RECEIVED
SEP 16 1996

Interim Action Plan for

Potential Release Sites 35-003(d, l, and q)

d = 59
l = 59
q = 59

Field Unit 4

Environmental Restoration Project

August 1996

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-96-2826

5352

LATA

Prepared By CW Date 7/16/96
Checked By _____ Date _____

Cost Estimate

TA-35-7

Project Title: Engr. Erosion Control & Drainage Plan "C" Δ 7/15/96 CW

Estimate No. 3
Sheet No. 4 of 4

Item No.	Description	Quan.	Unit	Daily Output	Man Hours	Crew	BARE COSTS MAT.	LABOR	EQUIP	TOTAL	TOTAL Incl. O&P
8.	Demobilization	1	ea.							630	741
	Subtotal									630	741
9.	Subtotal items 1-8									51,950	65,056
10	Contractor O.H. (30% m, L, E)										15,585
	Subtotal										80,641
11.	Final cleanup (0.3%)										242
	Subtotal										80,883
12.	Area Multiplier (1.025)										2,022
	TOTAL										82,905
									Use		$82,900

LATH

Prepared By (cnl) Date 7/16/96
Checked By _____ Date _____

Cost Estimate

TA-35-7

Project Title: Engr. Erosion Control & Drainage Plan "C"

Estimate No. 3
Sheet No. 3 of 4
Δ 7/15/96

Item No.	Description	Quan.	Unit	Daily Output	Man Hours	Crew	BARE COSTS MAT.	LABOR	EQUIP	TOTAL	TOTAL Incl. O&P
6.	Culvert Installation										
	24" bitum. coated (CMP)										
a.	remove pavement (020 550 2300)	200	S.F.	1900	.025	B-39		0.52	0.08	120	182
	small quantity + 200%							1.04	0.16	240	364
b.	excavate (022 254 0060)	145	C.Y.	200	.080	B-11M		1.78	1.41	463	629
c.	24" CMP (027 164 2140)	240	L.F.	160	.175	B-21	18.50	3.96	0.67	5,551	6,600
d.	backfill (022 204 0010)	35	C.Y.	14	.571	1Clab		11.10		389	620
	air tamper (022 204 0500) +	65	C.Y.	190	.211	B-9		4.17	0.80	323	491
	roller (022 204 0400) +	100	C.Y.	100	.120	B-10A		2.79	0.84	363	525
e.	replace paving (025 100 1050	23	S.Y.	70	.686	B-37	6.45	14.05	2.00	518	736
	small area + 200%									1,036	1,472
f.	storm water inlets										
	(027 150 0800)	2	ea.	2	12	B-6	340.00	252.00	103.00	1,390	1,760
g.	grate (beehive) (027 150 1578	2	ea.	24	.667	2Clab	196.50	19.43	—	432	950
	Subtotal									10,825	14,329
7.	Riprap										
a.	load (022 216 6000)	10	C.Y.	715	.022	B-12N		0.53	0.87	14	16
b.	haul (022 266 0560)	10	C.Y.	32	.250	B-34C		5.10	12.85	180	220
c.	place (022 712 0100)	10	C.Y.	62	.258	B-12G	10.00	6.15	7.50	237	285
	Subtotal									431	521

LATA

Prepared By [illegible] Date 7/16/96
Checked By _____ Date _____

Cost Estimate

TA-35-7

Project Title: Engr. Erosion Control & Drainage Plan - "C" Δ 7/15/96

Estimate No. 3
Sheet No. 2 of 4

Item No.	Description	Quan.	Unit	Daily Output	Man Hours	Crew	BARE COSTS MAT.	LABOR	EQUIP	TOTAL	TOTAL Incl. O&P
4.	Topsoil (81CY X 1.15 swell)										
a.	load (022 216 4050)	90	C.Y.	550	.022	B-10R	3.58	0.51	0.42	406	468
b.	haul (022 266 0560)	90	C.Y.	32	.0250	B-34B		5.10	12.85	1,616	1,980
c.	spread (022 286 0400)	90	C.Y.	200	.040	B-10S		1.39	1.64	273	357
d.	place stabilization fabric (022 308 6000)	4400	S.Y.	10,000	.002	B-6	1.48	0.05	0.02	6,864	7,656
e.	fine grade & seed, incl. lime fert, seed w/equip (022 286 1000)	4400	S.Y.	1,000	.048	B-14	0.18	0.98	0.21	6,028	8756
	Subtotal									15,187	19,217
5.	Construct Soil Berm (400 x 2' high - borrow mtl.)										
a.	load (022 216 4010)	120	C.Y.	1135	.014	B-120	3.58	0.34	0.78	564	636
b.	haul (022 266 0560)	120	C.Y.	32	.250	B-34C		5.10	12.85	2,154	2,640
c.	spread (022 262 0170)	120	C.Y.	600	.020	B-10P	-	0.46	1.35	217	264
d.	compact (022 226 5000)	120	C.Y.	2600	.005	B-10Y	-	0.11	0.13	30	37
										2,965	3,577

LHTH

Prepared By (CM) Date 7/16/96
Checked By _____ Date _____

Cost Estimate

TA35-7
Project Title: Engr. Erosion Control & Drainage Plan - "C"

Estimate No. 3
Sheet No. 1 of 4
Δ 7/15/96

Item No.	Description	Quan.	Unit	Daily Output	Man Hours	Crew	BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL Incl. O&P
1.	Field Office Expense (move-in, util, equip, etc.) per month (010 034 0010	1	mo.							879	966
	Subtotal									879	966
2.	Mobilization										
	loader (022 274 1200)	1	ea.	4.5	1.778	–	–	36	174	210	247
	roller (022 226 5000)	1	ea.					36	174	210	247
	grader (025 274 0200)	1	ea					36	174	210	247
	Subtotal									630	741
3.	Borrow Material 661 C.Y. X 0.2 swell)										
a.	load (022 216 4050)	793	C.Y.	550	.022	B-10R	3.58	0.51	0.42	3,576	4,124
b.	haul (022 266 0560)	793	C.Y.	32	.250	B-34B		5.10	12.85	14,234	17,446
c.	spread (022 286 0400)	793	C.Y	200	.060	B-10S		1.39	1.64	2,403	3,148
d.	compact (022 226 5000)	793	C.Y	2600	.005	B-10Y		.11	.13	190	246
	Subtotal									20,403	24,964

LATA

Prepared By (CM) Date 7/2/96
Checked By _____ Date _____

Cost Estimate

TA-35-7

Project Title: Engr. Erosion Control & Drainage Plan - "B" Δ 7/15/96

Estimate No. 2
Sheet No. 4 of 4

Item No.	Description	Quan.	Unit	Daily Output	Man Hours	Crew	BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL Incl. O&P
8.	Demobilization	1	ea.							630	741
	Subtotal									630	741
	Subtotal items 1-8									36,274	45,278
	Contractor O.H. (30% M.L.E)										10,885
	Subtotal										56,163
	Area multiplier (1.025)										1,404
	Subtotal										57,567
	Final Cleanup (0.3%)										172
	TOTAL										57,739
										use	$57,800
	means Site Work & Landscape - 1995										

LATA

Prepared By (CM) Date 7/2/96
Checked By _____ Date _____

Cost Estimate

TA-35-7
Project Title: Engr. Erosion Control & Drainage Plan

Estimate No. 2
Sheet No. 3 of 4
" B " Δ 7/15/96

Item No.	Description	Quan.	Unit	Daily Output	Man Hours	Crew	BARE COSTS MAT.	LABOR	EQUIP	TOTAL	TOTAL Incl. O&P
6.	Culvert installation 24" coated CMP										
a.	Remove pavement (020 550 2300)	200	S.F.	1900	.025	B-39		0.52	0.08	120	182
	sm. 11 quantity +200%							1.04	0.16	240	364
b.	Excavate (022 254 0060)	145	C.Y.	200	.080	B-11M		1.78	1.41	463	629
c.	24" CMP (027 164 2140	240	L.F.	160	.175	B-21	18.50	3.96	0.67	5551	6600
d.	Backf. 11 (022 2040010)	35	C.Y.	14	.571	1 clab		16.10		389	620
	air tamp + 0500	65	C.Y.	190	.211	B-9		4.17	0.80	323	491
	roller + 0400	100	C.Y.	100	.120	B-10A		2.79	0.84	363	525
e.	Replace paving (025 100 1050)	23	S.Y.	70	.686	B-37	6.45	14.05	2.00	518	736
	add 200% - smaller area									1036	1472
f.	Stormwater inlets (027 150 0800)	2	ea	2	12	B-6	340.00	252.00	103.00	1390	1760
g.	Grate (beehive) (027 150 1578)	2	ea	24	.667	2 clab	196.50	19.43	—	432	950
	Subtotal									10,825	14,329
7.	Rip Rap										
a.	load (022 216 6000)	10	C.Y.	715	.022	B-12N		0.53	0.87	14	16
b.	haul (022 266 0560)	10	C.Y.	32	.250	B-34C		5.10	12.85	180	220
c.	place (022 712 0100)	10	C.Y.	62	.258	B-12G	10.00	6.15	7.56	237	285
	Subtotal									431	521

LATA

Prepared By (CM) Date 7/2/96
Checked By _____ Date _____

Cost Estimate

TA-35-7

Project Title: Engr. Erosion Control & Drainage Plan - "B" Δ7/15/96

Estimate No. 2
Sheet No. 2 of 4

Item No.	Description	Quan.	Unit	Daily Output	Man Hours	Crew	BARE COSTS MAT.	LABOR	EQUIP	TOTAL	TOTAL Incl. O&P
4.	Topsoil (50C.Y.X.3=well)										
a.	load (022 216 4050)	48	C.Y.	550	.022	B-10R	3.58	0.51	0.42	216	250
b.	haul (022 266 0560)	48	C.Y.	32	.250	B-34-B		5.10	12.85	862	1056
c.	spread (022 286 0400)	48	C.Y.	200	.06	B-10S		1.39	1.64	145	191
d.	Place stabilizing fabric (022 308 6000)	267	S.Y.	10,000	.002	B-6	1.49	0.05	0.02	417	465
e.	Fine grade & seeding, incl. lime, fert, seed w/equip. (022 286 1000)	267	SY	1,000	.048	B-14	0.18	0.98	0.21	366	531
	Subtotal									2,006	2493
5.	Construct Soil Berm (400'x2'high Borrow material)										
a.	load (022 216 4010)	120	C.Y.	1135	.014	B-10	3.58	0.34	0.78	564	636
b.	haul (022 266 0560)	120	C.Y.	32	.25	B-34C	–	5.10	12.85	2154	2640
c.	spread (022 262 0170)	120	C.Y.	600	.02	B-10P	–	0.46	1.35	217	264
d.	compact (022 226 5000)	120	C.Y.	2600	.005	B-10Y	–	0.11	0.13	30	37
	Subtotal									2965	3577

LATA

Prepared By (CW) Date 7/2/96
Checked By _____ Date _____

Cost Estimate

TA-35-7

Project Title: Engr. Erosion Control & Drainage Plan - "B" Δ-7/15/96

Estimate No. 2
Sheet No. 1 of 4

Item No.	Description	Quan.	Unit	Daily Output	Man Hours	Crew	BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL Incl. O&P
1.	Field Office Expense (move in, util., equip. etc.) per month (010 034 0010)	1	mo.							879	966
	Subtotal									879	966
2.	Mobilization	1	ea.								
	loader (022 274 1200)		ea.	4.5	1.778		—	36	174	210	247
	roller (022 226 5000)							36	174	210	247
	grader (025 274 0200)							36	174	210	247
	Subtotal									630	741
3.	Borrow material (580 C.Y. × 0.23 swell)										
a.	load (022 216 4050)	696	C.Y.	550	.022	B-10R	3.58	0.51	0.42	3139	3619
b.	Haul (022 266 0560)	696	C.Y.	32	.250	B-34B		5.10	12.85	12493	15312
c.	spread (022 286 0400)	696	C.Y.	200	.060	B-10S		1.39	1.64	2109	2763
d.	compact (022 226 5000)	696	C.Y.	2600	.005	B-10Y		0.11	0.13	167	216
	Subtotal									17,908	21,910

LATA

Prepared By CAM Date 7/2/96
Checked By _____ Date _____

Cost Estimate

TA-35-7

Project Title: Engr. Erosion Control & Drainage Plan - "A" Δ 7/15/96

Estimate No. 1
Sheet No. 3 of 3

Item No.	Description	Quan.	Unit	Daily Output	Man Hours	Crew	BARE COSTS MAT.	LABOR	EQUIP	TOTAL	TOTAL Incl. O&P
Δ	Final Cleanup (0.390)										147
Δ	TOTAL										49,089
										Use	49,100
	Means Site Work & Landscaping - 1995										

LATA

Prepared By (CM) Date 7/2/96
Checked By _____ Date _____

Cost Estimate

TA-35-7

Project Title: Engr. Erosion Control & Drainage Plan "A" Δ 7/15/96 (CM)

Estimate No. 1
Sheet No. 2 of 3

Item No.	Description	Quan.	Unit	Daily Output	Man Hours	Crew	BARE COSTS MAT.	LABOR	EQUIP	TOTAL	TOTAL Incl. O&P
4.	Construct Soil Berm (400' long - 2' high) Borrow material										
a.	load (022 216 4010)	120	C.Y.	1135	.014	B-120	3.58	0.34	0.78	574	636
b.	haul (022 266 0560)	120	C.Y.	32	.25	B-34C	5.10	12.85	—	2154	2640
c.	spread (022 262 0170)	120	C.Y.	600	.02	B-10P	—	0.46	1.35	217	264
d.	compact (022 226 5000)	120	C.Y.	2600	.005	B-10Y	—	0.11	0.13	30	37
	Subtotal									2975	3577
5.	Demobilization									420	494
	Subtotal									420	494
	Subtotal items 1-5									31,780	38,214
	Contractor O.H. (30% mtl. L & E)										9534
	Subtotal										47,748
	Area Multiplier (102.5)										1194
	Subtotal										48,942

