laboratory. These ten samples must pass the above conformance tests. If any of these samples fail, a sample from every roll of geotextile on site and a sample from every roll that is subsequently delivered from the same Manufacturer must be conformance tested by the Geosynthetics CQA Laboratory. The cost of all such tests are to be borne by the Contractor.

The CQA Engineer will document actions taken in conjunction with conformance test failures and report all actions taken to the Owner.

1.5 HANDLING AND PLACEMENT

The Geosynthetics Contractor will be required to handle all geotextile in such a manner as to ensure the geotextile is not damaged in any way. The CQA Engineer will verify and document compliance with the following:

- Just prior to geotextile placement, the layer that underlies the geotextile, if it is a geosynthetic, is clean and free of excessive amounts of dust, dirt, stones, rocks, or other obstructions that could potentially damage the liner system.

- In the presence of excessive wind, the geotextile is weighted with sandbags (or equivalent weight approved by the CQA Engineer).

- Geotextile is kept under tension to minimize the presence of wrinkles in the geotextile. If necessary, the geotextile is positioned by hand after being unrolled to minimize wrinkles.

- Geotextiles are cut using a geotextile cutter approved by the geotextile Manufacturer and the CQA Engineer. If in place, special care is taken to protect other materials (such as underlying geosynthetics) from damage which could be caused by the cutting of the geotextiles.

- The Contractor takes any necessary precautions to prevent damage to the underlying layers during placement of the geotextile.

- During placement of geotextiles, care is taken not to entrap in the geotextile stones, excessive dust, or moisture that could damage the underlying layers, generate clogging of drains or filters, or hamper subsequent seaming.

- Geotextile is not left exposed for a period in excess of 30 days after placement unless a longer exposure period is approved by the CQA Engineer and Owner.

The CQA Engineer will document any noncompliance with the above requirements and report them to the Owner.

1.6 SEAMS AND OVERLAPS

The CQA Engineer will verify and document that all geotextile seams are oriented, overlapped and sewn in accordance with the General Specifications.

The Contractor will be required to pay close attention at seams to ensure that no protective soil layer material could be inadvertently placed beneath the geotextile.

Sewing will be required to be performed as required in the General Specifications.

1.7 REPAIR

The CQA Engineer will verify and document that any holes or tears in the geotextile are repaired in accordance with the requirements of the General Specifications.

The CQA Engineer will document any noncompliance with the above requirements and report it to the Owner.

SECTION VI - GEOCOMPOSITE CONSTRUCTION QUALITY ASSURANCE

1.0 GEOCOMPOSITES

1.1 MANUFACTURING

The Geosynthetics Contractor will be required to provide the CQA Engineer with the following information from the geocomposite Manufacturer:

- Certification required by the General Specifications signed by a responsible party employed by the geocomposite Manufacturer;
- The certification from the geocomposite Manufacturer that no reclaimed polymer was added to the resin during the manufacture of the geonet component of the geocomposite rolls assigned this project; and,
- The manufacturing quality control certificates for each shift's production of geocomposite rolls which include geocomposite roll numbers and identification, sampling procedures, and descriptions and results of quality control tests for the geonet specified in the General Specifications signed by a responsible party employed by the geocomposite Manufacturer.

The CQA Engineer will examine all of the geocomposite Manufacturer certifications to verify and document that the property values listed on the certifications meet or exceed those specified within the General Specifications and that proper and complete documentation has been provided by the geocomposite Manufacturer for all geocomposite used at the site. The CQA Engineer will report any deviations from the above requirements to the Owner prior to installation of the geocomposite.

1.2 LABELING

The CQA Engineer will verify and document that the geocomposite Manufacturer has labeled all rolls of geocomposite as specified within the General Specifications.

The CQA Engineer will examine rolls upon delivery and any deviation from the above requirements will be reported to the Owner prior to installation of the geocomposite.

1.3 SHIPMENT AND STORAGE

The CQA Engineer will observe rolls of geocomposite upon delivery at the site and any deviation from the requirements of the General Specifications will be reported to the Owner. Any damaged rolls will be rejected by the CQA Engineer and required to be repaired or replaced by the Contractor.

1.4 CONFORMANCE TESTING

Either at the Manufacturer's plant or upon delivery of the geocomposite rolls, the CQA Engineer will ensure that samples are removed and forwarded to the Geosynthetics CQA Laboratory for testing to verify and document conformance with the requirements of the General Specifications.

Conformance samples will be taken across the entire width of the roll and will not include the first 3 feet. Unless otherwise specified, samples will be 1.5 feet long (minimum) by the roll width. The CQA Engineer will mark the machine direction on the samples with an arrow.

Samples will be taken at a rate of one per lot or one per 100,000 ft^2, whichever is greater. These samples will be tested for: peel strength (ASTM F 904); and hydraulic transmissivity, in accordance with the text methods presented in the specification.

The CQA Engineer will examine all results from laboratory conformance testing and will report any nonconformance to the Owner as soon as the results are become available.

The following procedure will apply whenever a sample fails a conformance test that is conducted by the Geosynthetics CQA Laboratory:

- The Contractor will be required to replace the roll (or rolls) of geocomposite that is not in conformance with the specifications with a roll that meets the requirements of the General Specifications.

- The CQA Engineer will ensure that conformance samples are removed for testing by the Geosynthetics CQA Laboratory from the closest numerical roll on both sides of the failed roll. These two samples must pass the above conformance tests. If either of these samples fail, samples will be collected from the 5 numerically closest untested rolls on both sides of the failed sample and tested by the Geosynthetics CQA Laboratory. These ten samples must pass the above conformance tests. If any of these samples fail, a sample from every roll of geocomposite on site and a sample from every roll that is subsequently delivered from the same Manufacturer must be conformance tested by the Geosynthetics CQA Laboratory. The cost of such tests is to be borne by the Contractor.

The CQA Engineer will document actions taken in conjunction with conformance test failures and report all actions to the Owner.

1.5 HANDLING AND PLACEMENT

The Contractor will be required to handle all geocomposite in such a manner as to ensure it is not damaged. The CQA Engineer will verify and document compliance with the following:

- Just prior to geocomposite placement, the layer that will underlie the geocomposite is clean and free of excessive amounts of dust, dirt, stones, rocks, or other obstructions that could potentially damage the underlying layers or clog the drainage system.

- In the presence of excessive wind, the geocomposite is weighted with sandbags (or equivalent weight approved by the CQA Engineer).

- Geocomposite is kept under tension to minimize the presence of wrinkles in the geocomposite. If necessary, the geocomposite is positioned by hand after being unrolled to minimize wrinkles.

- Geocomposites are cut using a geocomposite cutter approved by the geocomposite Manufacturer and the CQA Engineer. If in place, special care is taken to protect other materials from damage which could be caused by the cutting of the geocomposites.

- The Geosynthetics Contractor takes all necessary precautions to prevent damage to the underlying layers during placement of the geocomposite.

- Geocomposite is not welded to geomembranes.