LATA

Prepared By [illegible] Date 7/1/96
Checked By _____ Date _____

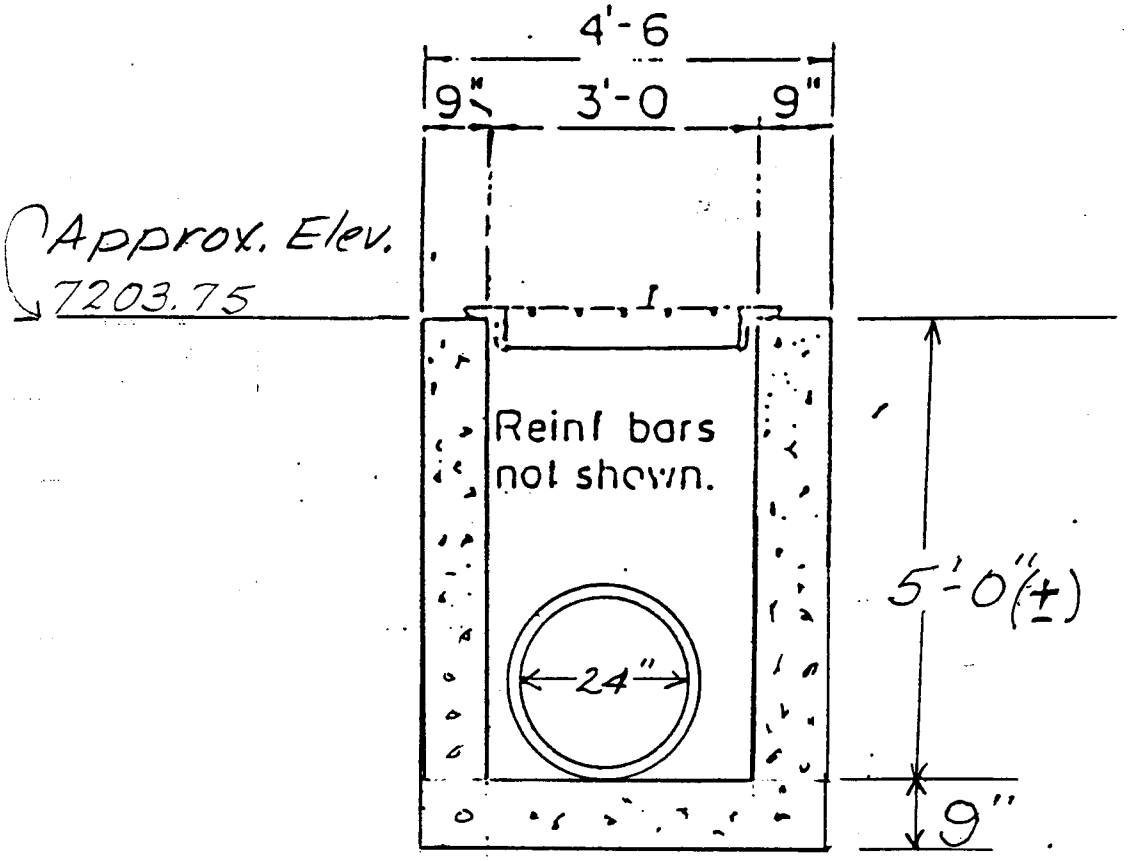
Cost Estimate

TA-35-7

Project Title: Engr. Eros Controlled Drainage Plan - "A" Δ-7/15/96

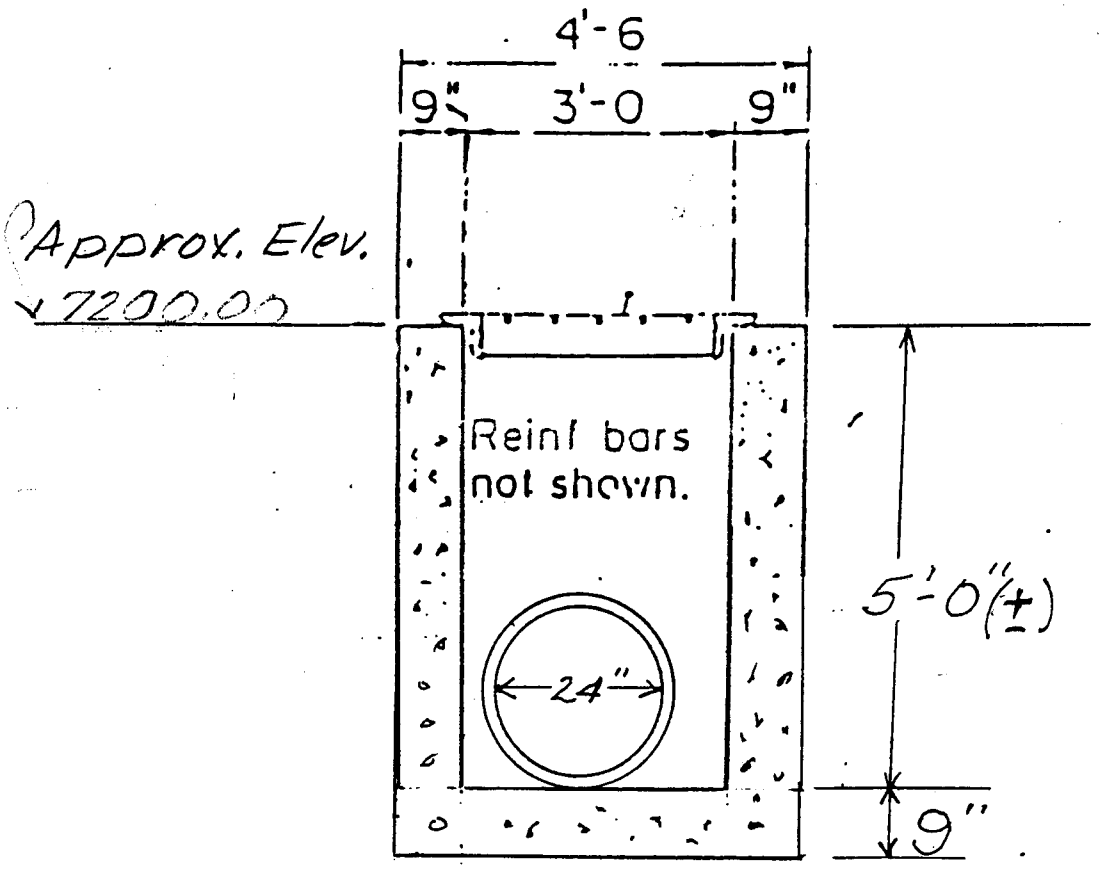
Estimate No. 1
Sheet No. 10 of 13

Item No.	Description	Quan.	Unit	Daily Output	Man Hours	Crew	BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL Incl. O&P
1	Field Office Expense (movein, util, equip, etc.) permonth (010 034 0010)	1	mo.							879	966
	Subtotal									879	966
2.	mobilization										
a.	loader (022 274 1200)	1	ea.	4.5	1.778	B 34K		36 ea	174 ea	210	247
b.	roller (022 274 1200)	1	ea.	4.5	1.778	"		36 ea	174 ea	210	247
	Subtotal									420	494
3.	Fill Rock										
Δ a.	load (022 216 6000)	580	C.Y.	715	.022	B 12-N	3.70	0.53	0.87	2950	3393
Δ b.	haul (022 266 0560)	580	C.Y.	32	.25	B 34-B	5.10	12.85		10,411	12760
Δ c.	Place (022 712 0100)	580	C.Y.	62	.258	B 12G	10.00	6.15	7.50	13,717	16,530
	Subtotal									27,086	32,683



DROP INLET

1



DROP INLET

2

Engineering Erosion Control and Drainage Plan

Technical Area 35 - Operable Unit 1129

Major erosion has occurred within the past few years to an area of approximately 0.4 acre situated due east of the location of old building TA-35-7. Runoff consisting primarily of drainage from the roof of building TA-35-2 and a surrounding area totaling approximately 3.0 acres has caused serious erosion to a small arroyo. If left as is the runoff will continue to badly erode SWMU NOS. 35-003 (d, l, and q) and 35-003 (r). A hundred year flood would produce 2 1/2 inches of storm water over the drainage area and force over 204,000 gallons of water to be channeled over this already severely eroded area. A flood of this magnitude would cause further major washouts to SWMU NOS. 35-003 (d, l, and q) and 35-003 (r), which could produce widespread problems for the Laboratory in the future.

An in depth engineering study has been conducted concerning the erosion problem in this area to determine the most feasible and economical ways to solve the problem. Three rational approaches were selected. Alternative "A" is a stop gap approach which will leave the existing drainage culverts in place, fill the eroded arroyos with large rock, and build a berm along the north side of the service road to the east. This approach would channel much of the sheet flow water into Ten Site Canyon. The second alternative, "B," is to pack the arroyos with fill material and compact it, bringing in topsoil and re-seeding the arroyo areas with a mixture if native grasses and installing a stabilizing membrane to obtain proper germination. This alternative would also require building the aforementioned berm, and installing approximately 240 feet of new 24 inch corrugated metal culvert. This alternative would divert much of the runoff to the southeast of former Building 35-7 into Ten Site Canyon, abandoning the existing culvert. The third alternative, Plan "C," would not only accomplish all items in Plan "B" but would also re-grade the slopes over the entire area, east of Building TA-35-7.

Alternative "A" requires 350 cubic yards of large rock to be hauled to the site and stockpiled along the north side of the service road southeast of SWMU NOS. 35-003 (d, l, and q) and 35-003 (r). This rock will then be placed into the eroded ditches. Some additional handwork by laborers will be necessary to complete this operation. Once the rock is in place, approximately 120 cubic yards of clean fill material will be hauled to the area and installed along the north side of the service road. This material will extend for approximately 400 feet to the east, beginning at the west end of SWMU NOS. 35-003 (d, l, and q) and 35-003 (r). This material will be wetted to proper moisture content and compacted to 80-85% maximum density in a berm approximately two feet high. The berm will force water that would normally drain into the eroded area to the east into Ten Site Canyon, southeast of the eroded area. The estimated cost of this alternative is $49,100.

Alternative "B" requires filling of all eroded gullies with approximately 696 cubic yards of borrow materials and compacting to 85% maximum density. Then 6 inches of topsoil will be spread over the arroyo areas only, and will be seeded with a native grass mixture. A stabilizing membrane will be used to allow proper germination.

To channel some of the surface sheet flow runoff, a 400 foot compacted berm approximately two feet high will be installed along the north side of the service road, south and east of SWMU NO. 35-003 (d, l, and q). This berm will consist of approximately 120 cubic yards of clean borrow materials, which will be hauled to the site and dumped. The material will be spread, moistened and compacted to 85% maximum density. The berm will force some runoff presently emptying into SWMU NO. 35-003 (d, l, and q) into Ten Site Canyon, east of SWMU. This will also prevent further erosion of the affected area and move the final discharge into a lower discharge site in Ten Site Canyon.

To further minimize erosion to SWMU NO. 35-003, a new 24 inch corrugated metal pipe culvert 40 feet long with two inlets will be installed southeast of Building TA-35-2 and continue southeast for approximately 200 feet emptying onto the north slope of Ten Site Canyon for a total length of 240 feet. To reduce the force of the discharge from the culvert, approximately 10 cubic yards of large rock will be placed under the pipe's discharge end. The existing culvert will be plugged on the upstream end and abandoned in place, further preventing runoff from reaching SWMU NOS. 35-003 (d, l, and q) and 35-003 (r). The estimated cost of this alternative is $57,800.

Alternative "C" is more involved than Alternative "B." but will provide a more complete solution to the drainage problems currently plaguing SWMU NOS. 35-003 (d, l, and q) and 35-003 (r). Filling the three erosional cuts in SWMU NO. 35-003 (d, l, and q) will require hauling, stockpiling, and placing approximately 793 cubic yards of clean borrow material in the cuts and over the surrounding area. This includes a swell factor of 30% after proper wetting and compacting the material to 85% maximum density. This amount of material will allow the grade of the slopes to be corrected to 2 1/2:1 or 3:1, preventing future erosion. Approximately 50 cubic yards of topsoil will be placed over the fill slopes and graded smooth. The entire area will be seeded with a native grass mixture with a stabilizing membrane to permit proper germination of the grass mixture.

This alternative includes the berm as shown in alternative "B" and the 24 inch CMP installed exactly as in "B."

The estimated cost of Alternative "C" is $82,900.

An 8 1/2 X 11 area map is attached.

9.3 Engineering Erosion Control and Drainage Plan

The attached Engineering Erosion Control and Drainage Plan, which was prepared by a registered professional civil engineer, describes three levels of erosion control. Alternative "B" was chosen for the reasons described in Section 3.0.

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Los Alamos
NATIONAL LABORATORY

RADIOLOGICAL WORK PERMIT

ESH USE ONLY

Permit Number: 35-ER-96-010

Effective Date/Time: 8-20-96 | Expiration Date/Time: 12-31-96

GENERAL INFORMATION (to be completed by requester)

Requested by: JOHN HAYES | Group: AS1/FU#4 | Telephone Number: 662-1348 | Mail Stop: M-327

Work Location (TA, Building, Room Number): TA-35 PRS# 35-003(d,l,q) | SOP Number: N/A | Small Job Ticket: N/A | Work Order Number: N/A

Work to be performed (Add attachment if necessary):
FILL IN DRAINAGE CHANNEL & CONSTRUCT BERM TO RE-ROUTE DRAINAGE IF NECESSARY

Approval required by (date): 8-26-96 | Desired start date: 9-1-96 | Probable end date: 12-31-96

Describe additional hazards (Ex: limited egress, confined space, chemicals, criticality, hot particles, etc.)
SLIPS, TRIPS, FALLS HEAVY EQUIPMENT — SEE THA.

PRE-JOB RADIOLOGICAL CONDITIONS

Estimated Radiation Levels
Surface Contamination TBD dpm/100 cm² Airborne Contamination TBD DAC External Dose Equivalent Rate 0.01 mrem/hr
Identify nuclides if possible ^{90}Sr, ^{137}Cs, ^{238}U, ^{234}Th

Measured Radiation Levels*
Beta + gamma (mrem/hr): NP-64,000 / 0.01
Neutrons (mrem/hr): N/A

Measured Contamination Levels*

	DIRECT (dpm/100 cm²)	SMEAR (dpm/100 cm²)
Alpha	NDA / NDA	NA
Beta + gamma	20,000 / 64,000	NA
Tritium		N/A

* Record general area/highest level encountered—see survey report for additional information.

Identify any contamination under paint or on inaccessible surfaces: NONE

Airborne Contamination Data: TBD DAC | Surveyed by: [signature] | Z Number: 108821 | Date: 8/7/96

RADIATION PROTECTION REQUIREMENTS

Protective Clothing Requirements ☐ None required
- ☑ Level I (Coveralls, 2 pairs of surgeon's gloves, booties, and skull cap)
- ☐ Level II (2 Coveralls, 2 pairs of surgeon's gloves, 2 pairs of booties, and hood)
- ☐ Taped openings
- ☐ Other (See special requirements below)

Respiratory Requirements ☐ None required
- ☐ Full-face respirator
- ☐ Chemical cartridge
- ☐ SCBA
- ☐ Supplied-air mask
- ☐ ESH-5 respirator card
- ☐ Supplied-air suit
- ☐ Particulate cartridge
- ☐ CAM
- ☑ Special air test
- ☐ Regular air test
- ☐ Combination cartridge
- ☐ Ventilation (Specify)
- ☐ _____

Dosimetry Requirements ☐ None required
- ☑ WB dosimeter
- ☐ Secondary dosimeter
- ☐ PNAD packet
- ☐ TLD finger rings
- ☐ Alarming dosimeter
- ☐ NTA badges
- ☐ Nose swipes
- ☐ Whole-body count
- ☐ Urinalysis
- ☐ Workers are on Pu access list

RCT Monitoring Requirements ☐ None required
- ☐ Intermittent coverage
- ☑ Continuous coverage
- ☑ Personnel before leaving job
- ☐ Notify RCT at job end
- ☐ Self-frisking
- ☑ Equipment and tools before removal
- ☐ Notify RCT before job starts @ _____
- ☐ RCT monitor undress

Special Posting Requirements ☐ None required
- ☑ Required (Specify) EXCLUSION ZONE

Training Requirements
- ☐ GERT
- ☐ RadWorker I
- ☑ RadWorker II
- ☐ Other

Special Requirements ☐ None required
- ☑ ALARA review/pre-job briefing
- ☐ Special ALARA controls (See attachment)
- ☑ Heat stress monitoring required (contact ESH-5)

Instructions /Limiting Conditions (Add attachments if necessary)
~~* IF ENTERING DRAINAGE CHANNEL ONLY~~ NP

Completed by: | Z Number: | Date:

APPROVALS

	Z Number	Group	Date		Z Number	Group	Date
1. Line Manager				3.			
2. RCT Supervisor [signature]	108821	Group ESH-1	Date 8-27-96	4.			

Form 1571 (12/94)

ESH 94-304

Hazard Controls

Engineering/Administrative Controls, Special Equipment, etc. Water application for dus suppression. Pre-start and Daily heavy equipment inspections; employe will be kept a minimum of 5' away from the channel. A high-vol air sa will be obtained.

Additional Comments Attached: Yes XX **No** ___

PPE (Personal Protective Equipment)

Head when heavy equipment is operating (hard hat)
Face & Eye safety glasses with sidesheilds
Gloves Leather optional @ SSO discretion
Hearing Ear muffs or plugs when heavy equipment is operating
Body None
Foot Steel toed shoes or boots
Respiratory: Type of Respirator None required **Type of Cartridge** N/A

Additional Protection/Comments Utility mark-outs will be performed prior to excavation. The channel will be inspected by a competent person on a daily basis.

Exposure Limits

As determined in Table 6.1 of SSHASP #127

Monitoring

Noise - initially while heavy equipment is in operation. Airborne dust, Heat/Cold stress, and Radiological Monitoring as stipulated in Table 6.1 of SSHASP #127.

Participant Acknowledgment: ***Pre-job Conference: Date/Initials*** ___

Printed Name	Z Number	Signature	Date

Los Alamos National Laboratory

TASK HAZARD ANALYSIS

Location/Room TA-35 PRS #35-003 (d,l,q)

Task Name TA-35 Interim Action Agg.D *THA No.* _____ *Date* _____

SSO Approval JOHN HAYES *Date* _____

Project Leader/Supervisory Approval _____ *Date* _____

ER/HS Representative Review _____ *Date* _____

Health Physics Review _____ *Date* _____

User Group _____ *Date* _____

Task Description

Fill and compact an erosion channel on the East-side of TA-35. The original storm drain will be plugged & excavated. A new storm drain inlet will be relocated approximately 65 ft. North.

Hazard Analysis

Circle: **Chemical** **Biological** **Physical** **Radiological**

Describe: Biological - Ticks, Ants, Snakes, Spiders (L)/Physical - Slips, Trips, Falls, Pinch Points (L), Heave Equip. Operation: Dozer/ Loader, Backhoe, Compactor (M)/Radiological - Gross Beta activity up to 360 pCi/g (L)/Overhead Electric - Minimum clearance as specified in Table 4-3 pg. 17 of SSHASP#127 (H).

List all other associated Special Work Permits and Number *(include RWP, SWP, CSP, LO/TO, Spark/Flame, etc.)*

RWP #35-ER-96-010

Excavation Permit# 95E-625-3

Will task affect other LANL operations, other employees, or other tasks? No XX Yes ____

If yes, explain precautions taken and contacts notified _____

Instructions for Completing the Task Hazard Analysis/Control Form

- Write in location, task name and the date.
- Issue a Task Hazard Analysis No. For example, D94-04-01 to the first task and i sub-task(s) is associated with this task, issue D94-04-01a, etc. A THA inventory should be established for D&D projects.
- Two signatures are required before task work may begin. The SSO and the Job-S Supervisor, Field Team Leader or the Project Leader must review and approve th THA prior to work commencing. It should be noted that an ER/HS Representative signature is not required for a task to begin, however all THA's should be sent to t representative for review (Oliver Wilton or Joe Louck, Mail Stop K494).
- Task Description

  Describe the task and any steps within the task. Assess only one task per form. Examples of tasks are mobilization and demobilization, intrusive sampling, non-intrusive sampling, equipment and personal decon, duct removal, concrete cutting, etc.
- Hazard Analysis

  List all of the potential hazards associated with the task. Each category (chemical, physical, etc.) has to be addressed. For radiological, the SSO should review the RWP and include, in the *Hazard Controls* section, the PPE prescribed by health physics personnel and add any other PPE necessary for other hazards. If only radiological issues are of concern then a THA form is not required. If another permit (e.g., Confined Space Permit) is required for the task and the permit adequately addresses all hazards then a THA form is not required. Assign Risk Category (H, M or L) to each hazard: See DOE 5483.XX for methodology

RAC	Risk Category
1&2	High Risk (H)
3	Medium Risk (M)
4&5	Low Risk (L)

- Hazard Controls

  List all controls to be used for employee protection.
- Exposure Limits

  List all exposure limits.
- Monitoring

  Describe any industrial hygiene monitoring (either real time or time integrated) required by the task.
- Participant Acknowledgment

  All personnel involved with the task are required to sign the THA to verify that they understand the hazards associated with the task and how the hazards will be controlled. This should be accomplished by conducting a prework meeting.

Change Order Control Form number: 127.01

Project Title: Site Wide Soil Sampling
Operable Unit (OU): 1129
Technical Area (TA): 35
Change requested by: John K. Hayes

Plan number: 127
Draft number: Rev 2
Plan date: 31 May 1996
Task Number and Name: **Task 2 Site Characterization**

Duration of Authorization Requested: 1 August 1996 through 31 December 1996

Description of Modification: *(attach additional pages as necessary)*

Add an additional task 2-G to Table 2-2 of this SSHASP. This task will be **Interim Action at TA-35 PRS Nos. 35-003(d,l,q).** This task will consist of filling and compacting an erosion channel ranging in depth from 1 ft to 22ft and extending downward approximately 200 feet. In addition, the original storm drain will be plugged and excavated, and a new storm drain inlet will be relocated approximately 65 ft north of its current position. For a detailed description, see the attached Interim Action Plan TA-35 PRS Nos. 35-003(d, l, q) and the Engineering Erosion Control and Drainage Plan.

This Interim Action will prevent further erosion of an area encompassing the three PRS's previously identified. The potential contaminants of concern and monitoring requirements are consistent with those identified in Tables 4-3 and 6-1 of this SSHASP. One additional monitoring requirement will be performed (a high volume air sample). This will ensure that no airborne radionuclide contamination is being suspended during the filling of the drainage channel. This sampling is being performed as a precaution.

In addition, a Radiation Work Permit (RWP) and a Task Hazard Analysis will be generated to address any radiological concerns, task hazards, and ppe requirements necessary to safely complete this job. A pre-job radiological survey will be conducted by a FU-4 and ESH-1 oversight RCT's to determine the radiological conditions prior to preparing the RWP. An excavation permit (# 95E-625-35) has been obtained for TA-35 excavation work. Dust suppression (wetting) will be implemented.

All workers must read and abide by the requirements listed in SSHASP #127. Training requirements will be consistent with those stipulated in the SSHASP Table 2-2 Task 2-A (bore drilling/core sampling).

Justification: *(attach additional pages as necessary)*

- Necessary to prevent any potential contaminants associated with PRS Nos. 35-003(d, l, and q) from being remobilized into Ten Site Canyon, or Mortandad Canyon, and possibly a water course.

SSHASP MODIFICATION FORM

Project Title: Site Wide Soil Sampling

TA(s): 35

SSHASP No.:127

Modification No.:127.01

Modifications of the SSHASP shall be made per Section 1.3 of the HASP.
Attach to this page the SSHASP modifications.

Comments of the following reviewers have been incorporated as stipulated, or resolved with written record and copy to the respective reviewer.

	(Print Name)	(Title)	(Signature)	(Date)
Prepared by	John K. Hayes	SSO/RCT		

Review and Approval by:

	(Print Name)	(Title)	(Signature)	(Date)
Field Unit HS Representative	Bill Brazile	ESH-5 Oversight	William J. Brazile	
Field Unit Health Physics Representative	Marty Peifer	ESH-1 Oversight	Marty Peifer	8/29/96
FTM or DPL, or FTL or JS (optional at discretion of FPL)	Deba Daymon	FTM	Deba Daymon	8/27/96
FPL	Allyn Pratt	FPL		

Concurrence by:

	(Print Name)	(Title/Company)	(Signature)	(Date)
Subcontractor Representative (Management or HS Rep.)	Paul Parker	Parker Construction		
Subcontractor Representative (Management or HS Rep.)		TBD		

1.0 RATIONALE AND OBJECTIVE

This document describes the interim action (IA) plan for Potential Release Site (PRS) Nos. 35-003(d, l, and q), which are located within Los Alamos National Laboratory (the Laboratory) Technical Area (TA) -35. Deep erosion channels have formed in the noncompacted backfill material at the east end of Ten Site Mesa where a pump pit (TA-35-8), a pipe trench (TA-35-9), and a liquid waste holding tank (TA-35-10) were located. The site drains into a small tributary of Ten Site Canyon, which is referred to as Pratt Canyon in the Resource Conservation and Recovery Act Facility Investigation (RFI) report for the PRSs in this area (LANL 1996, 54422). The best management practices proposed in this IA plan will prevent further erosion of the area, which encompasses the three PRSs.

2.0 SITE DESCRIPTION AND CHARACTERIZATION DATA

2.1 Description

A detailed description of the site and the characterization data can be found in the *RFI Report for Potential Release Sites 35-003(d, e, f, g, l, m, o, q, and r) 35-016(g and h)* (hereafter referred to as the RFI report) (LANL 1996, 54422).

The site to be addressed by this IA encompasses part of three potentially contaminated PRSs, Nos. 35-003(d, l, and q), which are located about 150 ft east of the former Air Filter Building (TA-35-7) (see Figure 2.1-1). These PRSs have undergone a Phase I RFI and have been proposed for further characterization in the RFI report.

Collectively the PRSs cover an area approximately 150 ft by 200 ft. After the structures were removed in 1985, the site was backfilled with up to 20 ft of clean, noncompacted fill material. The site slopes moderately eastward approximately 125 ft to the mesa edge, which slopes into Pratt Canyon (approximate slope of 1:1).

The primary source of erosion is a storm water corrugated metal pipe (CMP) located near the southeast corner of former TA-35-7. The main erosion channel ranges in depth from 1 ft to approximately 22 ft and extends about 160 ft across the site. Then it splits into two channels that continue eastward approximately 40 ft to the mesa edge. A smaller erosion channel originates at the north side of the site and was formed from storm water runoff associated with the unpaved service road. This erosion channel ranges in depth from 1 ft to approximately 10 ft at the point of confluence with the main erosion channel.

2.2 Operational History

The PRSs are associated with the former TA-35 wastewater treatment plant. PRS No. 35-003(d) is the site of the former liquid waste holding tank (TA-35-10) and an associated daylight diversion channel; PRS No. 35-003(l) is the site of the former pump pit (TA-35-8); PRS No. 35-003(q) is the site of the former pipe trench (TA-35-9). These structures, collectively referred to as the "tank farm," were used until 1963 when a new wastewater treatment plant at TA-50 became operational. However, the holding tank was used as late as 1974 to store low-level wastes (Kennedy 1968, 846; Emelity et al. 1975, 324).

PRS No. 35-003(r) (Pratt Canyon) is the disposal area for liquid and sludge effluent from the former TA-35 wastewater treatment plant. From 1951 until 1963, radioactive-contaminated liquids and sludge were

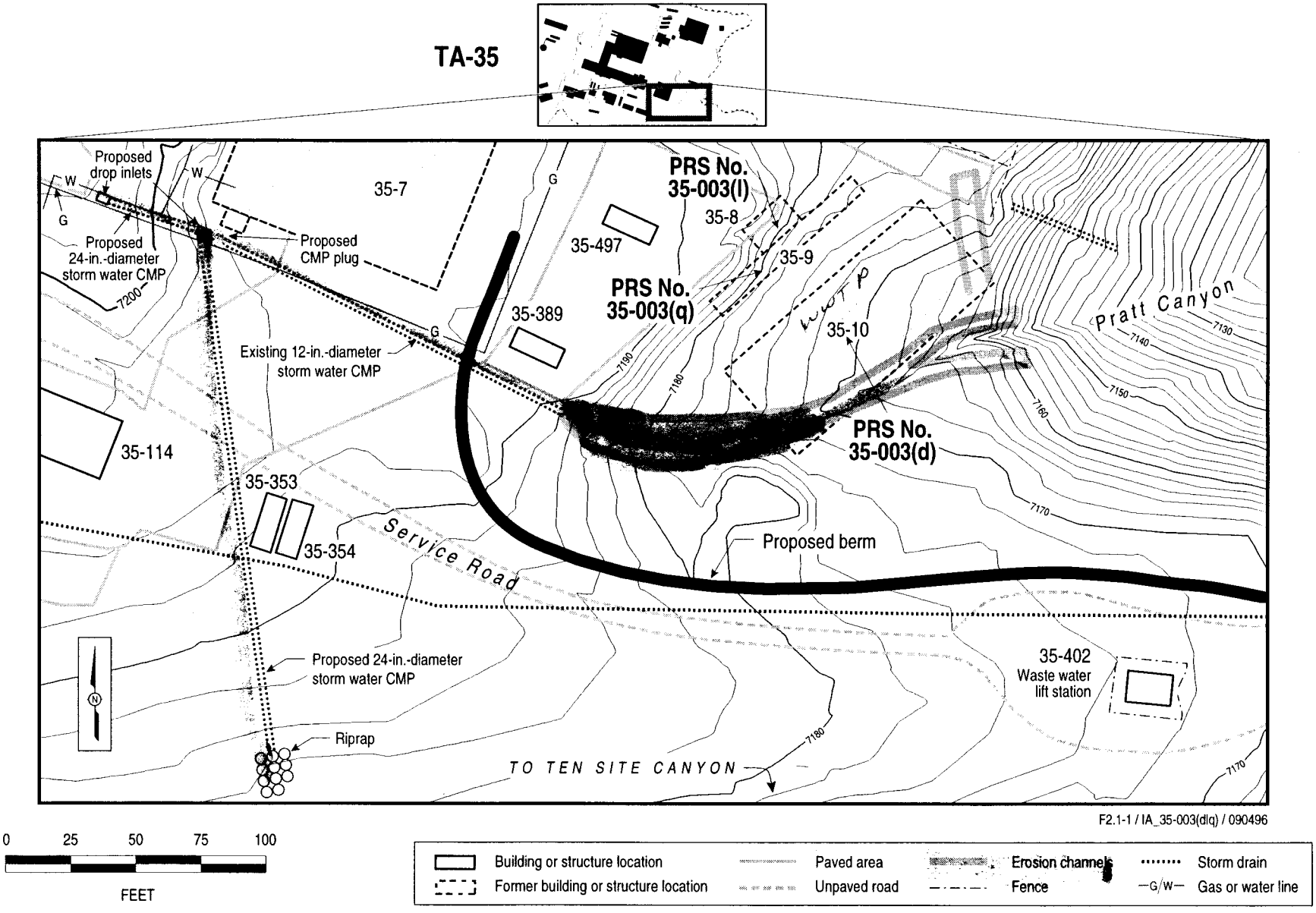

Figure 2.1-1. Location map for PRS Nos. 35-003(d, l, and q).

released from the wastewater treatment plant into Pratt Canyon. The RFI report describes documented releases from the wastewater treatment plant in more detail (LANL 1996, 54422). Effluent was routinely released from former TA-35-7 through Line 95 into the daylight diversion channel to the south rim of Pratt Canyon. The west end of the canyon ends abruptly at the backfill headwall at the east edge of the site, which is about 40 to 50 ft high. A colluvial fan composed of boulders and cobbles of tuff backfill material is present below the erosion channel that extends about 75 ft into the upper part of the canyon.

2.3 Spills and Accidental Releases

Spills and accidental releases from the holding tanks and associated piping were documented throughout the operational history of the former TA-35 wastewater treatment plant. The first documented release was in July 1951 when 5 mCi of radioactive liquid was reported to have been released from the holding tanks (Aeby 1954, 742). Reports of 11 spills or nonoperational releases were documented between 1951 and 1956. Spills or leaks from the pump pit, pipe trench, and the piping connected to the holding tanks were collected in the daylight diversion channel. Several reports mentioned that the holding tanks were accidentally overfilled and contaminated liquids spilled directly into Pratt Canyon (Aeby 1952, 741; Aeby 1954, 742; Aeby 1955, 743; Aeby and Garcia 1954, 745; Keenan 1975, 845; LASL 1962, 859).

2.4 Sampling Activities

RFI Phase I sampling for PRS Nos. 35-003(d, l, and q) was performed from April 6, 1994, through May 2, 1994, and supplemental sampling was performed in December 1995. A total of 13 locations were sampled, and 49 soil samples were collected (not including duplicate quality assurance/quality control samples). Results of the sampling are presented in the RFI report (LANL 1996, 54422).

RFI Phase I sampling for PRS No. 35-003(r) was performed on May 3, 1994, June 15 and 16, 1994, October 31 through November 7, 1994, February 27, 1995, and December 8, 1995. A total of 13 locations were sampled, and 62 samples were collected. Results of the sampling are presented in the RFI report (LANL 1996, 54422).

2.5 Characterization Data

Sample results did not exceed screening action level (SAL) values for any chemicals of potential concern (COPCs) at PRS Nos. 35-003(d, l, and q). Mixed polychlorinated biphenyls and benzo[a]pyrene were identified as COPCs among the chemical carcinogens because their maximum concentrations exceeded 10% of SAL values. These samples were collected in surface intervals (1- to 2-ft depths) in the backfill material that was placed at the site during decontamination and decommissioning (D&D) activities in 1985.

Activities associated with PRS Nos. 35-003(d, l, and q) are known to have resulted in releases of radionuclides to the environment. The releases have been documented in previous investigations and in the RFI report. In particular, soil containing up to 360 pCi/g of gross-beta activity was left in place following the 1985 D&D. The contaminated soil was covered by the backfill material (Elder et al. 1986, 3089). During Phase I field screening, gross-beta/gamma radiation was measured above background levels at the tuff/backfill interface in two sample locations (LANL 1996, 54422).

Eight organic chemicals and one inorganic chemical were identified as COPCs in the screening assessment for PRS No. 35-003(r). Elevated levels of radiation in soils and biota were detected with gross-beta/gamma meters during RFI surveys.

3.0 INTERIM ACTION

The purpose of this IA is to prevent any potential contaminants associated with PRS Nos. 35-003(d, l, and q) from being remobilized into Ten Site Canyon, Mortandad Canyon, or possibly a water course. The storm drain, shown in Figure 2.1-1, is the primary source of storm water runoff that is causing the deep erosion channels at the site. The recent erosion may have reached the 1995 D&D excavation depth (approximately 20 ft below the current land surface) where contamination from spills and releases remains in the soil.