- During placement of clean geocomposite, care is taken not to entrap stones, excessive dust, or moisture that could damage the underlying geomembrane, generate clogging of drains or filters, or hamper subsequent seaming.

- A visual examination of the geocomposite is carried out over the entire surface, after installation, to ensure that no potentially harmful foreign objects, such as needles, are present.

- Geocomposite is not left exposed for a period in excess of 30 days after placement unless a longer exposure period is approved by the CQA Engineer and the Owner.

The CQA Engineer will document any noncompliance with the above requirements and report it to the Owner.

1.6 SEAMS AND OVERLAPS

The components of the geocomposite (e.g., geotextile-geonet-geotextile) are not bonded together at the ends and edges of the rolls. The CQA Engineer will document that the geocomposite is overlapped and secured or seamed in accordance with the General Specifications.

1.7 REPAIR

The CQA Engineer will verify that any holes or tears in the geocomposite are repaired in accordance with the General Specifications.

The CQA Engineer will observe any repair, document any noncompliance with the above requirements, and report the noncompliance to the Owner.

SECTION VII - GEONET CONSTRUCTION QUALITY ASSURANCE

1.0 GEONET

1.1 MANUFACTURING

The Geosynthetics Contractor will be required to provide the CQA Engineer with the following information from the geonet Manufacturer:

- Certifications required by the General Specifications signed by a responsible party employed by the geonet Manufacturer;

- The certification from the geonet Manufacturer that no reclaimed polymer was added to the resin during the manufacture of the geonet rolls assigned to this project; and,

- The manufacturing quality control certificates for each shift's production of geonet rolls, which include geonet roll numbers and identification, sampling procedures, and descriptions and results of quality control tests for polymer specified in the General Specifications signed by a responsible party employed by the geonet Manufacturer.

The CQA Engineer will examine all geonet Manufacturer's certifications to verify and document that the property values listed on the certifications meet or exceed those specified within the General Specifications and that proper and complete documentation has been provided by the geonet Manufacturer for all geonet used at the site. The CQA Engineer will report any deviations from the above requirements to the Owner.

1.2 LABELING

The CQA Engineer will verify and document that the geonet Manufacturer has labeled all rolls of geonet as specified within the General Specifications.

The CQA Engineer will examine rolls upon delivery and any deviation from the above requirements will be reported to the Owner prior to installation of the geonet.

1.3 SHIPMENT AND STORAGE

The CQA Engineer will observe the rolls of geonet upon delivery at the site and any deviations from the requirements specified within the General Specifications will be reported to the Owner. Any damaged rolls will be rejected by the CQA Engineer and will be required to be repaired or replaced by the Contractor.

1.4 CONFORMANCE TESTING

Either at the Manufacturer's plant or upon delivery of the geonet rolls, the CQA Engineer will ensure that samples are removed and forwarded to the Geosynthetic CQA Laboratory for testing, to verify and document conformance with the requirements of the General Specifications.

Conformance samples will be taken across the entire width of the roll and will not include the first 3 feet. Unless otherwise specified, samples will be 1.5 feet long (minimum) by the roll width. The CQA Engineer will mark the machine direction on the samples with an arrow.

Samples will be taken at a rate of one per lot or one per 100,000 ft^2, whichever is greater. These samples will be tested for:

- Polymer specific gravity
- Carbon black
- Thickness
- Transmissivity
- Polymer melt index

Tests shall be conducted in accordance with the method indicated in the specification.

The CQA Engineer will examine all results from laboratory conformance testing and will report any nonconformance to the Owner as soon as the results become available.

The following procedure will apply whenever a sample fails a conformance test that is conducted by the Geosynthetics CQA Laboratory:

- The Contractor will be required to replace the roll (or rolls) of geonet that is not in conformance with the specifications with a roll that meets the requirements of the General Specifications.

- The CQA Engineer will ensure that conformance samples are removed for testing by the Geosynthetics CQA Laboratory from the closest numerical roll on both sides of the failed roll. These two samples must pass the above conformance tests. If either of these samples fail, samples will be collected from the five numerically closest untested rolls on both sides of the failed sample and tested by the Geosynthetics CQA Laboratory. These ten samples must pass the above conformance tests. If any of these samples fail, a sample from every roll of geonet on site and a sample from every roll that is subsequently delivered from the same Manufacturer must be conformance tested by the Geosynthetics CQA Laboratory. The cost of such tests is to be borne by the Contractor.

The CQA Engineer will document actions taken in conjunction with conformance test failures and report all actions taken to the Owner.

1.5 HANDLING AND PLACEMENT

The Contractor will handle all geonet in such a manner as to ensure the geonet is not damaged. The CQA Engineer will verify and document compliance with the following:

- The geonet is free of dirt or excessive dust just before installation.

- Just prior to geonet placement, the geomembrane liner that will underlie the geonet is clean and free of excessive amounts of dust, dirt, stones, rocks, or other obstructions that could potentially damage the geomembrane or clog the drainage system.

- On side slopes, the geonet is secured at the top of the slope then rolled down the slope in such a manner as to keep the geonet sheet in tension. If necessary, the geonet is positioned by hand after being unrolled to minimize wrinkles. Geonet can be place in the horizontal direction (i.e., across the slope) in some special locations (e.g., at the toe of a slope). If an extra layer of geonet is required, this extra layer of geonet can be placed in the horizontal direction. Such locations will be identified on the Construction Drawings.

- In the presence of excessive wind, the geonet is weighted with sandbags or the equivalent.

- Unless otherwise specified, geonet is not welded to geomembrane.

- Geonet will only be cut using a cutter approved by the geonet Manufacturer and the CQA Engineer. If in place, special care is taken to protect underlying geosynthetics from damage that could be caused by cutting of the geonet.

- The Geosynthetics Contractor takes any necessary precautions to prevent damage to underlying layers during placement of the geonet.

- During placement of geonets, care is taken not to entrap in the geonet dirt or excessive dust that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane. If dirt or excessive dust is entrapped in the geonet, it is hosed clean prior to placement of the next material on top of it. In this regard, care should be taken with the handling or sandbags, to prevent rupture or damage of the sandbag.

- Geonet is not placed in direct contact with textured geomembrane liner unless specifically called for in the Construction Drawings.

The CQA Engineer will document any noncompliance with the above requirements and report it to the Owner.

1.6 STACKING AND JOINING

Geonet will be stacked and joined in accordance with the Construction Drawings and the General Specifications. As a minimum, the CQA Engineer will verify and document that staking, joining and overlapping is in accordance with the General Specifications.

The CQA Engineer will document any noncompliance with the above requirements and report it to the Owner.

1.7 REPAIR

The CQA Engineer will verify and document that any holes or tears in the geonet are repaired in accordance with the General Specifications.

The CQA Engineer will observe any repair, note any noncompliance with the above requirements and report them to the Owner.