Section 9.3 contains a detailed site erosion control engineering plan. The engineering plan contains three options ranging from minimal erosion control to more elaborate control. The first and least expensive option offers only a short-term remedy (up to three years) and involves filling in the eroded areas with large rocks. This option does not divert the storm water from the site, which is the primary cause the erosion. The PRSs at the site and directly downstream from the site are proposed for further investigation. However, a long-term remedy is more appropriate because a final decision about the disposition of the PRSs may not be made for several years. This IA is expected to provide adequate erosion control and contaminant stabilization for 10 to 15 years at a reasonable cost.

Decommissioning of various structures near the former TA-35 wastewater treatment plant is currently in progress. Former TA-35-7 has been removed, and the site will be graded as specified in the final grading and paving plan (LANL 1995, 54767).

As part of this IA, the existing 12-in.-diameter storm water CMP will be plugged with a CMP plug at a point just east of where a new drop inlet will be constructed. This new drop inlet will be located south of the southwest corner of former TA-35-7 (see Figure 2.1-1). A new 24-in.-diameter storm water CMP will be installed at this drop inlet. The 24-in.-diameter storm water CMP will extend approximately 200 ft south-southeast under the service road and discharge to Ten Site Canyon. Riprap will be placed at the discharge point to slow the storm water velocity and prevent erosion. A second drop inlet will be installed approximately 50 ft northwest of the first inlet and will be connected to the first inlet by a length of 24-in.-diameter storm water CMP.

The erosion channels will be backfilled, compacted, and stabilized to prevent further erosion. Approximately 700 yd^3 of clean backfill material will be placed in the channels. The material will be wetted then compacted to 80% to 85% maximum density. The channels will be planted with approximately 270 yd^2 of native grass seed.

The deep erosion channel at the mesa edge will be backfilled and graded to a slope of 2.5:1 to 3:1. The slope will be reseeded and covered with a stabilizing vegetative membrane.

A 2-ft-high berm may be constructed to prevent storm water runoff from flowing over and into radioactively contaminated PRS No. 35-003(r). The berm will extend from approximately 20 ft east of the southeast corner of former TA-35-7 southward approximately 135 ft, where the berm will be angled about 90°. It will extend between the southern edge of the current erosion area and the service road and continue eastward beyond the sanitary waste water lift station (see Figure 2.1-1) for approximately 50 ft. The berm will consist of backfill material that will be stabilized with either a stabilizing vegetative membrane, gravel, or riprap.

4.0 MONITORING ACTIVITIES

No sample activities are planned in conjunction with this IA. However, sampling is scheduled to begin in 1997, which will determine the need for further remediation at the site. Sampling and analysis plans are described in the RFI report (LANL 1996, 54422).

5.0 MAINTENANCE AND INSPECTION

The erosion stabilization area will be inspected regularly by Field Unit 4 personnel until ownership of the site is released to either the TA-35 operational groups or the Laboratory Facilities, Security, and Safeguards Division (to be negotiated). Field Unit 4 personnel will document the inspections in accordance with the Storm Water Pollution Prevention (SWPP) Plan. If an inspection reveals any loss of integrity to the erosion control measures, appropriate actions will be taken to reestablish integrity including repair or the addition of riprap. The SWPP Plan will be updated as appropriate.

6.0 WASTE MANAGEMENT

No waste (or very little waste) is expected to be generated from this IA. If waste is generated, it will be associated with the removal of the storm drain CMP. The waste is not expected to be hazardous or radioactive; therefore, it will probably be disposed of at the Los Alamos County landfill. If it is determined that waste may be generated, a Waste Characterization Strategy Form will be completed immediately. At that time, Waste Profile Forms also will be completed and submitted to ensure proper waste disposal.

7.0 COST AND SCHEDULE

It is expected that field activities will be completed in 7 (nonconsecutive) days, beginning the third week of August 1996. Table 7-1 shows the estimated cost for completing this IA.

TABLE 7-1

ESTIMATED COST WORKSHEET

Category	Rate	Units	Cost
Field Preparation Activities			
Engineering plan	$1,000/day	4 days	$4,000
IA plan preparation	$700/day	6 days	$4,200
IA plan technical edit and review	$700/day	3 day	$2,100
Preparation of waste characterization form (if necessary)	$700/day	1 day	$700
Preparation of Storm Water Pollution Prevention Plan	$700/day	1.5 days	$1,050
Preparation of Spill Prevention, Control, and Countermeasures Plan	$700/day	1.5 days	$1,050
Preparation of site-specific health and safety plan	$700/day	4 days	$2,800
		Subtotal	**$15,900**
Field Activities			
Field unit oversight	$500 day	7 days	$3,500
Subcontractor mobilization	See Attachment A		$741
696 yd^3 backfill (load, haul, spread, and compact)	See Attachment A		$21,910
60 yd^3 topsoil (load, haul, spread)	See Attachment A		$1,497
Site restoration (place stabilizing fabric, fine grade, and reseed)	See Attachment A		$996
Soil berm construction (load, haul, spread, and compact)	See Attachment A		$3,577
Culvert Installation (remove pavement, excavate, backfill, replace pavement)	See Attachment A		$5,019
24-in. coated CMP	See Attachment A		$6,600
Storm water inlet drop and grate	See Attachment A		$2,710
Riprap	See Attachment A		$521
Demobilization	See Attachment A		$741
		Subtotal	**$47,812**
Final Activities			
Acceptance inspection	$500/day	1 day	$500
Final report preparation	$700/day	3 days	$2,100
Final report technical edit and review	$700/day	2 days	$1,400
		Subtotal	**$4,000**
		Total Estimated Cost	**$67,712**

8.0 REFERENCES

Aeby, J. W., October 28, 1952. "Monitoring in Canyon Mortandad," Los Alamos Scientific Laboratory Memorandum to Dean D. Meyer (H-1) from Jack W. Aeby (H-1), Los Alamos, New Mexico. **(Aeby 1952, ER ID Number 741)**

Aeby, J. W., August 12, 1954. "Contaminated Water Dumped into Canyon Mortandad since 9-1-51," Los Alamos Scientific Laboratory Memorandum to Dean Meyer from Jack W. Aeby, Los Alamos, New Mexico. **(Aeby 1954, ER ID Number 742)**

Aeby, J. W., January 31, 1955. "Ten-Site Monitoring—Week Ending January 23, 1955," Los Alamos Scientific Laboratory Memorandum to Dean D. Meyer (H-1) from Jack W. Aeby (H-1), Los Alamos, New Mexico. **(Aeby 1955, ER ID Number 743)**

Aeby, J. W., and T. Garcia, May 28, 1954. "More digging in Canon Mortandad," Los Alamos Scientific Laboratory Memorandum to Dean Meyer from Jack W. Aeby and Tony Garcia, Los Alamos, New Mexico. **(Aeby and Garcia 1954, ER ID Number 745)**

Elder, J. C., E. J. Cox, D. P. Hohner, and A. M. Valentine, September 1986. "Radioactive Liquid Waste Lines Removal Project at Los Alamos (1981–1986)," Los Alamos National Laboratory Report LA-10821-MS, Los Alamos, New Mexico. **(Elder et al. 1986, ER ID Number 3089)**

Emelity, L. A., J. R. Buchholz, A. M. Valentine, W. R. Goldsmith, L. C. Borduin, M. E. Muller, and R. A. Hemphill, January 1975. "A Survey of Liquid Waste Management Problems at the LASL," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. **(Emelity et al. 1975, ER ID Number 324)**

Keenan, T. K., September 10, 1975. "Releases of Effluents to Ten Site Canyon," Los Alamos Scientific Laboratory Memorandum H7-TKK-506 to LaMar Johnson (H-8) from T. K. Keenan (H-7), Los Alamos, New Mexico. **(Keenan 1975, ER ID Number 845)**

Kennedy, W. R., February 8, 1968. "Prevention, Control, and Abatement of Water Pollution by Federal Activities—Storage of Hazardous Materials," Los Alamos Scientific Laboratory Memorandum H-6 to Herman E. Roser (LAAO) from William R. Kennedy (H-6), Los Alamos, New Mexico. **(Kennedy 1968, ER ID Number 846)**

LANL (Los Alamos National Laboratory), May 1991. "Environmental Restoration Standard Operating Procedures," Vol. I–II, Los Alamos, New Mexico. **(LANL 1991, ER ID Number 21556)**

LANL (Los Alamos National Laboratory), April 11, 1995. Engineering Drawing SK-DD-1995-6, sheet number 6, Los Alamos, New Mexico. **(LANL 1995, ER ID Number 54767)**

LANL (Los Alamos National Laboratory), June 1996. "RFI Report for Potential Release Sites 35-003(d, e, f, g, l, o, q, and r) 35-016(g and h)," Los Alamos National Laboratory Report LA-UR-96-1605, Los Alamos, New Mexico. **(LANL 1996, ER ID Number 54422)**

LASL (Los Alamos Scientific Laboratory), May 15, 1962. "Report on Mortandad Canyon Soil Analyses," Los Alamos Scientific Laboratory Report (draft), Los Alamos, New Mexico. **(LASL 1962, ER ID Number 859)**

9.0 ANNEXES

9.1 Implementation Standard Operating Procedures

See Volumes I and II of the Environmental Restoration Project standard operating procedures, as updated to 1996 (LANL 1991, 21556).

9.2 Site-Specific Health and Safety Plan

This IA will be performed in accordance with the approved site-specific health and safety plan, which is attached.

SECTION 206—EXCAVATION & BACKFILL FOR CULVERTS & MINOR STRUCTURES

206.1 DESCRIPTION.

206.11 This work shall consist of the excavation, backfill, select backfill, and disposal of all materials required for the construction of box culverts, pipe culverts, storm drains, cattleguards, and other drainage structures in accordance with the specifications and the lines, grades, and typical cross sections shown in the contract.

Ditches at inlets and outlets of culverts and other ditches indicated in the plans shall be constructed under the item for unclassified excavation.

Structure excavation shall include all pumping, bailing, draining, sheeting, bracing, and incidentals required for proper execution of the work.

206.2 MATERIALS.

206.21 Select Backfill. Select backfill material shall be composed of stone, crushed stone, crushed or screened gravel, caliche, sand, or a combination of such materials. The material shall be non-plastic, free from organic matter, silt, clay balls and other deleterious materials, and shall conform to the gradations shown on the plans as determined by AASHTO T 27, unless otherwise shown in the contract. On all gradations, material passing the No. 200 sieve shall have a P.I. of six (6) or less.

206.3 CONSTRUCTION REQUIREMENTS.

206.31 General. Unsuitable foundation material shall be removed, as directed by the Project Manager, below the bottom of the structure. Suitable surplus excavated material may be used in the construction of embankments, and all unsuitable material shall be wasted. Material removed below the bottom of the structure shall be replaced with approved material.

All sheeting and bracing used in performing structure excavation shall be removed by the Contractor following the completion of the work.

The upper six (6) inches of existing ground foundations shall be compacted to not less than ninety five (95) percent of maximum density as determined by AASHTO T 99. The density and the approved surface elevation and shape of the foundations shall be maintained immediately prior to the placement of structures and forms.

Bedding material shall be sand or sandy soil all of which passes a 3/8 inch sieve and not more than twenty (20) percent of which passes a No. 200 sieve.

Backfilling shall consist of suitable materials uniformly distributed in layers not to exceed eight (8) inches (loose measurement) in depth and uniformly compacted to 100 percent of maximum density as determined by AASHTO T 99, and AASHTO T 224. Field densities will be determined by AASHTO T 205, by use of nuclear methods in accordance with AASHTO T 238 and T 239, or other approved methods.

No backfill shall be placed against newly constructed masonry or concrete structures for a period of fourteen (14) days or until the concrete has developed a compressive

strength of 2500 pounds per square inch. Backfill compaction shall be accomplished in a manner that will not damage or move the structure.

Materials for backfill shall be fine, readily compactable soil or granular material selected from excavation or from a source of the Contractor's choice. The material shall not contain lumps or stones larger than two (2) inches in diameter, clay, or other objectionable material. The backfill material shall have no more than twenty five (25) percent passing the No. 200 sieve.

Backfill material shall not be placed on frozen earth nor shall frozen material be placed within the backfill. Operations shall be suspended when backfill materials become frozen, and shall not be resumed until the materials are thoroughly thawed and sufficiently dried for satisfactory compaction.

206.32 Pipe Culverts, Storm Drains and Structural Plate Pipe. When rock or other unyielding foundation material is encountered, it shall be removed below the bottom of the structure for a depth not less that twelve (12) inches. This extra depth excavation shall be backfilled with approved free-draining material obtained from roadway excavation if available, otherwise it shall be base course or other granular material.

Trenches shall be excavated to a width sufficient to allow for proper jointing of the pipe and thorough compaction of the bedding and backfill material under and around the pipe. The completed trench bottom shall be firm for its full length and width. When required, in the case of cross drains, the trench shall have a longitudinal camber of the magnitude specified.

The pipe bedding shall be shaped to fit the pipe and shall have recesses shaped to receive the bell when bell and spigot type pipe is used.

206.33 Box Culverts & Other Drainage Structures. The elevations at the bottoms of footings as shown on the plans are approximate only, and all materials shall be removed to the field established elevations. Excavation in rock or other hard foundation material shall be cut to a firm surface, either level, stepped, or serrated, to the neat lines of the footings. All seams and cavities shall be cleaned and filled with concrete or grout.

Unsuitable foundation material shall be removed below the bottom of the structure. Suitable surplus excavated material shall be used in the construction of embankments. Material removed below the bottom of the structure shall be replaced with approved material.

Where footings are to be placed on excavated surface other than rock, special care shall be taken to prevent removal of material below the established grade, except where unsuitable material is encountered. The final six (6) inches above the established grade for the bottom of footings shall be removed by hand labor prior to the placing of the footing material. Where unsuitable material is encountered below footing foundations, it shall be removed and replaced with approved material.

Where the Contractor excavates below the established final elevation for bottom of footings or beyond the neat lines of the footings in rock or other hard foundation

material, the areas shall be backfilled, at the Contractor's expense, with concrete of the same class as the footings.

After each footing excavation is completed, the Contractor shall notify the Project Manager. Footings shall not be placed until the Project Manager has approved the depth of the excavation and the character of the foundation material. The density and the approved surface elevation and shape of the foundation shall be maintained immediately prior to the placement of the reinforcing steel.

206.4 METHOD OF MEASUREMENT.

206.41 Unsuitable material excavation will be measured by the cubic yard.

Select backfill material will be measured by the ton or cubic yard.

Unsuitable material excavation will be measured in place between the flowline of the structure and the limits of unsuitable material excavation as determined by the Project Manager.

Excavation for culverts, drop inlets, headwalls, headgates, endwalls, and other similar structures will be considered incidental in the completion of the work and no separate measurement will be made therefor.

206.5 BASIS OF PAYMENT.

206.51 Unsuitable material excavation will be paid for at the contract unit price per cubic yard.

Select backfill material will be paid for at the contract unit price per ton or cubic yard.

Payment will be made under:

Pay Item	Pay Unit
Unsuitable Material Excavation	Cubic Yard
Select Backfill Material	Ton, Cubic Yard

When unsuitable material excavation is required, but no item is established, payment for unsuitable material excavation will be paid for at fifty percent (50%) of the latest average unit bid price for "Structure Excavation & Backfill for Bridges."

Excavation and backfill for culverts and minor structures will be included in the contract unit price per linear foot of culvert or in the contract unit price for Class "A" Concrete.

510—PORTLAND CEMENT CONCRETE

510.1 DESCRIPTION

510.11 General. This work shall consist of furnishing and placing portland cement concrete in compliance with the specifications and the lines, grades, and dimensions shown in the contract. Unless otherwise specified by the Project Manager the Contractor shall use a concrete mixture utilizing fly ash as a substitute for a portion of the portland cement.