SECTION VIII - POLYETHYLENE PIPE AND FITTINGS CONSTRUCTION QUALITY ASSURANCE

1.0 POLYETHYLENE PIPE MANUFACTURE AND DELIVERY

1.1 MANUFACTURING

Prior to incorporating the polyethylene pipe and fittings into the work the Contractor will be required to provide the CQA Engineer with the certifications required by the General Specifications signed by a responsible party employed by the pipe Manufacturer.

The CQA Engineer will verify and document that the property values certified by the pipe Manufacturer meet the requirements of the General Specifications based on a sampling interval of one sample per lot. The CQA Engineer will report any deviations from the above requirements to the Owner.

1.2 LABELING

The CQA Engineer will verify that the pipe is labeled with the information specified in the General Specification. Any deviations from the labeling requirements will be reported to the Owner prior to pipe installation.

1.3 SHIPMENT AND STORAGE

The CQA Engineer will verify and document that the pipe and fittings are stored in accordance with the General Specifications.

The CQA Engineer will visual inspect the pipe upon delivery at the site and any deviations from the requirements of the General Specifications will be reported to the Owner.

1.4 CONFORMANCE TESTING

No conformance testing will be conducted on the materials delivered to the site.

2.0 PIPE INSTALLATION

2.1 HANDLING AND LAYING

The CQA Engineer will verify and document that the pipe is installed at the specified locations and grades and that placement of backfill around and over the pipe is conducted in accordance with the requirements of the General Specifications, and in a manner intended to prevent damage to the pipe.

The pipe and fittings will be carefully examined before installation by the CQA Engineer. The CQA Engineer will verify and document that cracks, damage or defects are not present in the pipe and fittings in excess of that allowed by the General Specifications.

The CQA Engineer will also note the condition of the interior of pipes and fittings. Foreign material shall be removed from the pipe interior before it is moved into final position. No pipe will be permitted to be placed until the CQA Engineer has observed the condition of the pipe. The CQA Engineer will document any deviation from the above requirements and report it to the Owner.

2.2 JOINTS AND CONNECTIONS

Lengths of pipe will be required to be assembled into suitable installation lengths by the butt-fusion process. Butt-fusion refers to the butt-joining of the pipe by softening the aligned faces of the pipe ends in a suitable apparatus and pressing them together under controlled pressure.

The CQA Engineer will spot-monitor butt fusion welding operations to ensure that the Contractor follows the General Specifications.

The CQA Engineer will document any noncompliance with the above requirements and report it to the Owner.

2.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will provide the CQA Surveys. The CQA Surveyor will independently survey the final elevation of the invert of all polyethylene leachate collection pipe (excluding laterals).

The results of the survey will be compiled in a report signed by the CQA Surveyor and the CQA Engineer and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the results contained in the report before any subsequent construction that completely covers the pipe occurs.

SECTION IX - ADS SLOTTED CPT AND N12 CONSTRUCTION QUALITY ASSURANCE

1.0 ADS SLOTTED CPT MANUFACTURE AND DELIVERY

1.1 MANUFACTURING

Prior to incorporating the slotted CPT into the work the Contractor will be required to provide the CQA Engineer with the certifications required by the General Specifications signed by a responsible party employed by the pipe Manufacturer.

The CQA Engineer will verify and document that the property values certified by the pipe Manufacturer meet the requirements of the General Specifications based on a sampling interval of one sample per lot. The CQA Engineer will report any deviations from the above requirements to the Owner.

1.2 LABELING

The CQA Engineer will verify that the pipe is labeled with the information specified in the General Specification. Any deviations from the labeling requirements will be reported to the Owner prior to pipe installation.

1.3 SHIPMENT AND STORAGE

The CQA Engineer will verify and document that the pipe and fittings are stored in accordance with the General Specifications.

The CQA Engineer will visual inspect the pipe upon delivery at the site and any deviations from the requirements of the General Specifications will be reported to the Owner.

1.4 CONFORMANCE TESTING

No conformance testing will be conducted on the materials delivered to the site.

2.0 PIPE INSTALLATION

2.1 HANDLING AND LAYING

The CQA Engineer will verify and document that the pipe is installed at the specified locations and grades and that placement of backfill around and over the pipe is conducted in accordance with the requirements of the General Specifications, and in a manner intended to prevent damage to the pipe.

The pipe and fittings will be carefully examined before installation by the CQA Engineer. The CQA Engineer will verify and document that cracks, damage or defects are not present in the pipe and fittings in excess of that allowed by the General Specifications.

The CQA Engineer will also note the condition of the interior of pipes and fittings. Foreign material shall be removed from the pipe interior before it is moved into final position. No pipe will be permitted to be placed until the CQA Engineer has observed the condition of the pipe.

The CQA Engineer will document any deviation from the above requirements and report it to the Owner.

2.2 JOINTS AND CONNECTIONS

Lengths of pipe will be required to be assembled into suitable installation lengths by split couplers. The CQA Engineer will spot-monitor installation of the split couplers to ensure that the Contractor follows the General Specifications. The CQA Engineer will document any noncompliance with the above requirements and report it to the Owner.

2.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will provide the CQA Surveys. The CQA Surveyor will independently survey the final elevation of the invert of all slotted CPT.

The results of the survey will be compiled in a report signed by the CQA Surveyor and the CQA Engineer and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the results contained in the report before any subsequent construction that completely covers the pipe occurs.

SECTION X - CORRUGATED METAL PIPE CONSTRUCTION QUALITY ASSURANCE

1.0 CORRUGATED METAL PIPE MANUFACTURE AND DELIVERY

1.1 MANUFACTURING

Prior to incorporating the corrugated metal pipe (CMP) into the work the Contractor will be required to provide the CQA Engineer with the certifications required by the General Specifications signed by a responsible party employed by the pipe Manufacturer.

The CQA Engineer will verify and document that the property values certified by the pipe Manufacturer meet the requirements of the General Specifications based on a sampling interval of one sample per lot. The CQA Engineer will report any deviations from the above requirements to the Owner.

1.2 LABELING

No labels required in specifications.

1.3 SHIPMENT AND STORAGE

The CQA Engineer will verify and document that the pipe and fittings are stored in accordance with the General Specifications.

The CQA Engineer will visual inspect the pipe upon delivery at the site and any deviations from the requirements of the General Specifications will be reported to the Owner.

1.4 CONFORMANCE TESTING

No conformance testing will be conducted on the materials delivered to the site.

2.0 CMP INSTALLATION

2.1 HANDLING AND LAYING

The CQA Engineer will verify and document that the pipe is installed at the specified locations and grades and that placement of backfill around and over the pipe is conducted in accordance with the requirements of the General Specifications, and in a manner intended to prevent damage to the pipe.

The pipe and fittings will be carefully examined before installation by the CQA Engineer. The CQA Engineer will verify and document that cracks, damage or defects are not present in the pipe and fittings in excess of that allowed by the General Specifications.

The CQA Engineer will also note the condition of the interior of pipes and fittings. Foreign material shall be removed from the pipe interior before it is moved into final position. No pipe will be permitted to be placed until the CQA Engineer has observed the condition of the pipe.

The CQA Engineer will document any deviation from the above requirements and report it to the Owner.

2.2 JOINTS AND CONNECTIONS

Lengths of pipe will be required to be assembled into suitable installation lengths. The CMP will be joined using the manufacturer's recommended equipment and procedures. The CQA Engineer will spot-monitor joining operations to ensure that the Contractor follows the manufacturer's specifications. The CQA Engineer will document any noncompliance with the above requirements and report it to the Owner.

2.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will provide the CQA Surveys. The CQA Surveyor will independently survey the final elevation of the invert of all CMP.

The results of the survey will be compiled in a report signed by the CQA Surveyor and the CQA Engineer and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the results contained in the report before any subsequent construction that completely covers the pipe occurs.

SECTION XI - CARBON AND STAINLESS STEEL PIPE CONSTRUCTION QUALITY ASSURANCE

1.0 STEEL PIPE MANUFACTURE AND DELIVERY

1.1 MANUFACTURING

Prior to incorporating the steel pipe into the work the Contractor will be required to provide the CQA Engineer with the certifications required by the General Specifications signed by a responsible party employed by the pipe Manufacturer.

The CQA Engineer will verify and document that the property values certified by the pipe Manufacturer meet the requirements of the General Specifications based on a sampling interval of one sample per lot. The CQA Engineer will report any deviations from the above requirements to the Owner.

1.2 LABELING

The CQA Engineer will verify that the pipe is labeled with the information specified in the General Specification. Any deviations from the labeling requirements will be reported to the Owner prior to pipe installation.

1.3 SHIPMENT AND STORAGE

The CQA Engineer will verify and document that the pipe and fittings are stored in accordance with the General Specifications.

The CQA Engineer will visual inspect the pipe upon delivery at the site and any deviations from the requirements of the General Specifications will be reported to the Owner.

1.4 CONFORMANCE TESTING

No conformance testing will be conducted on the materials delivered to the site.

2.0 PIPE INSTALLATION

2.1 HANDLING AND LAYING

The CQA Engineer will verify and document that the pipe is installed at the specified locations and grades and that placement of backfill around the pipe is conducted in accordance with the requirements of the General Specifications, and in a manner intended to prevent damage to the pipe.

The pipe will be carefully examined before installation by the CQA Engineer. The CQA Engineer will verify and document that cracks, damage or defects are not present in the pipe fittings in excess of that allowed by the General Specifications.

The CQA Engineer will also note the condition of the interior of pipes. Foreign material shall be removed from the pipe interior before it is moved into final position. No pipe will be permitted to be placed until the CQA Engineer has observed the condition of the pipe.

The CQA Engineer will document any deviation from the above requirements and report it to the Owner.

2.2 JOINTS AND CONNECTIONS

Lengths of pipe will be required to be assembled into suitable installation lengths by butt welding.

The CQA Engineer will spot-monitor welding operations to ensure that the Contractor follows the General Specifications.

The CQA Engineer will document any noncompliance with the above requirements and report it to the Owner.

2.3 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will provide the CQA Surveys. The CQA Surveyor will independently survey the final elevation of the basal location of all steel pipe.

The results of the survey will be compiled in a report signed by the CQA Surveyor and the CQA Engineer and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the results contained in the report before any subsequent construction that completely covers the pipe occurs.

SECTION XII - POLYETHYLENE TANK CONSTRUCTION QUALITY ASSURANCE

1.0 POLYETHYLENE TANK MANUFACTURE AND DELIVERY

1.1 MANUFACTURING

Prior to incorporating the polyethylene tank into the work the Contractor will be required to provide the CQA Engineer with the certifications required by the General Specifications signed by a responsible party employed by the polyethylene tank Manufacturer.

The CQA Engineer will verify and document that the property values certified by the polyethylene tank Manufacturer meet the requirements of the General Specifications based on a sampling interval of one sample per lot. The CQA Engineer will report any deviations from the above requirements to the Owner.

1.2 LABELING

The CQA Engineer will verify that the polyethylene tank is labeled with the information specified in the General Specification. Any deviations from the labeling requirements will be reported to the Owner prior to pipe installation.

1.3 SHIPMENT AND STORAGE

The CQA Engineer will verify and document that the polyethylene tanks are stored in accordance with the General Specifications.

The CQA Engineer will visual inspect the polyethylene tank upon delivery at the site and any deviations from the requirements of the General Specifications will be reported to the Owner.

1.4 CONFORMANCE TESTING

No conformance testing will be conducted on the materials delivered to the site.

2.0 POLYETHYLENE TANK INSTALLATION

2.1 HANDLING AND LAYING

The CQA Engineer will verify and document that the polyethylene tank is installed at the specified locations, and in a manner intended to prevent damage to the polyethylene tank.

The polyethylene tank will be carefully examined before installation by the CQA Engineer. The CQA Engineer will verify and document that cracks, damage or defects are not present in the polyethylene tank in excess of that allowed by the General Specifications.

The CQA Engineer will document any deviation from the above requirements and report it to the Owner.

The owner will obtain and keep on file at the facility written statements by the CQA engineer certifying that the design and installation of the tank system was performed in accordance with the requirements of paragraphs (B) through (F) of 40 CFR 264192.

2.2 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will provide the CQA Surveys. The CQA Surveyor will independently survey the final locations and elevation of the base of the polyethylene tank.

The results of the survey will be compiled in a report signed by the CQA Surveyor and the CQA Engineer and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the results contained in the report before any subsequent construction hinders surveying of the polyethylene tank.

SECTION XIII – STABILIZATION BINS CONSTRUCTION QUALITY ASSURANCE

1.0 STABILIZATION BINS MANUFACTURE AND DELIVERY

1.1 MANUFACTURING

Prior to incorporating the stabilization bins into the work the Contractor will be required to provide the CQA Engineer with the certifications required by the General Specifications signed by a responsible party employed by the stabilization bins tank Manufacturer.

The CQA Engineer will verify and document that the property values certified by the stabilization bins manufacturer meet the requirements of the General Specifications based on a sampling interval of one sample per lot. The CQA Engineer will report any deviations from the above requirements to the Owner.

1.2 LABELING

The CQA Engineer will verify that the stabilization bins are labeled with the information specified in the General Specification. Any deviations from the labeling requirements will be reported to the Owner prior to pipe installation.

1.3 SHIPMENT AND STORAGE

The CQA Engineer will verify and document that the stabilization bins are stored in accordance with the General Specifications.

The CQA Engineer will visual inspect the stabilization bins upon delivery at the site and any deviations from the requirements of the General Specifications will be reported to the Owner.

1.4 CONFORMANCE TESTING

No conformance testing will be conducted on the materials delivered to the site.

2.0 STABILIZATION BINS INSTALLATION

2.1 HANDLING AND LAYING

The CQA Engineer will verify and document that the stabilization bins are installed at the specified locations, and in a manner intended to prevent damage to the stabilization bins.

The stabilization bins will be carefully examined before installation by the CQA Engineer. The CQA Engineer will verify and document that cracks, damage or defects are not present in the stabilization bins in excess of that allowed by the General Specifications.