510.12 Classifications. The following are the designated classes of concrete and shall be provided as specified in the contract:

TABLE 510–A
CONCRETE CLASSES

Class	[1]Minimum Compress. Strength @ 28 days (Production)	[2]Minimum Cement Content per Cu. Yd.	Maximum Water/ Cement Ratio	[3]Max. Slump (Site)	Size Coarse Aggregate	[4]Percent Fine Aggregate
	P.S.I.	Lbs.		Inches	US Customary	
A	3000	564	0.49	4	1"	36–42
AA	4000	658	0.42	4	1"	34–42
B	2500	470	0.60	4	1"	36–45
C	3500	611	0.49	4	3/4"	38–42
D	4000	658	0.49	4	3/4"	38–42
E	2500	—	—	4	—	—
[5]F	3000	658	0.44	2 1/2	1 1/2"	36–42
G	3000	611	0.44	***	[6]3/4"	40–42

AA—Superstructure
E —Nonstructural
F —Slip-formed Pavement
G —Drilled Shafts

[1]A minimum twenty percent (20%) laboratory overdesign strength shall be provided.
[2]The term "Cement" as used in Table 510–A and these specifications shall also be construed to include cementitious material, whichever applies. Cementitious material shall consist of cement plus fly ash.
[3]As determined by AASHTO T 119.
[4]Percentage of fine aggregate other than that shown may be used only when approved by the Central Materials Laboratory.
[5]The minimum strength for Class F concrete shall be achieved at fourteen (14) days.
[6]Maximum size aggregate during free fall placement shall be in accordance with Subsection 502.221 Concrete.
***Slump shall be in accordance with Subsection 502.221 Concrete.

510.121 Concrete Class Substitutions. Class AA Superstructure concrete may be substituted for Class F concrete when a slip-formed paving method is not used.

Class B Concrete may be substituted for Class E concrete.

Class A concrete may be substituted for Class B concrete.

Class C or Class D concrete may be substituted for Class A or Class B concrete.

510.13 Mix Design. The Contractor shall be responsible for the portland cement concrete (PCC) mixture and shall select one of the design options provided in Subsection 510.31 Proportioning. Regardless of the option chosen, the Contractor shall still be responsible for providing concrete which meets the specifications.

510.2 MATERIALS.

510.21 The Contractor shall use pre-approved admixtures, cement, fly ash, or blended portland-fly ash cement, shown on current lists. The Contractor shall obtain from the manufacturer and furnish a certificate of compliance stating that the materials delivered to the work comply with the requirements herein provided.

No change in the source or character of the materials shall be made without due notice to the Project Manager.

510.22 Portland Cement. Portland cement shall be "low-alkali" and shall conform with the requirements of ASTM C 150 for the type required. Unless otherwise specified in the contract, Type II cement shall be furnished.

All cement for any given structure shall be of the same brand unless otherwise approved by the Project Manager. Brand changes in cement may be allowed only upon written request by the Contractor and written approval by the Project manager

510.221 Blended Portland-Fly Ash Cement. Blended portland-fly ash cement shall meet the requirements of ASTM C 595 and shall consist of portland cement uniformly blended with fly ash, either by intergrinding the portland cement and fly ash or by blending the portland cement and fly ash. The portland cement and fly ash shall meet the requirements of their respective specifications.

The blended portland-fly ash cement must be preapproved by the Project Manager

(a) **Approval of Blended Portland-Fly Ash Cement Source.** The prospective blended portland-fly ash cement supplier shall furnish test data, acceptable to the Central Materials Laboratory showing that the blended portland fly ash cement does impart satisfactory strength and durability to concrete.

510.222 Packaging. When portland cement and blended portland-fly ash cement is delivered in packages, the packages shall plainly state the name brand, the manufacturer, and the cement type. When cement is delivered in bulk, the same information shall be contained in the shipping documents accompanying the shipment.

510.223 Storage. The cement shall be well protected from rain and moisture. Cement of different brands, types, or which comes from different mills shall be stored separately.

Separate, readily identifiable storage shall be furnished at the project or plant site for blended portland-fly ash cement and under no circumstances, shall portland cement and portland-fly ash cement be mixed or intermingled.

510.224 Rejection. All cement which has come in contact with moisture, or which has partially set, contains lumps, or fails to meet the specified requirements shall be rejected and removed from the project site.

510.23 Admixtures. Admixtures or combinations of admixtures shall not contain more than 0.035 percent chloride by weight.

510.231 Air-entraining Admixtures. Air-entraining admixtures for concrete shall conform to the requirements of AASHTO M 154.

510.232 Chemical Admixtures. Water-reducing admixtures, superplasticizers, set-retarding admixtures, and non-chloride accelerating admixtures, or combinations thereof shall conform to the requirements of AASHTO M 194.

Superplasticizers and accelerators shall not be used in the production of superstructure concrete unless otherwise approved by the Project manager.

510.24 Curing Materials.

510.241 Liquid Membrane Forming Compounds. Liquid membrane-forming compounds for curing concrete shall conform to the requirements of Type 1–D or Type 2, AASHTO M 148, unless otherwise specified.

510.242 Linseed Oil Emulsion. Linseed oil emulsion curing agent shall be formulated with high viscosity heat bodied linseed oil and shall be non-pigmented. Linseed oil emulsion composition shall conform to the requirements of Table 510–B.

TABLE 510–B
LINSEED OIL COMPOSITION

Composition	Volume Percent
Oil phase	50.0 ± 1.0
Water phase	50.0 ± 1.0
Oil Phase	
Boiled high viscosity heat bodied linseed oil	80.0 ± 0.1
Z-8 bodied linseed oil	20.0 ± 0.1
Water Phase	99.60 ± 0.01
Water	0.37 ± 0.01
Socium Hydroxide	0.03 ± 0.001
Dipicolonic acid	

Water retention will be tested in accordance with ASTM C 156. The loss of water shall not exceed 0.50 kg/m^2 of surface area in 72 hours.

Each container shall be marked or labeled with the manufacturer's name, contents, "Linseed Oil Emulsion," lot number and date of manufacturer.

The emulsion shall be stable at the time of application.

510.243 Sheet Materials For Curing Concrete. Sheet materials for curing concrete shall meet the requirements of AASHTO M 171 except that only white reflective type shall be permitted.

510.25 Water. Potable water from municipal or other sources approved by the New Mexico Environmental Department (NMED) will not require testing. Water from other sources must be approved by the Project Manager before incorporating into the work. Water shall be sampled and tested in accordance with AASHTO T 26.

Water used in mixing and curing concrete or for washing concrete aggregates shall be clear and free from injurious amounts of acid, oil, alkali, organic matter, or other deleterious material. Water shall have a pH value of not less than 4.5 or more than 8.5 as determined by AASHTO T 26 prior to its use. The sulfate content and the chloride content each shall not exceed one thousand parts per million.

Where a source of water is relatively shallow, the intake shall be enclosed and the level of water shall be maintained at such a depth to exclude silt, clay, vegetable matter and other foreign material.

510.26 Coarse Aggregate. Coarse aggregate shall be crushed stone, crushed gravel, or natural washed gravel, conforming with the requirements herein provided.

At least fifty percent (50%) by weight of the minus 3/4 inch (minus 1 1/2 inch for PCCP) sieve size particles shall have a minimum of two (2) fractured faces.

Coarse aggregate for Class G concrete shall have two (2) or more fractured faces percentage by weight, between zero and sixty percent (0 & 60%) of the minus 3/4 inch sieve size particles.

A fractured face shall be as defined in subsection 401.221 Gradation & Quality Requirements.

In lieu of producing coarse aggregate meeting the fracture faces requirements, the Contractor shall have the option of thoroughly and uniformly washing the coarse aggregate.

510.261 Deleterious Substances. The amount of deleterious substances shall not exceed the limits shown in Table 510–C.

TABLE 510–C
COARSE AGGREGATE DELETERIOUS SUBSTANCE TOLERANCES

Substance	Percent By Weight
Soft Fragments	2.0
Coal and Lignite	0.25
Clay Lumps	0.25
Material Passing No. 200 Sieve	1.00
Flat or Elongated Pieces[1]	15.00

[1]**Elongated Piece:** One in which the ratio of the length to width of its circumscribing rectangular prism is greater than 5 to 1.

Flat Piece: One in which the ratio of the width to thickness of its circumscribing rectangular prism is greater than 5 to 1.

Concrete aggregate shall be free from sticks and roots. Aggregate contaminated with sticks and roots will be rejected.

510.262 Coarse Aggregate Quality Requirements. Coarse aggregate shall have a percent wear of forty five (45) or less at 500 revolutions, when tested in accordance with AASHTO T 96 and shall have a soundness loss of fifteen (15) or less when tested in accordance with AASHTO T 104 using magnesium sulfate solution and a test duration of five (5) cycles.

510.263 Coarse Aggregate Gradation Requirements. Coarse aggregate or the combined component parts shall conform with the gradations shown in Table 510–D.

TABLE 510–D
COARSE AGGREGATE GRADATION REQUIREMENTS

Size	1–1 1/2"	1"	3/4"
Sieve Size		Percent Passing	
2"	100		
1–1/2"	95–100	100	
1"	---	95–100	100
3/4"	35–70	---	95–100
1/2"	---	25–60	---
3/8"	10–30	---	20–55
No. 4	0–5	0–10	0–10
No. 8	---	0–5	0–5
No. 200	0–1	0–1	0–1

When coarse aggregate is 100 percent crushed aggregate, material passing no. 200 sieve shall not exceed two percent (2.0) by weight.

Coarse aggregate with more than the maximum percentage passing the No. 200 sieve may be accepted provided the combined gradation with fine aggregate does not exceed two percent (2%).

(a) **PCCP Gradations.** The combined component of the coarse aggregate for PCCP shall meet the gradation requirements for 1 1/2" coarse aggregate shown in Table 510–D. The aggregate shall be stored in two (2) different nominal size aggregate stockpiles and each stockpile shall contain at least thirty five percent (35%) of the total required coarse aggregates.

510.27 Fine Aggregate. Fine aggregate shall consist of natural sand or other inert materials with similar characteristics conforming with the requirements herein provided.

510.271 Deleterious Substances. The amount of deleterious substances shall not exceed the limits shown in Table 510–E.

TABLE 510–E
FINE AGGREGATE DELETERIOUS SUBSTANCE TOLERANCES

Substance	Percent By Weight
Clay Lumps	3.0
Coal and Lignite	1.0
Material Passing No. 200 Sieve	3.0
Other Deleterious Substances	1.0

510.272 Fine Aggregate Quality Requirements. Fine aggregate shall have a soundness loss of twelve (12) or less when tested in accordance with AASHTO T 104 using magnesium sulfate solution and a test duration of five (5) cycles.

The sand equivalent, when tested in accordance with AASHTO T 176, shall be at least seventy five percent (75%).

510.273 Fine Aggregate Gradation Requirements. Fine aggregate shall be well graded from coarse to fine and shall conform with the grading requirements shown in Table 510–F.

TABLE 510–F
FINE AGGREGATE GRADATION REQUIREMENTS

Sieve Size	Percent Passing
3/8 inch	100
No. 4	95–100
No. 16	45–80
No. 50	5–30
No. 100	0–10
No. 200	0–3

The gradation requirements shown represent the extreme limits which will be used to determine acceptability for use from all sources of supply.

The degree of uniformity will be determined by a fineness modulus test, conforming to the requirements of AASHTO M 6, of representative samples, obtained by the Project Manager from sources to be used by the Contractor. Fine aggregate from the designated source(s) having a variation in fineness modulus greater than 0.20 above or below the fineness modulus of the original representative sample in the approved design mix may be rejected.

Fine aggregate with more than the maximum percentage passing the No.200 sieve may be accepted provided the combined gradation with coarse aggregate does not exceed two (2) percent.

510.28 Fly Ash. Fly ash shall conform to the physical and chemical requirements of ASTM C 618, including the optional requirements for available alkalies and reactivity with cement alkalies as modified [illegible] with the exceptions shown in Table 510–G. The Contractor may use either Class C or Class F fly ash.

If fly ash is supplied in bags, the bags must be waterproof and the name brand, the manufacturer, type, and source shall be clearly identified thereon. Each fly ash shipment to the project site shall be accompanied by a copy of a properly executed certificate of compliance.

Brand changes in fly ash may be allowed only upon written request by the Contractor and written approval by the Project Mgr. Class changes between Class C and Class F fly ash and intermixing of fly ash of different classes and sources will not be permitted.

TABLE 510–G
FLY ASH REQUIREMENTS

Characteristic	Class F	Class C
Moisture Content, max., %	1.0	1.0
Loss on Ignition, max., %	3.0	3.0
[1]Magnesium Oxide (MgO), max., %	5.0	5.0

[1]When the autoclave expansion or contraction limit is not exceeded when combined with the cement which will be used on the project, an MgO content above 5.0% will be acceptable.

510.281 Source Approval & Acceptance. Acceptance of fly ash will be on the basis of certification of approved sources and satisfactory test results on project verification samples. Fly ash from a particular source or supplier must be preapproved by the Project Manager before being used in portland cement concrete.

The request for source approval shall include the following information:

1. The name of supplier or company;
2. Location of the power plant;
3. Coal origin;
4. Storage facilities and capacity;
5. Production procedures;
6. Details regarding the suppliers quality control program including the following:
   a. Routine sampling and testing frequency.
   b. Evidence that the Laboratory responsible for the certified ASTM C 618 test results is participating in the Cement & Concrete Reference Laboratory (CCRL) pozzolanic inspection program and a copy of a letter authorizing CCRL to send a copy of the inspection report directly to the Project Manager.
   c. Measures taken to ensure that fly ash not meeting specification requirements is kept separated from material meeting the requirements.
7. Copies of test reports showing results obtained in the quality control program for the previous six (6) months including at least one (1) complete ASTM C 618 analysis per month.

Sources approved by the Project Manager will be placed on the Department's approved source list.

510.282 Sources on Approved List. Sources on the approved list shall furnish the following information to the Project Manager on a monthly basis:

1. Copies of test results obtained in their routine quality control program;
2. A certified ASTM C 618 analysis.

510.283 Withdrawal of Source Approval. Source approval may be revoked for any of the following reasons:

1. If there is a change in equipment or production procedures from those shown in the original request for approval;

2. If a project sample fails to comply with specification requirements;

3. If a source becomes inactive;

4. If a source does not furnish fly ash to the Department for a period of one year.

510.29 Aggregate Testing. Coarse and fine aggregate will be tested in accordance with AASHTO methods shown in Table 510–H and such other methods as may be required by the Project manager.

TABLE 510–H
AGGREGATE TEST METHODS

Sampling	AASHTO T 2
Clay Lumps	AASHTO T 112
Coal and Lignite	AASHTO T 113
Amount of Material Passing No. 200 Sieve	AASHTO T 11
Organic Impurities	AASHTO T 21
Sieve Analysis	AASHTO T 27
Soundness (Magnesium Sulfate)	AASHTO T 104
Lightweight Particles	AASHTO T 113
Sand Equivalent	AASHTO T 176

510.3 CONSTRUCTION REQUIREMENTS.

510.31 Proportioning. Concrete mix proportions shall be determined by the Rational (absolute volume) procedure of design.

A minimum of twenty percent (20%) and a maximum of thirty percent (30%) by equal volume of Class F fly ash per volume of portland cement and a minimum of twenty five percent (25%) and a maximum of thirty five percent (35%) by equal volume of Class C fly ash per volume of portland cement will be permitted, except that mineral admixtures including fly ash or natural pozzolan shall not be used in the concrete mix for drilled shafts.

The proportions of coarse and fine aggregates, portland cement, fly ash and water shall be maintained within the limits provided on the summary of portland cement concrete mix design.

The water/cement ratio shall not exceed the maximum for the class of concrete required.

The cement content of concrete as determined by AASHTO T 121 shall be within a tolerance of plus or minus two percent (± 2 % of the specified or approved amount. If the cement content varies by more than two percent (2%) from the designated value, the proportions shall be adjusted as approved by the Project Manager so as to maintain a cement content which does not vary more than two percent (2%) from the designated value.

All concrete shall have an entrained air content between 4½ and 7½ percent by volume, except that Class G concrete shall have entrained air content between 3 and 5 percent by volume. Air content will be determined by using AASHTO T 152 for gravel and stone coarse aggregate and AASHTO T 196 for slag and other highly porous coarse aggregate.

A concrete mix design will be developed using one of the design options outlined herein. The Contractor will indicate at the preconstruction conference the option chosen.

510.311 Mix Design Option A. The Contractor shall submit representative samples of the proposed materials to the Project Manager. After the component materials have been approved, the Testing Laboratory will then determine the proportions by means of trial mixes, including the approximate amount of air-entraining agent, any other admixtures, and fly ash, which will be necessary to meet the requirements of these specifications. It will take a minimum of fifty five (55) calendar days for the Department to issue a mix design.