The CQA Engineer will document any deviation from the above requirements and report it to the Owner.

The owner will obtain and keep on file at the facility written statements by the CQA engineer certifying that the design and installation of the stabilization bins was performed in accordance with the requirements of paragraphs (B) through (F) of 40 CFR 264192.

2.2 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will provide the CQA Surveys. The CQA Surveyor will independently survey the final locations and elevation of the base of the stabilization bins.

The results of the survey will be compiled in a report signed by the CQA Surveyor and the CQA Engineer and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the results contained in the report before any subsequent construction hinders surveying of the stabilization bins.

SECTION XIV~~II~~ - CONCRETE FORMWORK CONSTRUCTION QUALITY ASSURANCE

1.0 CONCRETE FORMWORK MANUFACTURE

1.1 MANUFACTURING

Prior to incorporating the formwork into the work the Contractor will be required to provide the CQA Engineer with the requirements of the General Specifications.

The CQA Engineer will verify and document that the material properties meet the requirements of the General Specifications. The CQA Engineer will report any deviations from the above requirements to the Owner.

2.0 FORMWORK INSTALLATION

2.1 HANDLING AND LAYING

The CQA Engineer will verify and document that the formwork is installed at the specified locations, and in the manner intended by the General Specifications.

The CQA Engineer will document any deviation from the above requirements and report it to the Owner.

2.2 SURVEYING

A Professional Land Surveyor registered in the State of New Mexico will provide the CQA Surveys. The CQA Surveyor will independently survey the final locations and elevation of the formwork.

The results of the survey will be compiled in a report signed by the CQA Surveyor and the CQA Engineer and will be reviewed by the Owner. The Owner and the CQA Engineer will approve the results contained in the report before any subsequent construction hinders surveying of the formwork.

SECTION X~~I~~V - REINFORCEMENT STEEL CONSTRUCTION QUALITY ASSURANCE

1.0 REINFORCEMENT STEEL MANUFACTURE AND DELIVERY

1.1 MANUFACTURING

Prior to incorporating the reinforcement steel into the work, the Contractor will be required to provide the CQA Engineer with the material certifications required by the General Specifications signed by a responsible party employed by the reinforcement steel Manufacturer.

The CQA Engineer will verify and document that the property values certified by the reinforcement steel Manufacturer meet the requirements of the General Specifications. The CQA Engineer will report any deviations from the above requirements to the Owner.

1.2 LABELING

The CQA Engineer will verify that the reinforcement steel is labeled with the information specified in the General Specification. Any deviations from the labeling requirements will be reported to the Owner prior to pipe installation.

1.3 SHIPMENT AND STORAGE

The CQA Engineer will verify and document that the reinforcement steel is stored in accordance with the General Specifications.

1.4 TESTING

If requested by the Engineer, testing outlined in the General Specifications will be conducted.

2.0 REINFORCEMENT STEEL INSTALLATION

2.1 FABRICATION AND INSTALLATION

The CQA Engineer will verify and document that the reinforcement steel is installed at the specified locations, and in a manner intended to prevent damage to the work.

The reinforcement steel will be examined to ensure that the requirements of the General Specifications are followed.

The CQA Engineer will document any deviation from the above requirements and report it to the Owner.

SECTION XVI - JOINTS IN CONCRETE CONSTRUCTION QUALITY ASSURANCE

1.0 JOINT MATERIAL MANUFACTURE

1.1 MANUFACTURING

Prior to incorporating the joint materials into the work the Contractor will be required to provide the CQA Engineer with the certifications required by the General Specifications signed by a responsible party employed by the Manufacturer.

The CQA Engineer will verify and document that the property values certified by the Manufacturer meet the requirements of the General Specifications. The CQA Engineer will report any deviations from the above requirements to the Owner.

2.0 JOINT INSTALLATION

2.1 HANDLING AND LAYING

The CQA Engineer will verify and document that the joint materials, locations and installation procedures are in accordance with the General Specifications. The CQA Engineer will document any deviation from the above requirements and report it to the Owner.

SECTION XVII - MISCELLANEOUS METALWORK CONSTRUCTION QUALITY ASSURANCE

1.0 MISCELLANEOUS METALWORK SUBMITTALS

Prior to incorporating the miscellaneous metalwork into the work, the Contractor will be required to provide the CQA Engineer with the submittals required by the General Specifications.

2.0 FABRICATION AND INSTALLATION

The CQA Engineer will verify and document that the miscellaneous metalwork is fabricated and installed at the specified locations, and in a manner intended by the General Specifications.

SECTION XVIII - CAST IN PLACE CONCRETE

1.0 SUBMITTALS

Prior to incorporating the cast in place concrete into the work, the Contractor will be required to provide the CQA Engineer all submittals required by the General Specifications.

2.0 CONFERENCE

Prior to incorporating the cast in place concrete into the work, the Contractor will be required to hold a meeting to discuss items required in the General Specifications.

3.0 TESTING

The CQA Engineer will verify and document that material sampling and testing required in the General Specifications is completed.

SECTION XIX - ELECTRICAL SYSTEM AND PUMP CONTROL CONSTRUCTION QUALITY ASSURANCE

1.0 SUBMITTALS

Prior to incorporating the electrical system and pump controls into the work, the Contractor will be required to provide the CQA Engineer with the submittals required by the General Specifications.

2.0 INSTALLATION

The CQA Engineer will systematically examine wiring and conduits before covering or backfilling to confirm proper routing, wire size, and connection methods.

3.0 COMPONENT CHECK

The CQA Engineer will perform or review component checks of resistance, grounding, and load prior to complete system check.

Checking and calibration of these systems will be performed according to manufacturers recommendations and procedures.

4.0 TESTING

The CQA Engineer will witness and document acceptance testing of the pump control system.

SECTION XX - PUMPS, PIPING, METERS, AND VALVE CONSTRUCTION QUALITY ASSURANCE

1.0 SUBMITTALS

Prior to incorporating the pumps, piping, instruments (such as flow meter), and valves into the work, the Contractor will be required to provide the CQA Engineer with the submittals required by the General Specifications.

2.0 INSTALLATION

The CQA Engineer will observe connections and components for proper assembly, usage and construction.

3.0 COMPONENT CHECK

The CQA Engineer will perform or review component checks of equipment to confirm operation in accordance with the specifications.

Checking and calibration of these systems will be performed according to manufacturers recommendations and procedures.

4.0 TESTING

The CQA Engineer will witness and document acceptance testing of the leachate removal system.

SECTION ~~XVIII~~ XXI - CONSTRUCTION QUALITY ASSURANCE DOCUMENTATION

1.0 DOCUMENTATION

1.1 INTRODUCTION

An effective CQA plan depends largely on recognition of all construction activities that should be monitored, and on assigning responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of construction quality assurance activities. The CQA Engineer will document that all quality assurance requirements have been addressed and satisfied.

The CQA Engineer will provide the Owner with signed descriptive remarks, data sheets, and logs to verify and document that all monitoring activities have been carried out. The Owner will maintain at the site a complete file of Construction Drawings, the CAQ plan, the General Specifications, (test procedures, daily reports, testing logs, and other pertinent forms and documents. The forms to be used for CQA documentation should include, at a minimum, those presented in this CQA Plan. The forms presented in this CQA Plan may be revised as necessary by the CQA Engineer.

1.2 DAILY RECORD KEEPING

1.2.1 Overview

Daily records will be completed in the field documenting CQA project administration, soils CQA, geosynthetics CQA, and other required CQA activities. The forms to be completed that pertain to each of these categories of records are discussed below.

1.2.2 Project Administration Records

Most project administration records are completed daily by the CQA Engineer and submitted weekly to the Owner. Examples of these forms are included in Appendices B and are briefly described below.

Daily Field Report

The Daily Field Report will be prepared by the CQA Engineer and submitted weekly to the Owner. At a minimum, the Daily Field Report will include the following information:

- The date, project name, location, and other identification;
- A narrative of the events and activities, including meetings and observation which occurred during a given day;
- The weather conditions;
- Source and amount of water used to construct the clay liner, if any;

- The name of parties to any discussions;
- The relevant subject matter or issues;
- The activities planned and performed;
- The schedule; and,
- The signature of the CQA Engineer.

Weekly Field Report

On a weekly basis, the CQA Engineer will summarize in a Weekly Field Report the activities recorded on the Daily Field Reports. This report will be submitted each week to the Owner along with the Daily Field Reports, and will include, at a minimum, the following information:

- The date, project name, location, and other information;
- A summary of work activities during reporting period;
- A summary of construction situations, deficiencies, and/or defects occurring during the reporting period;
- A summary of actions taken to remedy such situations, deficiencies and or defects; and,
- The signature of the CQA Resident Engineer.

Since the weekly report is presented in a report format, a form is not presented in Appendix B.

1.2.3 Soils CQA Records

Records kept for soils related activities will be completed by the CQA Engineer. The information will be recorded as testing is done in the field or as results are received from the laboratory. The records will be available for review on site, and copies will be issued as part of the Final Report. Examples of the relevant forms are included in Appendix B and are briefly described below.

Field Laboratory Compaction Test Log (ASTM D 698 Method A, B, C, D and ASTM D 1557 Method A, B, C).

The results of field compaction tests will be recorded on the Field Laboratory Compaction Test Log. Separate forms are available for each test method used.

Standard Count, Field Sand Cone and Rubber Balloon Density Test Log

The results of the sand cone and or rubber balloon Density Test Log. The results will be used for comparison or calibration with nuclear density test results.

Summary of Sieve Analysis Test Data

This form will provide a summary of sieve analysis test results for soils.

Summary of Field Density Test

This form will provide a summary of field nuclear density test results and sand cone test results for soils.

Summary of Index Laboratory Test Data

This form will provide a summary of index test results performed as required for soils.

Summary of Permeability Laboratory Data

This form will provide a summary of laboratory permeability test data required for clay liners.

1.2.4 Geosynthetics CQA Records

Records for the installation of geosynthetics will be completed by the CQA Engineer. The information will be recorded as the work progresses. The records will be available for review on site and copies will be issued as part of the final CQA report. Examples of the CQA forms to be completed for geosynthetics are included in Appendix D and briefly described below.

Material Inventory

The identifying roll number and pertinent information of each roll of geosynthetic received at the site will be recorded on this form as the materials arrive at the site. This information will be used to track manufacturer's quality control information, conformance test samples, and other CQA documentation.

Nondestructive Test Log

This form will be used to record the time, date, equipment operator, and results of vacuum box or air pressure testing of production geomembrane seaming operations.

Panel Placement Monitoring Log

This form will be used to record geomembrane panel numbers as they are placed in the field and to cross-reference the assigned panel numbers with roll numbers. The weather conditions, time, and temperature at placement will be recorded on the log. Measured dimensions used to calculate the area of the geomembrane will be recorded on the log.

Repair Summary Log

Information on repairs to geomembrane panels and seams will be recorded on this form. The information recorded will include a code to describe the type of repair, the name of the operator making the repair, the location (i.e. seam or panel location) of the repair, nondestructive testing results of the repair, and initials of the CQA Engineer observing the repair.

Seam and Panel Location Log

The relative location of repairs to geomembrane panels and seams described in the Repair Summary Log will be recorded on this form. The results of destructive tests and nondestructive can be indicated in this log, as well as, location and results of thickness measurements taken for each panel.

Destructive Test Log

This form will be used to record the results from testing performed on geomembrane seams at the Geosynthetics CQA Laboratory (an independent testing laboratory). The results for both pep and shear will be recorded. The form will be completed as data becomes available.

Trail Seam and Seaming Log

This form will be used to record results of trial geomembrane seam testing and to track production seaming activities. The time, temperature, type of seaming equipment used, name of seamer, and length of seam will be recorded.

Certificate of Acceptance Subgrade Surface

The Certificate of Acceptance is required to be signed by the Contractor prior to the installation of the geomembrane. The area being accepted must be described on the certificate.

1.2.5 Survey Records

Record Drawings resulting from the surveying performed by the CQA Surveyor will be reviewed by the CQA Engineer and the Owner. The Record Drawings will be available for review onsite, and copies will be issued as part of the final CQA Report issued by the CQA Engineer. At a minimum, these Records Drawings will include as-built survey data for the following liner system components:

- Prepared subgrade;
- Structural fill
- Clay liner;
- Polyethylene pipe and fittings;
- Geomembrane liners;
- Drainage Gravel;
- Protective soil layer;
- Road Base;
- Cover Soil;
- Vegetative cover;
- Pipe bedding;
- Select Subbase;
- Subbase;
- Foundation sand;
- Geocomposite;
- Geonet;
- Geotextile;

- Polyvinyl Chloride Pipe;
- Geosynthetic Clay Liner
- Steel Pipe; and,
- Polyethylene Tank.

1.3 PHOTOGRAPHIC DOCUMENTATION

Photographic documentation will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file will contain color prints; negatives will also be stored in a separate file in chronological order. These photographs will be available for review by the Owner, the CQA Engineer, and other interested parties. Selected photographs will be reproduces as part of the Final Report. The remaining photographs will be transmitted to the Owner and archived by the Owner as part of the operating records.

1.4. DESIGN AND/OR SPECIFICATION CHANGES

Design and/or specification changes may be required during construction. In such cases, the CQA Engineer will notify the Owner. The Owner will submit these changes to NMED for review and approval according to permit notifications requirements of 40 CFR 270.41 and 42.~~The Owner will notify NMED, and when necessary, the Design Engineer.~~

Major design and/or specifications changes will be made only with the written agreement of the Design Engineer and the Owner and will take the form of an addendum to the General Specifications.

1.5 SIGNATURES AND FINAL REPORTS

At the completion of the work, the CQA Engineer will submit a final CQA report to the Owner.