510.312 Mix Design Option B. The Contractor shall make arrangements with and submit representative samples of the proposed materials to a Private Testing Laboratory (PTL) preapproved by the Project Manager. The PTL shall be supervised on site by a Civil Engineer licensed by the State of New Mexico.

The PTL shall determine the proportions by means of trial mixes, including the approximate amounts of air-entraining agent, any other admixture, and fly ash, which will be necessary to meet the requirements of these specifications. The trial mixes shall be conducted under the supervision of the licensed Engineer. Each mix design must be certified as correct by the Professional Civil Engineer supervising the PTL. All testing for Option B concrete shall be accomplished by American Concrete Institute (ACI) level one (1) or equivalent certified personnel.

Option B concrete mix design(s) submittals shall include but not be limited to the following:

1. Class(s) of concrete;
2. List of all materials used;
3. Material Certifications (both chemical and physical);
4. Material test results for the following:
   a. Soundness Loss (Coarse and fine with calculations);
   b. Percentage of fracture faces;
   c. Gradations (coarse and fine including AASHTO T-11)
   d. Bulk SSD specific gravities;
   e. Los Angeles Wear Abrasion;
   f. Fineness Modulus (fine aggregate);
   g. Aggregate absorption (coarse and fine aggregate);

h. Aggregate correction factor;

i. Concrete temperature;

j. Slump (in the case where a superplasticizer is used, the slump before and after the superplasticizer is added);

k. Unit weights;

l. Two cylinder breaks at 7,14, and 28 days each;

m. Concrete mix proportions (water, cement, flyash, coarse and fine aggregate and air content by pressure method);

n. Sand Equivalent (fine aggregate);

o. Dry-rodded unit weight (coarse aggregate).

5. Water/cementitious material ratio;

6. Type and amount of admixtures used (on approved list only)

7. Water source (including pH);

8. Procedure (calculations showing how proportions were determined);

9. Location of aggregate source and type of deposit.

510.313 Adjustments to Approved Mix Designs. Except as provided for herein, all proposed changes made by the Contractor to the approved mix design(s) must be reviewed and approved by the Project Manager before incorporation into the project.

The mix design may be varied to fit field conditions, and to obtain a workable mix, when approved by the Project Manager.

Adjustments made to the water and air content will not require approval. Water may be adjusted to obtain the desired slump, provided that the maximum water/cement ratio is not exceeded.

510.32 Batching. Measuring and batching of material shall be done at a batching plant or by continuous volumetric batching in a continuous mixer.

Methods and equipment for adding air-entraining agent or other admixtures to the batch, when required, must be approved by the Project Manager prior to initiating mixing operations.

510.321 Batching Plant. Batching plants shall include bins, weighing hoppers, and scales and shall be equipped to proportion aggregates, bulk cement, and fly ash by means of weighing devices approved by the Project Manager, unless otherwise required in the contract.

Aggregate scales and hoppers may provide for weighing each aggregate on a separate scale or for accumulative weighing on a single scale for all aggregates.

If cement is used in bulk, a bin, hopper, and separate scale for cement shall be included. Fly ash may be weighed in the same hopper with the portland cement, however, cement shall be weighed before the fly ash. The weighing hoppers shall be properly sealed and vented to preclude dusting during operations.

The batch plant site, layout, equipment, and provisions for transporting material shall be such as to ensure a continuous supply of material to the work site.

The batch plant shall:

1. Accurately weigh and batch materials for portland cement or portland cement-fly ash concrete within the tolerances specified;

2. Provide a means or method of removing an overload of any one (1) material prior to contamination by any other material when more than one (1) material is weighed in one (1) hopper;

3. Provide scale dials or instrumentation devices for beam scales and load cells, which are readily visible to both the operator and the inspector;

4. Incorporate weighing hopper or hoppers of sufficient size to contain the material without loss or spillage;

5. Properly proportion the various materials to obtain the required uniformity and consistency;

The weighing hopper or hoppers shall be so designed to efficiently discharge all weighed materials for each batch.

The material charging equipment shall deliver the batch to the mixer without loss or spillage.

Scales for weighing aggregates, cement, water and fly ash shall conform to the requirements of Subsection 109.01 Measurement of Quantity.

510.322 Portland Cement & Fly Ash. Either sacked or bulk cement and fly ash may used. No fraction of a sack shall be used in a batch of concrete unless the cement or fly ash is weighed.

Cement and fly ash shall be measured by weight. Fly ash may be weighed cumulatively with the portland cement, however, cement shall be weighed before the fly ash. All bulk cement and fly ash shall be weighed on an approved weighing device except when continuous proportioning and mixing equipment is used. The accuracy of batching shall be within plus or minus one percent (± 1% of the required weights.

Scales and hoppers shall be used for weighing the cement and fly ash with a device to indicate complete discharge of the batch of cement and fly ash into the batch box or container.

Cement and fly ash supplied in bulk shall be contained in weather tight bins and weighing hoppers. The weighing hoppers shall be properly sealed and vented to preclude dusting during operation.

Discharge chutes shall not be suspended from the weighing hoppers and shall be arranged so that cement and fly ash will not lodge in, or leak from them.

510.323 Water. Water may be measured either by volume or by weight. The accuracy of measuring the water shall be within plus or minus two percent (±2%).

Unless the water is to be weighed or metered, the water measuring equipment shall include an auxiliary tank from which the measuring tank shall be filled. The measuring tank shall be equipped with an outside tap and valve to provide for checking the setting, unless other means are provided for readily and accurately determining the amount of water in the tank. The volume of the auxiliary tank shall be at least equal to that of the measuring tank.

In lieu of the volume method, the Contractor will be permitted to use a water metering device that is accurate within the prescribed limits. Water meters shall be checked for accuracy at least once a year.

510.324 Aggregates. Aggregates for all concrete shall be handled from stockpiles or other sources to the batching plant in such manner as to secure a uniform grading of the material. Aggregates that have become segregated or mixed with earth or foreign material shall not be used. Methods of handling aggregates which result in segregation, degradation, or excessive breakage of particles will not be permitted. No aggregate in the form of frozen lumps shall be used in the manufacture of concrete.

Fine aggregate and individual sizes of coarse aggregate shall be separately stored and accurately weighed in an adequate hopper or hoppers in the respective amounts required by the Project Manager. Batching shall be so conducted as to result in the weights of material required, within a tolerance of plus or minus two percent (±2%).

Aggregates coated to the extent that they will not pass the materials passing the No. 200 sieve wash test for coarse aggregate or the sand equivalent test for fine aggregate at the time of batching shall be washed as required, or they will be rejected. No payment will be made for aggregates rejected or for the cost of washing.

(a) **Stockpiles.** Fine and coarse aggregate from different sources of supply shall not be mixed or stored in the same stockpile or used alternately in the same work without approval of the Project Manager.

All aggregates shall be stockpiled in such manner that segregation of coarse and fine particles of each size is avoided. Aggregates from different sources and of different gradings shall not be stockpiled together.

The Contractor shall take necessary measures to prevent intermingling of the different sizes of stockpiled aggregates. Such preventative measures may include, but are not necessarily limited to, physical separation of stockpiles or construction of bulkheads of adequate length and height.

The Contractor shall take necessary measures to prevent contamination of aggregates by contact with the ground and stockpiled aggregates shall be protected from dust and other foreign matter.

1. **PCCP Aggregate Stockpiles.** Stockpiles of aggregates for PCCP shall be built up in layers not to exceed four (4) feet in depth. Each layer shall be completely in place before beginning the next, and shall not be allowed to "cone" down over the next lower layer.

2. **Superstructure Concrete Aggregate Stockpiles.** The Contractor shall maintain separate stockpiles for superstructure concrete aggregate or designate portions of large stockpiles of aggregates specifically for superstructure concrete to provide for advance testing of aggregates for moisture content and quality. Uniform moisture content shall be maintained throughout the stockpile during the scheduled operation as herein provided.

The quantity of material in these stockpiles or designated portions of stockpiles shall be adequate to provide all of the concrete required for the section or sections of superstructure to be constructed during a scheduled operation.

(b) Moisture Control. Aggregate moisture content throughout the stockpiles of accepted aggregates, shall be constant within a tolerance of plus or minus one percent ($\pm 1\%$), immediately prior to and at the time of batching for a scheduled operation.

The moisture content throughout the stockpiles of accepted aggregates for bridge superstructure concrete shall be constant within a tolerance of plus or minus one-half percent ($\pm 1/2\%$), immediately prior to and at the time of batching for a scheduled operation.

When the moisture content in the aggregates varies by more than the specified tolerances, corrective action shall be taken to bring the moisture content to a constant and uniform quantity before any concrete is mixed.

If the moisture content in the aggregates is found to vary by more than the specified tolerances during a scheduled operation, the mixing and placement of concrete shall be immediately suspended. Operations shall not be resumed until such time as the moisture content throughout the aggregates to be used for the remainder of the scheduled operation has been brought within the specified tolerances.

All aggregates produced or handled by hydraulic methods and washed aggregates shall be stockpiled or binned for draining at least twelve (12) hours before being batched. Rail shipment requiring more than twelve (12) hours will be accepted as adequate binning only if the car bodies permit free drainage. If the aggregates contain high or non-uniform moisture contents, storage or stockpile periods in excess of twelve (12) hours may be required by the Project Manager.

510.325 Air-entraining & Chemical Admixtures. Admixtures shall be stored in separate containers and in a manner that will avoid contamination, evaporation, and damage. Liquid admixtures shall be protected from freezing and from temperature changes which adversely affects their characteristics.

Methods and equipment for adding air-entraining agent or other admixtures to the batch shall be approved by the Project Manager. For admixtures used in the form of suspensions of nonstable solutions, agitating equipment shall be provided to ensure thorough distribution of the ingredients.

Volumetric measures for each batch shall be marked in ounces, and shall be constructed so that the quantity of admixture required can be readily determined before being injected into the batch. All admixtures shall be measured into the mixer within plus or minus three percent (±3%) of the required amount.

510.33 Mixing. Concrete may be mixed at the site of the work, in a central mix plant, compulsory mixer, or in truck mixers. The mixer shall be of a type and capacity approved by the Project Manager except that the central plant mixer shall be at least three (3) cubic yards in capacity. Continuous mix concrete shall be mixed at the placement site.

Mixers shall be cleaned before the start of the project and at suitable intervals thereafter or as required by the Project Manager.

The pick up and throw-over blades in the drum shall be repaired or replaced when they are worn down 3/4 inch or more. The Contractor shall:

1. Have available at the job site a copy of the manufacturer's design drawings showing dimensions and arrangements of blades in reference to original height and depth; or,

2. Provide permanent marks on blades to show points of 3/4 inch wear from new conditions. Drilled holes of 1/4 inch diameter near the end and at the midpoint of each blade are recommended.

510.331 Production Requirements. The production of ready-mixed concrete and the production of site-mixed concrete shall meet the applicable requirements of AASHTO M 157 in addition to the following requirements:

(a) **Addition of Materials.** There shall be no water in the drum prior to initiating batching of concrete. When initiating batching operations, the batch shall be charged into the drum so that a portion of the mixing water shall enter in advance of the cement and aggregates.

Introduction of the unmixed materials (cement, coarse aggregate, sand, admixtures, and the remainder of the water) shall then be performed by a uniform and simultaneous flow into the mixer, with all water introduced into the drum by the first fifteen (15) seconds of the mixing period.

The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.

When the concrete is delivered in transit mixers or agitators additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements, if permitted by the Project Manager. The maximum water-cement ratio is not to be exceeded.

(b) **Slump Requirements.** Concrete that is not within the specified slump limits at time of placement shall not be used.

(c) **Mixing Speed.** The mixer shall be operated at a drum speed not to exceed the maximum speed shown on the manufacturer's name plate.

(d) **Mixer Capacity.** The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic feet, as shown on the manufacturer's standard rating plate on the mixer.

An overload of up to ten percent (10%) above the mixer's nominal capacity may be permitted provided concrete test data for strength, segregation, and uniform consistency are satisfactory, and provided no spillage of concrete takes place.

The volume of concrete mixed or transported shall not be less than one (1) cubic yard.

(e) **Mixing Time.** For purposes of these specifications, the term "mixing time" shall be defined as the time elapsing from the point the cement comes in contact with the aggregates until the concrete is deposited in place at the site of the work.

Concrete mixed less than the specified time shall be discarded and disposed of, at the Contractor's expense.

When the concrete is hauled in nonagitating trucks, the mixing time shall not exceed thirty (30) minutes. When the concrete is hauled in truck mixers or truck agitators, the mixing time shall not exceed 1½ hours, or 300 total mixing and agitating revolutions of the drum or blades, whichever comes first, except that the mixing time for superstructure concrete shall not exceed sixty (60) minutes.

Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is eighty five degrees (85°) F or above, the mixing time shall not exceed sixty (60) minutes.

510.34 Transporting. Mixed concrete from the central mixing plant or compulsory mixer shall be transported in truck mixers, truck agitators, or nonagitating trucks in accordance with the "Mixer & Agitator," and "Mixing & Delivery" requirements of AASHTO M 157, in addition to the following requirements.

510.341 Nonagitator Trucks. Bodies of nonagitating hauling equipment for concrete shall be smooth, mortar-tight metal containers and shall be capable of discharging the concrete at a satisfactory controlled rate without segregation. Covers shall be provided when needed for protection.

510.342 Truck Mixers & Agitators. The Contractor shall furnish the manufacturer's rated capacity of each mixer and agitator, and the recommended speed of rotation for the various uses of each mixer, to the Project Manager.

Truck mixers and agitators shall be equipped with readily available devices which indicate the number of revolutions of the drum, blades, or paddles.

510.35 Weather & Temperature Limitations. The requirements of Subsections 451.32 Weather & Temperature Limitations, and 511.33 Weather & Temperature Limitations, shall apply.

510.36 Concrete Sampling & Testing. Slump, unit weight, air content and cylinders for strength tests shall be performed with concrete obtained at the discharge end of the bucket, chute, or pump immediately prior to placement. For Class G concrete the air content will be measured from samples taken at the point of discharge from the truck.

If a superplasticizer is used, the slump shall be checked before and after the superplasticizer is added. The slump specifications outlined in Table 510–A shall not be exceeded prior to introduction of the superplasticizer. The slump shall not exceed seven (7) inches after the superplasticizer is added and vibrating shall be sufficient to consolidate the concrete without causing segregation.

510.4 CONCRETE STRENGTH.

510.41 Concrete strength shall be determined from the average of two (2) concrete cylinders made from the same sample of concrete and tested at twenty eight (28) days for structural concrete and at fourteen (14) days for PCCP concrete. The cylinders will be made, handled, and stored in accordance with AASHTO T 23 "Making and Curing Concrete Test Specimens in the Field" and tested in accordance with AASHTO T 22 "Compressive Strength of Cylindrical Concrete Specimens."

510.411 Individual Strength Test. An "individual strength test" will be determined by testing two (2) cylinders, at twenty eight (28) days or at fourteen (14) days for PCCP.

Four (4) cylinders shall be made per test. The first cylinder shall be tested at seven (7) days for use as an indicator of concrete compressive strength gain. The second and third cylinders shall be tested to determine the "individual strength test." The fourth cylinder shall remain available for testing if the difference between the second and third test cylinders is greater than 5.64%. If the fourth cylinder is tested, the two (2) cylinders with the closest strength will be used to determine the "individual strength test."

510.412 Field Cured Cylinders for Early Form Stripping or Opening of Highways. The Contractor may request that the Project Manager obtain additional cylinders, for field curing, in order to remove forms or open a highway earlier than twenty eight (28) days, fourteen (14) days for PCCP. The additional cylinders will be taken by the Project Manager and field cured at the site of concrete placement with the structure(s). Unless less stringent requirements are specified elsewhere in the contract, the forms may be stripped and traffic permitted on the structure or pavement when the field cured cylinder test is at least equal to the required twenty eight (28) day compressive strength.

Field cured cylinders will be used for construction information purposes only and not as a basis for final acceptance or rejection of the concrete.

510.413 Acceptance of Concrete Based on Cylinders. The concrete will be accepted with respect to compressive strength indicated by cylinder tests, when both of the following requirements are met:

1. The running average of three (3) consecutive individual strength tests, meets or exceeds the specified strength; and,

2. No individual strength test falls below the specified strength by more than 12.5%.

If three (3) sets of cylinders are not available for evaluation, only the criteria of requirement number 2, shall apply.