At a minimum, this report will include: (a) summaries of all construction activities; (b) sources and amounts of water used to construct the clay liners; (c) results of chemical quality analyses of construction water from each source; (d) observation logs and testing data sheets including sample location plans; (e) a discussion of any changes from design and material specifications; (f) CQA Record Drawings; and (g) a summary statement sealed and signed by a Professional Engineer registered in the State of New Mexico that construction quality assurance was conducted as provided in the CQA Plan and, based on visual observations and data generated in accordance with the CQA Plan, the landfill or surface impoundment was constructed in accordance with ~~the~~ 40 CFR 264.19, the Construction Drawings, the CQA Plan, and the General Specifications, except as properly authorized and documented in the CQA final report. The CQA Record Drawings will include the following: primary and secondary geomembrane panel layout drawings; all drawings (including cross-sections) depicting any deviations from the Construction Drawings; and all survey conformance data.

A separate Final Report will be issued for each phase of the landfill. The final CQA Report will present the results of CQC tests conducted by the installation constructors as well as the CQA tests.

APPENDIX A

TEST FILL PLAN

1.0 PURPOSE AND SCOPE

The purpose of the test fill is to establish a sequential and logical approach for the development of placement and compaction procedures to be used during construction of cohesive soil liners as an indicator that the soil liners are constructed in a way that meets design performance specifications. The test fill program will allow the Contractor, the Design Engineer, and the Construction Quality Assurance (CQA) engineer to identify appropriate placement and compaction procedures by establishing relationships between various compaction parameters, density, water content, Atterberg limits, particle size distribution, and permeability of the fill.

Once the construction procedures have been established by the test fill program, the Contractor and the CQA Engineer will monitor the cohesive soil liner construction procedures as an indicator that the design performance specifications are being achieved, Test fill construction procedures will include measuring lift thickness, counting the number of compactor coverages, and performing in-place density and moisture content tests to verify that the specified degree of compaction is achieved.

The test fill will be constructed in uniform horizontal lifts of uniform thicknesses.

This test fill program documents the requirements for constructing the test fill. The test fill program will include:

- subgrade preparation
- construction of a 3-foot-thick test fill
- inspection and testing of the test fill
- sampling of portions of the test fill

The test fill program described in this appendix may be modified based on site specific design and construction considerations.

Feasibility testing of clay sources will have been performed before the start of the test fill. These tests should provide the basic relationship of permeability with varying density and moisture content.

2.0 CONSTRUCTION EQUIPMENT

The equipment to be used for the test fill shall be proposed by the Contractor, and approved by the CQA Engineer and Project Manager.

3.0 TEST FILL MATERIAL

Test fill material shall be approved by the CQA Engineer. The material shall meet the requirements of the Specification Section 02221. The Material shall be an inorganic cohesive soil with a plasticity index (PI) ranging between 10 and 40; at least 50 percent of the soil shall pass the No. 200 sieve. As approved by the CQA Engineer, small quantities of fill with PI greater than 40 may be allowed if such materials are thoroughly mixed with other less plastic soils. Other materials may be considered based upon laboratory testing and upon approval of the Project Manager. The maximum particle size shall be 2 inches before processing. No frozen material shall be used, and in-place material that becomes frozen prior to completion of operations shall be removed.

4.0 TEST FILL CONSTRUCTION

4.1 SUBGRADE PREPARATION

The area within the limits of the test fill shall be cleared and grubbed of all trees, debris, brushes, stumps, roots, trash, and any other vegetation or objectionable material. Following clearing and grubbing, the area shall be stripped of topsoil. Topsoil shall be stockpiled in an area designated by the Project Manager.

The surface of the subgrade shall be proof-rolled so as to be free of soft zones, irregularities, loose earth, and abrupt changes in grade. The subgrade and test fill shall be sloped at a 2 percent grade. No standing water or excessive moisture shall be allowed on the surface of the subgrade. The surface shall be inspected by the CQA Engineer prior to beginning construction of the test fill.

If placement and compaction of soil materials on slope areas is to be accomplished by the downslope compaction method rather than by horizontal benching, the test fill shall have a sloped area of similar grade to the intended liner installation where the downslope compaction method can be evaluated.

4.2 CONFIGURATION

The test fill shall be a rectangle approximately 60 feet long by 20 feet wide. The test fill shall be constructed to a thickness of 3 feet in uniform horizontal lifts. Lines and grades shall be controlled by survey.

4.3 FILL PLACEMENT

The test fill shall be constructed in uniform horizontal lifts to a total thickness of 3 feet after compaction in accordance with the procedures specified below. The procedures, which vary with the lift considered, are intended to allow determination of a relationship between soil compaction criteria, which include density and moisture content, permeability, and compaction method parameters. Compaction method parameters include: (1) compactor characteristics; (2) thickness of compacted/uncompacted layers; (3) number of compactor coverages; and, soils moisture content.

4.3.1 First Lift

1. The first lift of test fill material shall be placed to a thickness resulting in 6 inches after compaction.

2. Soils moisture content shall be maintained when the placement window defined in the Specifications (Section 02221). The contractor shall adjust the moisture content as necessary to obtain the specified density criteria.

3. The test fill material shall be compacted with two one-way coverages using the Contractor's proposed compaction equipment.

4. The Contractor shall permit the CQA Engineer to perform in-place density tests and collect soil samples as specified in 5-3..

5. QA Engineer to perform in-place density tests and collect soil samples as specified in Section 5.3.

6. Holes left in the lift shall be repaired in accordance with methods outlined in the CQA plan. The repairs shall be compacted using procedures which have been shown to meet the required moisture and density criteria.

7. The test fill material shall be compacted a second time by applying two more one-way coverages with the selected compactor.

8. Steps 4 and 5 shall be repeated. Second tests shall be taken near the original tests.

9. The test fill material shall be compacted a third time by applying two more one-way coverages with the selected compactor.

10. Steps 4 and 5 shall be repeated. Third tests shall be taken near the first and second tests.

11. Steps 8 and 9, respectively, shall be repeated and continued until specified compaction criteria are obtained as identified by the CQA Engineer.

4.3.2 Second Lift

1. The loose thickness of the second lift shall be such that the thickness of the lift will be 6 inches after compaction.

2. A competent bond with the first lift shall be achieved by the Contractor and approved by the CQA Engineer.

3. Steps 2 through 10 of Section 4.3.1 shall be repeated.

4.3.3 Remaining Lifts

1. The loose thickness of the remaining lifts shall be such that the thickness of the lifts will be 6 inches after compaction.

2. The procedures for compacting and testing the remaining lifts shall be those that have been tested and proven effective during the compaction of the second lift.

4.3.4 Final Surface Preparation

The surface of the test fill shall be rolled with a smooth steel drum or pneumatic rolled so as to be free of irregularities, loose earth, and abrupt changes in grade. All stones larger than 1 inch shall be removed. Stones which are smaller than 1 inch and are judged to be detrimental to a geomembrane liner will be removed. One-half of the prepared soil surface shall be protected against drying with temporary plastic sheets. The sheets shall be placed immediately after the completion of surface preparation. Observations and documentation of desiccation cracking versus time shall be made on the uncovered section of the test fill.

5.0 INSPECTION AND TESTING

5.1 TEST FILL MATERIAL

The CQA Engineer shall perform testing on the cohesive soil material prior to its use in the test fill. Testing, using the most recent ASTM method, will include at least the following:

- soil density/moisture content relationship using the Modified and Standard Proctor Compaction Method (ASTM D 698 and ASTM D 1557)
- natural water content (ASTM D 2216)
- particle size distribution (ASTM D 422)
- Atterberg limits (ASTM D 4318)
- soil classification (ASTM D 2487)

5.2 SUBGRADE PREPARATION

The CQA Engineer shall observe the prepared subgrade for firmness, smoothness, and absence of abrupt changes in grade.

5.3 TEST FILL CONSTRUCTION

5.3.1 Lift Compaction

For the first and second lifts, the CQA Engineer shall perform the following activities:

- estimate the thickness of the loose lifts
- count the number of compactor coverages and observe compactor coverage of the test fill (Figure 1)
- at every two (2) coverages, perform a minimum of eight nuclear gauge in-place density and moisture reading (ASTM D 2292); compute degree of compaction (i.e., in-place dry density divided by the Standard Proctor or Modified maximum dry density; collect four additional soil samples for moisture content determination (ASTM D 2216)
- observe the repair of holes left in the lift as a result of density testing and soil sample collection
- continue in-place density testing and moisture content determination to enable development of a curve giving in-lace dry density versus number of compactor coverages for each lift thickness

For each of the remaining lifts, the CQA engineer shall perform the following activities:

- verify that the thickness of the loose lift does not exceed the loose thickness determined from testing of the second lift
- count the number of compactor coverages, determined from testing of the second lift, which are necessary to achieve the specified density and observe compactor coverage of the test fill
- perform a minimum of eight nuclear density tests per lift to verify the adequacy of the construction procedures previously established

The CQA Engineer shall collect a minimum of six (6) undisturbed ~~Shelby tube~~ samples ~~or 12-inch x 12-inch x 6-inch undisturbed block soil samples~~ from varying depths of the completed test fill. The samples shall be waxed or otherwise protected to retain natural moisture and tested in the laboratory for the following:

- hydraulic conductivity (permeability) using water as the permeant (ASTM D 5084)
- dry density
- particle size distribution (ASTM D 422)
- Atterberg limits (ASTM D 4318)
- soil classification (ASTM D 2487)
- soil moisture content (ASTM D 2216)

The CQA Engineer shall observe the test fill to verify the adequacy of the bonding between adjacent lifts. Such observation shall be exercised on the portion of the test fill which has been excavated to permit removal of undisturbed soil block samples.

5.3.2 Final Surface Preparation

The CQA Engineer shall observe the prepared surface for firmness, smoothness, and absence of abrupt changes in grade.

5.3.3 Permeability Testing

The permeability of the test fill shall be assessed by performance of a minimum of six (6) laboratory tests on ~~specimens trimmed form the~~ 12-inch diameter undisturbed specimens obtained ~~block of Shelby tube samples tested~~ at a location selected by the CQA Engineer.

5.4 TEST RESULTS

The test results which will be used to verify that the specified construction procedures meet the design performance criteria shall be:

- compaction testing (i.e., degree of compaction, in-place dry density, and moisture content)
- results of laboratory permeability testing performed on undisturbed soils samples
- soil index testing to evaluate material suitability

5.5 LINES AND GRADES

The following surfaces shall be surveyed to verify that proper thicknesses have been constructed:

- prepared surface of the subgrade
- final surface of the test fill

6.0 DOCUMENTATION

The CQA Engineer shall document activities associated with the construction, monitoring, and testing of the test fill. Such documentation shall include daily reports of construction activities and oral communications with the contractor. In addition, the following shall be documented for each of the section listed below:

6.1 TEST FILL MATERIAL

The CQA Engineer shall provide a moisture-density relationship for the test fill liner material and other and other test results as specified in Section 5.1.

6.2 TEST FILL CONSTRUCTION

6.2.1 Subgrade preparation

The CQA Engineer shall document observations on subgrade preparation, as specified in Section 5.2.

6.2.2 Test Fill Construction

The CQA Engineer shall document activities of the test fill construction, monitoring, and testing in a test fill summary report, which shall include but not be limited to:

- record of the compactor type, configuration, and weight; for sheepsfoot compactors, record the drum diameter and length, empty and ballasted weight, length and face area of feet, and yoking arrangement, if any
- record thicknesses of lifts prior to and after compaction
- record density versus number of compactor coverages for each lift thickness, as specified in Section 5.3.1
- record the number of compactor coverage which will provide the specified degree of compaction and permeability
- record the procedure to bond lifts
- results of moisture, in-place density and degree of compaction, as specified in Section 5.3.1
- repair of holes left in the lift as a result of density testing and soil sample collection, as specified in Section 5.3.1
- results of laboratory permeability testing and other soil properties tests performed on undisturbed soil samples
- as-built drawing of the test fill and locations of all test samples for each lift
- cross-section of the test fill showing number of lifts and lift thickness
- description of actual construction procedures
- observations of test fill excavation for removal of undisturbed soils samples and observations of layer bonding, as specified in Section 5.3.1

APPENDIX B

PROJECT ADMINISTRATION RECORDS

APPENDIX C

SOILS CQA RECORDS

APPENDIX D

GEOSYNTHETICS CQA RECORDS

MONTGOMERY WATSON DAILY FIELD REPORT
TRIASSIC PARK WASTE DISPOSAL FACILITY

Daily Report Number
Date Work Performed

MONDAY

Staff On-site

□ Name	□ Name	□ Name
□ Name	□ Name	□ Name
□ Name	□ Name	□ Name

Weather Conditions

Temperature (F)….
Skies……………..
Wind………………
Precipitation? □
Site Closure? □

Contractor Activity

Earthworks

- □ Type D subgrade preparation
- □ Sand placement
- □ Type B placement over geonet
- □ Type E placement over geotextile
- □ Other

Geosynthetics

- □ Geosynthetics deployment
- □ Geosynthetics detail work

Geosynthetic Activity Summary (Geosynthetic Installation Monitoring Summary attached)

Material Inventory (see Weekly Summary Report for material quantities)

- □ Geomembrane
- □ Geonet
- □ Geotextile

Material Deployment	today (sf)	total to date (sf)
Geomembrane		
Geonet		
Geotextile		

Issues List Updated □ (attached)

Area Approved for Sand Placement (see attached drawing)

Other:

QA Soil Testing

- □ Field Testing
- □ Laboratory Testing

Meeting Attendance (meeting notes attached)
Daily Construction Meeting

- □ Name
- □ Name
- □ Name
- □ NSC
- □ Name

Miscellaneous

Report prepared by: Diane Dwire