When the cylinder based acceptance requirements are not met, the Proj. Mgr. will review the strength tests and notify the Contractor in writing whether the concrete will be accepted at full price, will be accepted at a reduced price, or shall be removed and replaced by the Contractor at no additional cost to the Department. Only that area or lot of concrete represented by the individual strength test failing to meet either or both cylinder based acceptance requirements, shall be subject to investigation, a price reduction, or removal. When the cylinder based acceptance requirements are not met, steps shall be taken by the Contractor to increase the average of subsequent strengths.

510.414 Investigation of Low Strength Cylinder Test Results. The Contractor may core the in-place concrete if the strength of the in-place concrete fails to meet or exceed either or both cylinder based acceptance requirements.

All cores shall be obtained by the Contractor in accordance with AASHTO T 24 "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete." The cores will be tested in accordance with AASHTO T 22 "Compressive Strength of Cylindrical Concrete Specimens."

If the concrete in the structure will be dry under service conditions, the cores will be air dried at a temperature range of sixty degrees to eighty degrees (60° to 80°) F, and at a relative humidity of less than sixty percent (60%), for seven (7) days before testing and will be tested dry.

If the concrete in the structure will be more than superficially wet under service conditions, the cores will be cured in accordance with AASHTO T 24 and will be tested wet.

(a) **Procedure for Coring of PCCP.** If the Contractor elects to core, the Contractor shall core within forty two (42) calendar days of initial concrete placement. At least three (3) cores shall be taken for each individual strength test falling below the specified strength, and a minimum of one (1) set of three (3) cores obtained per each lot of 2500 square yards. The Project Manager will determine the locations to be cored.

(b) **Acceptance of Concrete Based on Cores.** The concrete will accepted with respect to compressive strength indicated by core tests, when the average of three (3) cores is at least eighty five percent (85%) of the specified strength and if no single core is less than seventy five (75%) of the specified strength.

If the core strengths are not adequate for acceptance at full price, the concrete shall be, as determined by the Project Manager either

1. Removed and replaced by the Contractor at no additional cost to the Department; or,

2. Paid for at the adjusted concrete contract unit price, in accordance with the appropriate price adjustment table in Subsection 510.5 Price Adjustments.

Additional cores may be extracted from locations represented by erratic core strength results, only as approved by the Department.

510.5 PRICE ADJUSTMENTS.

510.51 Price adjustments for noncompliance with strength specifications of the concrete, accepted by the Department, will be based on twenty eight (28) day, fourteen (14) day for PCCP, cylinder strengths or core strengths.

510.511 Cylinder Based Price Adjustments. If low strength concrete is accepted based on cylinders, the payment allowed for the entire low strength lot will be in accordance with Table 510–I.

TABLE 510–I
PRICE ADJUSTMENT PERCENTAGES FOR LOW STRENGTH CONCRETE BASED ON CYLINDERS

Percent of Specified Strength from Cylinders (to the nearest 1%)	Percent of Contract Unit Price Allowed
100 or more	100
97–99	96
94–96	91
90–93	84
85–89	75
80–84	64
75–79	51
Less than 74	*

*This concrete shall be removed and replaced, at the Contractor's expense, with concrete which meets the specification requirements or if permitted by the Project manager in writing, Class B or E concrete may be allowed to remain in place and the concrete will be paid for at twenty five percent (25%) of the contract unit price.

510.512 Core Based Price Adjustments. If low strength concrete is accepted based on cores, the payment allowed for the entire low strength lot shall be in accordance with Table 510–J.

TABLE 510–J
PRICE ADJUSTMENT PERCENTAGES FOR LOW STRENGTH CONCRETE BASED ON CORES

Percent of Specified Strength from Cores (to the nearest 1%)	Percent of Contract Unit Price Allowed
85	100
82–84	90
79–81	80
76–78	70
73–75	60
70–72	50
67–69	40
64–66	30
62–63	20
60–61	10
less than 60	0

The cost incurred in coring, at full payment, shall be at the Contractor's expense.

SECTION 540—STEEL REINFORCEMENT

540.1 DESCRIPTION.

540.11 This work shall consist of furnishing and placing steel reinforcement in compliance with the specifications and the dimensions, spacing, and type shown in the contract and in accordance with the specifications.

540.2 MATERIALS.

540.21 Bar Reinforcement. Bar reinforcement shall be deformed bars conforming to the requirements of AASHTO M 31 or AASHTO M 42, including the "Supplementary Requirements."

Grade 60 reinforcing bars may be substituted for Grade 40 reinforcing bars at no additional cost to the Department except that vertical bars in abutment back walls and stirrup bars which project from prestressed concrete beams or other precast units shall always be Grade 40.

540.22 Welded Wire Fabric. Welded wire fabric shall conform with the requirements of AASHTO M 55.

540.23 Spiral Reinforcement. Spiral reinforcement shall be fabricated from steel bars conforming to the requirements of AASHTO M 31 or AASHTO M 42, or from cold-drawn steel wire conforming to the requirements of AASHTO M 32, as specified in the contract.

540.24 Reinforcement Supports. Metal chairs or other metal supports for reinforcement which contact the exposed surfaces of the concrete shall be galvanized.

540.25 Reinforcing Wire. Wire for reinforcement shall conform with the requirements of AASHTO M 32.

540.26 Dowel & Tie Bars. Smooth dowels for joint load transfer in PCCP and deformed tie bars for PCCP joints shall conform to the requirements of AASHTO M 31, including "Supplementary Requirements."

The diameter, length, and grade shall be as shown in the contract.

After cutting the dowel bars to length, bars shall be hot dipped galvanized in accordance with AASHTO M 111.

540.27 Epoxy Coated Reinforcing Bars. Epoxy coated reinforcing bars shall conform to the requirements of AASHTO M 284 except as modified herein.

540.271 Coating Material. The coating material shall be a light colored powdered epoxy resin which will highlight rusting of untreated bar areas. The coating material shall be selected by the Project Manager.

The Contractor shall provide for the submittal t, of at least one (1) representative four (4) ounce sample of the resin powder used to coat each given lot of bars.

540.272 Accessories. Tie wire for tying epoxy coated reinforcing bars shall be plastic coated. Chairs, supports, and clips shall be one (1) of the following:

1. Steel, fully coated with plastic or fusion bonded epoxy.

2. Galvanized steel, with the cradle and the upper two (2) inches of the chair, support or clip coated with fusion bonded epoxy or plastic.

540.28 Certificates of Compliance. The Contractor shall furnish Certificates of Compliance from the fabricator to the Project Manager indicating compliance with the applicable requirements of this specification. The copies shall accompany each shipment of reinforcing steel to the project.

The certificate of compliance shall indicate the project number, the shipping invoice number, the name of the manufacturer, pounds shipped, heat numbers, laboratory test reports, and grade of steel.

540.281 Epoxy Coated Reinforcing Bar Certificates of Compliance. The applicator shall furnish the Department's Inspector, three (3) copies of a notarized certificate of compliance for each shipment of coated bars. The certificate of compliance shall contain all the information required Subsection 540.28 Certificates of Compliance, and shall also state that representative samples of the coated bars have been tested and that the test results comply with the requirements of AASHTO M 284, this specification, and batch numbers of the epoxy resin.

Results of tests by the fabricator during coating shall be retained and made available to Department's inspectors for inclusion in final inspection reports.

540.3 CONSTRUCTION REQUIREMENTS.

540.31 General. Unless otherwise provided, dimensions on plans are to the centerline of bars.

540.311 Bundling & Tagging. Bar reinforcement shall be shipped in standard bundles, tagged and marked in accordance with the Code of Standard Practice of the Concrete Reinforcement Steel Institute.

540.32 Bar Bending. Bent bar reinforcement shall be cold bent around a pin to the shapes shown in the contract. Unless otherwise specified bending shall be done in an adequately equipped shop.

Field bending of Grade 60 bars and epoxy coated bars is not permitted.

Unless otherwise provided, the diameter of bend shall be in accordance with Table 540–A.

TABLE 540–A
MINIMUM DIAMETER OF BEND

Type of Reinforcement	Size	Minimum Pin Diameter
Uncoated Bars		
Stirrups & Ties	#3 through #5	5 bar diameters
Main Reinforcement	#3 through #5	6 bar diameters
All Types	#6 through #8	6 bar diameters
All Types	#9 through #11	8 bar diameters
All Types	#14 through #18	10 bar diameters
Coated Bars		
Stirrups & Ties	#3 through #5	7½ bar diameters
Main Reinforcement	#3 through #5	9 bar diameters
All Types	#6 through #8	9 bar diameters
All Types	#9 through #11	12 bar diameters
All Types	#14 through #18	15 bar diameters

540.33 Requirements for Epoxy Coated Reinforcing Bars. Where epoxy coated bars are detailed over forty (40) feet long, the Contractor may furnish such bars in two (2) sections with lap splices.

The Contractor shall submit to the Project Manager in writing, a request for such a substitution showing details of splice locations and lengths of lap splices. The Contractor shall submit the request prior to fabrication of the bars, and shall allow at least two (2) weeks for review and approval. Longer bar lengths resulting from the proposal shall be provided at no additional cost.

The applicator shall make a trial run of the coating process to ensure that the process meets the specified requirements.

All required tests shall be performed on the trial specimens before production is started on the reinforcing bars for the project. The Contractor shall notify the Project Manager at least thirty (30) days before the date of the trial run.

540.331 Coating Thickness. The thickness of the coating after curing shall be between six (6) mils and ten (10) mils. For acceptance, at least eighty percent (80%) of all recorded film thickness measurements shall be in this range.

540.332 Cure of Coating. The coating film shall be fully cured. The applicator shall ensure that the entire coated production lot is supplied in a fully cured condition.

540.333 Continuity of Coating. Coating shall be free from holes, voids, contamination, cracks and damaged areas as determined by a visual examination of a representative number of bars.

A 67½ volt holiday detector shall be used in the production line to continuously check the coating for holidays.

There shall be no more than two (2) holidays or pinholes per linear foot of coated bar.

540.334 Coating Inspection & Tagging. Before coating reinforcing bars with epoxy, the Department's inspectors will inspect and tag approved bar bundles.

It will be the applicator's responsibility to maintain these tags through the coating process. The tagged bar in a bundle shall be the last to be fed through the cleaning unit. The tag shall be removed prior to cleaning and placed back on the last bar following coating and before rebundling.

After coating is complete a second tag will be attached to the bundle by the Inspector indicating that the bundle has been inspected and accepted for epoxy coating.

The Project Manager will not accept bundles arriving on the project without inspection tags indicating that the coating meets specification requirements.

540.335 Storage & Handling of Epoxy Coated Reinforcing Bars. Epoxy coated reinforcing steel shall be handled and stored by methods that will not damage the epoxy coating. Epoxy coated reinforcing steel shall be transported and stored on wooden or padded supports.

Devices used for handling epoxy coated reinforcement bars shall have adequately padded contact areas. Bundling bands shall be padded and all bundles shall be lifted with a strong back, with multiple support points or with a platform bridge so as to prevent bar-to-bar abrasion from sags in the bar bundle.

Bars or bundles shall not be dropped or dragged.

540.336 Repair of Damaged Coating. All visible damage and cracks in the coating shall be repaired prior to shipping. The total bar surface area covered by patching by the coating applicator shall not exceed one percent (1%) in any one (1) foot section.

Sheared ends and other cuts and exposed areas shall be patched promptly before detrimental oxidation occurs. Areas to be repaired shall be clean and free from surface contaminants.

All visible damage and cracks in the coating due to shipping and field handling shall be repaired by patching before concrete is placed. The total bar surface area covered by patching material shall not exceed two percent (2%) in any one (1) foot section.

540.34 Splicing. Splicing of bars other than at the locations specified in the contract, will not be permitted unless otherwise approved by the Project Manager.

Bars in lapped splices shall be placed and securely tied in a manner that will maintain at least the minimum reinforcing bar cover required.

Spiral reinforcement may be spliced by lapping or by butt welding. If lap splicing is used laps shall be at least forty eight (48) bar or wire diameters but not less than twelve (12) inches. The welding of splices shall conform with the requirements herein provided.

Welded wire fabric and bar mat reinforcement shall be lapped as shown in the contract. If not shown in the contract, the length of overlap measured between the outermost cross wires of each sheet shall be at least one (1) spacing of cross wires plus two (2) inches.

540.35 Field Cutting. If it becomes necessary to cut bars to length in the field, bars shall be sheared or sawed. Flame cutting will not be permitted. The ends of the epoxy coated bars cut in the field shall be patched with epoxy patching material.

540.36 Reinforcing Bar Placement. Reinforcing bars shall be placed as shown in the contract and shall be securely tied in position with wire of not smaller than 16 gage (0.0625 inch diameter). Reinforcing shall be placed, supported, and tied carefully, and concrete shall be placed and vibrated with care, to avoid damage to the epoxy coating.

All intersections shall be tied except where the reinforcing bar spacing is less than one (1) foot in either direction. Where the spacing is less than one (1) foot in either direction, alternate intersections shall be tied.

Metal spacers, chairs, hangers, and other approved devices of adequate strength to prevent crushing under full load shall be used to hold the reinforcing bars in position.

The use of concrete blocks to support reinforcing bars will not be permitted, except that dense, rectangular concrete blocks may be used to support the bottom mat of reinforcement in slabs which are cast on earth. Such concrete blocks shall:

1. Have compressive strength and density equal to or greater than the concrete to be placed;

2. Occupy a small area;

3. Contain embedded tie wires to provide for the attachment of reinforcement to the block.

Wooden spacers or support shall not be used to hold reinforcing in position.

Reinforcing bar mats in bridge deck and concrete box culvert slabs shall be securely tied down to beams and forms to prevent upward movement of the bar mats during concrete placement. Maximum spacing between ties shall be ten (10) feet.

540.361 Reinforcing Bar Placement Tolerances. Variations in spacing between adjacent bars shall not to exceed 1/2 inch or one twenty-fourth (1/24) of the spacing dimension shown in the contract, whichever is greater.

With the exception of slabs cast on earth, the clear coverage of reinforcement shall not vary more than 1/4 inch or one-eighth (1/8) of the dimension shown in the contract, whichever is greater.

The clear coverage of the reinforcement in slabs cast on earth shall not vary more than minus 1/2 inch from the position shown in the contract.

540.362 Cleaning of Reinforcing Bars. Before concrete is placed, the reinforcing bars shall be cleaned of dirt, mortar, oil, loose rust, loose mill scale and other materials that would reduce or destroy the bond.

540.37 Welding of Reinforcing Steel. Reinforcing steel shall be welded only when shown in the contract or authorized in writing by the Project Manager, Welding shall conform with the requirements of AWS Specification D1.4—Reinforcing Steel Welding Code.

540.38 Concrete Cover Requirements. The concrete cover shall be as shown in the contract. Concrete cover shall be defined as the distance from the surface of concrete to the edge of the bar nearest to that surface. If cover dimensions are not shown in the contract, the concrete cover requirements of Table 540–B shall apply.

TABLE 540–B
CONCRETE COVER REQUIREMENTS

Location	Minimum Cover
Concrete cast against & permanently exposed to earth:	3 inches
Concrete exposed to earth or weather:	2 inches
Principal reinforcement	
Stirrups, ties, and spirals	1 1/2 inches
Concrete bridge slabs:	2 inches
Top reinforcement	
Bottom reinforcement	1 inch
Concrete not exposed to weather or in contact with ground:	
Principal reinforcement	1 1/2 inches
Stirrups, ties, and spirals	1 inch.
Bar bundles	*2 inches

*Or equal to the diameter of a single bar of equivalent area, whichever is greater.

540.39 Cleaning & Final Inspection. Before concrete is placed, the reinforcing bars shall be cleaned of dirt, mortar, oil, loose rust, loose mill scale and other materials that would reduce or destroy the bond.

No concrete shall be placed until the Project Manager has inspected the reinforcing steel in place and has authorized the Contractor to place the concrete.

Acceptance of the reinforcing steel shall not relieve the Contractor of responsibility for coverage and position control of the steel.

540.4 METHOD OF MEASUREMENT.

540.41 Reinforcing bars will be measured by the pound.

Epoxy coated reinforcing bars will be measured by the pound.

Welded wire fabric will be measured by the pound.

540.42 Measurement of will be based on the computed weight of the bars or welded wire fabric.

The computed weight of reinforcing bars will be based on the nominal unit weight of the bar sizes shown in AASHTO M 31.

The computed weight of epoxy coated reinforcing bars will be based on the nominal weight before application of the epoxy coating.

The computed weight of welded wire fabric will be based on the nominal unit weights per square foot contained in the CRSI Manual of Standard Practice.

When splices are made for the convenience of the Contractor, and are approved by the Project Manager at locations not shown in the contract, the extra steel required for laps will not be included in computing the weight of the bars.

540.5 BASIS OF PAYMENT.

540.51 Reinforcing bars will be paid for at the contract unit price per pound.

Epoxy coated reinforcing bars will be paid for at the contract unit price per pound.

Welded wire fabric will be paid for at the contract unit price per pound.

Payment will be made under:

Pay Item	Pay Unit
Reinforcing Bars Grade	Pound
Epoxy Coated Pound	
Welded wire Fabric	Pound

540.52 Work Included in Payment. The following work and items will be considered as included in the payment for the main items and will not be measured or paid for separately:

Clips, supports, wire, and other material used for fastening reinforcement;

Samples and submittals.

SECTION 545—PROTECTIVE COATING OF MISCELLANEOUS STRUCTURAL STEEL

545.1 DESCRIPTION.

545.11 This work shall consist of furnishing coating materials, surface preparation, and applying the coatings materials, in accordance with the specifications and the contract requirements.

This specification describes coating systems for use in coating of new steel bridge railing and miscellaneous structural steel items such as drop inlet grates and cattle guards, and field coating of new steel piling and other miscellaneous structural steel.

The coating systems consist of a polyurethane or an epoxy primer and a polyurethane topcoat.

The Contractor shall field repair all coatings damaged in shipping, handling, erecting, or from construction operations.

545.12 Coating Options. The primer shall be shop applied and the topcoat may be shop applied or field applied.

545.13 Terminology and Standards. Terminology used herein is in accordance with the definitions used in Volume 2, Systems and Specifications of the Steel Structures Painting Manual. Standards specified in the Steel Structures Painting Council Specifications (SSPC-SP) will be referenced by the SSPC-SP designation.

545.2 MATERIALS.

545.21 Coating System. Both coats of a selected system shall be supplied by a single manufacturer. The Contractor shall select a complete system.

545.211 Color. The color of the topcoat shall be aluminum or light gray, unless otherwise specified in the contract. If another color is specified in the contract, it shall be the Contractor's responsibility to select an approved system which is also available in the specified color.

545.22 Submittals, Certification, & Sampling. All applicable requirements of Subsection 544.22 Submittals & Certification, Subsection 544.221 Product Data Sheets, and Subsection 544.222 Sampling, shall apply.

545.23 Zinc Coatings. Position dowels and anchor bolts for bridge railing and bearings shall be mechanically galvanized in conformance with AASHTO M-298, Class 50, or hot-dip galvanized in conformance with AASHTO M-232. All portions of bearings not welded to the beam or girder and other structural members and parts required to be zinc coated shall be galvanized in accordance with AASHTO M-111. Fabricated bearing components shall be blast cleaned to remove all mill scale prior to galvanizing.

545.3 CONSTRUCTION REQUIREMENTS.

545.31 Surface Preparation. The Contractor shall remove all visible deposits of oil, grease or other contaminants from the surfaces to be coated by any of the methods specified in SSPC-SP 1 or by other methods approved by the Project Manager.

The Contractor shall then blast clean all surfaces to be coated in accordance with SSPC-SP 6, commercial blast cleaning.

All cleaning residue shall be removed from steel surfaces with a good commercial grade vacuum cleaner, or by double blowing. If the double blowing method is used the top surfaces of structural steel shall be vacuumed after the double blowing operations are completed.

Interiors of rail tubes shall also be blown free of blasting debris.

The steel shall then be kept dust free and primed within eight (8) hours after blast cleaning, unless otherwise authorized by the Project Manager.
Inspector.

If cleaned surfaces rust or are contaminated with foreign materials before coating is accomplished, they shall be recleaned by the Contractor, at no additional cost to the

Areas where field welding are required shall be masked prior to coating.

After the steel has been primed, it shall be cleaned again before applying the topcoat.

545.32 Mixing the Coating. The coating shall be mixed with a high shear mixer, such as a Jiffy Mixer, in accordance with the coating manufacturer's directions, to a smooth and lump-free consistency.

Mixing shall be done, as far as possible, in the original containers and shall be continued until all of the metallic powder or pigment is in suspension. Mixed primers shall be kept under continuous agitation up to and during the time of application.

545.33 Thinning Coatings. Thinning will not be allowed unless approved by the Inspector or Project Manager. If it is necessary to thin the coatings for proper application in adverse weather conditions, to coat intricate surfaces, or to obtain better coverage of the coatings, the thinning shall be done in accordance with the manufacturer's recommendations and using thinners supplied by the coating manufacturer.

545.34 Weather & Temperature Limitations. The coatings shall be applied only when the ambient air temperature and surface temperature of the steel are both above fifty degrees (50°) F and when the ambient air temperature and the temperature of the steel are at least five degrees (5°)F higher than the dew point.

The surface temperature of the steel and the ambient air temperature shall not be so hot as to cause blistering or porosity in the coatings.

Coatings shall not be applied when there is condensation or frost on the metal surfaces.

545.341 Relative Humidity. The coatings shall not be applied when the relative humidity is greater than ninety percent (90%).

545.35 Coating Applications. Application of coatings shall not be initiated until the surface preparation is inspected and approved by the Project Manager or the Project's Inspector. The Inspector may waive such inspection.

All coating shall be done in a neat and workmanlike manner as described in SSPC-PA 1, producing a uniform, even coating which is firmly bonded to the underlying surface.

The Contractor shall pre-spray edges, welds, bends and other areas most likely to be under the minimum thickness requirements. Areas of primer or the total coating system which are deficient in thickness shall be repaired.

Coated areas of primer or topcoat exhibiting running, sagging or mud cracking shall be repaired according to the manufacturer's recommendations or as directed by the Project Manager.

The topcoat shall not be applied until the primer has fully cured.

The Contractor shall follow the manufacturer's recommendations for maximum time between coats. If more than thirty (30) days elapse between the application of the primer and the topcoat, the Contractor shall contact the manufacturer of that coating system, for recommendations for surface preparation prior to applying the topcoat.

Where requirements of the coating manufacturer differ from the requirements in this specification, the more stringent requirements shall apply.

All metal coated with impure, unsatisfactory, or unauthorized coating material, or coated in an unworkmanlike or objectionable manner shall be thoroughly cleaned and recoated or otherwise corrected as directed by the Project Manager. Inspector.

The topcoat shall cover the prime coat thoroughly and uniformly without color variations, streaks, or blotches.

545.351 Required Coating of Components. Unless otherwise specified, the primer and topcoat shall be applied to all steel surfaces including the bottoms of rail post base plates, all surfaces of rail post anchor plates, and surfaces to be embedded in concrete, except for those surfaces to be in contact with elastomeric bearing pads or subject to sliding and rotational movements.

The full exposed lengths of new steel piling from the bottoms of the pier caps to two (2) feet below the finished grade or streambed elevations shall be coated.

(a) **Coating of Sole Plates for Concrete Bridges.** Sole plates for concrete bridges shall be delivered to the job site with one (1) coat of primer applied to all surfaces except for masked-off strips where the sole plates will be welded to the shoe plates of the prestressed beams and the surfaces to be in contact with elastomeric bearing pads.

Before installation, surfaces to be in contact with the pads shall be cleaned to SSPC-SP 6 requirements.

After installing the pads and welding the sole plates to the shoe plates, the Contractor shall touch up the primer and apply the topcoat to all exposed surfaces.

(b) Coating of Galvanized Components. Tie coats for galvanized components shall be applied in accordance with the recommendations of the coating manufacturer. The tie coats may be brushed.

Following the erection of the steel, galvanized hardware shall be topcoated.

545.352 Spray Equipment. The coatings shall be applied with the spray nozzles and at the pressures recommended by the manufacturer of the coating system.

545.353 Film Thickness Requirements. The required dry film thicknesses shall be as shown in table 545–B.

TABLE 545–B
REQUIRED FILM THICKNESSES

Coating	Dry Film Thickness Range, mils
Primer	2.0 to 4.0
Topcoat	3.0 to 6.0

Dry film thickness will be determined by the use of magnetic film thickness gages or electronic film thickness detectors.

545.36 Handling Steel. Newly coated structural steel shall not be handled or loaded until the coating(s) has thoroughly cured.

The fabricator and Contractor shall exercise care in handling coated structural steel during shipping, storage and erection.

The structural steel shall be stored on pallets at the job site, or by other means approved by the Project Manager, so it does not rest on the dirt and such that components do not rest or fall on each other.

Steel shall be insulated from binding chains by softeners approved by the Project Manager or the Project Inspector. Hooks and slings used for hoisting steel shall be padded. Parts shall be spaced during shipment in such a way that no rubbing occurs.

545.37 Provisions for Inspection. The Fabricator or Contractor shall notify the Project Manager : at least three (3) working days in advance of any coating operation, to permit adequate time to plan inspection activities.

545.38 Field Repair. The Contractor shall field repair all coated areas of structural steel which are rusted or which show damage due to improper handling or other reasons. In preparation for repairs, all adhering dirt, grease, form oil and other undesirable material shall be removed by solvents or detergent, using methods approved by the Project Manager.

Large damaged, rusted or uncoated areas shall be blast cleaned to SSPC-SP 6 standards. Small areas with full-thickness damage shall be power tool cleaned using abrasive disks. On rusted or full-thickness damaged areas both coats of the system shall be applied.

Large areas shall be primed using spray equipment, brush or roller. Small areas shall be primed by brush. The topcoat may be sprayed or brushed.

Two (2) or more coats may be necessary to build up the required film thickness. On areas where only the topcoat is damaged only the topcoat need be applied.

The final finish shall be smooth, and uniform in appearance and color.

All requirements listed herein for inspection, mixing, thinning, temperature and humidity requirements, film thickness and applying the coatings shall apply to the repaired areas.

545.39 Protection of the Work & Public. During coating operations, all portions of structures not being coated shall be protected against blast cleaning operations, paint splatter, splashes, and smirches by protective covering or other methods approved by the Project Manager, however, the Contractor shall be responsible for all damage the coating operations cause to persons, vehicles or property.

545.4 METHOD OF MEASUREMENT & BASIS OF PAYMENT.

545.41 Unless otherwise provided, the furnishing, preparation and application of the coating system will be considered as included in the payment for the structural steel and no separate measurement or direct payment will be made therefor.

SECTION 602—SLOPE & EROSION PROTECTION STRUCTURES

602.1 DESCRIPTION.

602.11 This work shall consist of furnishing and placing riprap, gabions, sacked concrete revetment, concrete block revetment and other systems specified in the contract on the slopes of embankments and the sides and bottoms of channels, drain outlets, ditches and other locations shown in the contract. The work shall be performed in compliance with and to the lines, grades, dimensions and at the locations, shown in the contract.

The type(s) of slope protection structures to be furnished and placed shall be as specified in the contract.

602.2 MATERIALS

602.21 Classifications. Riprap will be classified as shown in Table 602–A. Riprap of the class specified and gabions shall meet the requirements shown.

At least eighty percent (80%) of the stones used shall meet the size requirements specified.

Stones less than the minimum dimension shown may be used only to fill the voids between stones. For riprap Class A and gabions stones smaller than the least dimension of the mesh openings shall not be used.

TABLE 602–A
RIPRAP CLASSIFICATIONS & GABION REQUIREMENTS

Class	Description	Stone Cubic Min.	Volume, Feet Max.	*Minimum Dimension, Inches
A	Wire Enclosed Riprap	1/6	2/3	4
B	Non-Enclosed Riprap	1	2	6
C	Non-Enclosed Riprap	2	4	9
D	Derrick Stone	14	27	12
E	Grouted Riprap	1/3	1	3
F	Grouted Riprap	1	2	6
G	Rock Plating	—	—	**4 to 8
n/a	Gabions	—	—	**4 to 8

*Minimum size in the least dimension.
**Seventy to eighty percent (70%–80%) of the stone shall be at least four (4) inches but not more than eight (8) inches in least dimension. The remainder of the stone shall be no larger than four (4) inches in any dimension.

602.22 Riprap.

602.221 Stone for Riprap. Stone to be used for riprap, except for riprap Class G, shall be rocks or rough quarry stone with a percent wear of not more than sixty (60) as determined by AASHTO T 96 and a soundness loss of not more than twenty one (21) as determined by AASHTO T 104 using a magnesium sulfate solution with a test duration of five (5) cycles.

602.222 Wire Mesh. The wire mesh shall be fabricated so as to be non-raveling and shall be furnished in such lengths and widths as to reduce the number of splices to a minimum. Wire mesh shall conform to the details shown in the contract. The composite wire mesh shall meet the testing requirements specified in Subsection 602.35 Wire Mesh Testing & Certification.

(a) **Wire.** Wire used in the wire mesh shall conform to the requirements of ASTM A 641 for soft hardness, and shall have a Class 3 zinc coating. The zinc coating shall be determined in accordance with ASTM A90.

Wire composing the mesh shall be 11 1/4 gage (0.118 inches in dia.) or larger.

(b) **Mesh Openings.** Openings of the mesh shall be uniform in size measuring not more than 4 3/4 inches in the largest dimension but must have at least one dimension of 3 1/4 or less.

(c) **Selvedge End Connectors.** Connectors (fasteners) for selvedge ends may be ties, clips, hog rings, or lacing wire. Only clips listed as approved on the Department's "Approved Product Listing" may be used.

Ties, clips, and hog rings shall be nine (9) gage (approx. 0.148 inches dia.) or larger. Hard drawn, twelve (12) gage (approx. 0.106 inches dia.) or larger, wire clips, having a method of closure such that the clips remain closed after installation, may be used in lieu of soft nine (9) gage wire. Hard drawn wire shall conform to the requirements of ASTM A 764 for galvanized MB, Type III.

Lacing wire shall be 13 1/2 gage (approx. 0.092 inches dia.) or larger.

602.223 Stakes. Stakes shall be steel railroad rails, standard weight galvanized steel pipe, or steel angles.

Steel railroad rails shall have a unit weight of at least thirty (30) lbs. per yard.

Standard weight galvanized steel pipe shall be at least four (4) inches O.D.

Steel angles shall be at least four (4) by four (4) by 3/8 inches in dimension.

602.224 Grout. Portland cement, aggregate and water for grout shall conform to the the requirements of Section 510—Portland Cement Concrete.

602.23 Sacked Concrete Revetment. The sacked concrete revetment manufacturer must be listed as an approved vendor on the NMDOT's Approved Products Listing."

Bags of sacked concrete shall weigh between sixty (60) to eighty (80) pounds each, dry weight and shall contain between—to 2/3 cubic feet of concrete material.

Each bag shall contain a concrete mix of one (1) part cement to three (3) parts sand or a mix design shown in the contract or a mix design having first been approved by the Project Manager .

The concrete mix shall be capable of attaining a minimum compressive strength of 3,500 psi after twenty eight (28) days unless otherwise specified in the contract.

The sacked concrete shall be kept in dry storage at all times until application.

(a) **Packaging.** Sacks used for concrete riprap shall be made of jute, cotton, or scrim reinforced paper and shall be completely biodegradable and capable of holding the sand-cement mix without significant leakage.

The sack material shall be permeable and shall permit passage of sufficient water to ensure complete hydration of the concrete mix.

Paper sacks shall be made of non-asphaltic, three (3) layer laminated paper reinforced with polyester fiber scrim. Paper sack perforations shall be uniform and offset in the three (3) layer bag to prevent the dry cement from escaping.

Only one (1) type and size of sack shall be used throughout the project unless otherwise shown in the contract.

(b) **Portland Cement.** Portland cement shall conform to the requirements of Section 510—Portland Cement Concrete.

(c) **Aggregate.** Aggregate shall conform to the requirements of Section 510—Portland Cement Concrete for fine aggregate.

(d) **Steel Anchorage.** Steel staples shall conform to the requirements of Section 540—Steel Reinforcement and shall be epoxy coated or shall be galvanized in accordance with ASTM A 123.

602.24 Concrete Block Revetment. Concrete block revetment products must be listed as approved in the NMDOT's "Approved Products Listing" before incorporation into the work.

Concrete block revetment shall be of the type and size shown in the contract.

Concrete block units shall have a minimum compressive strength of 3,000 psi, unless otherwise shown in the contract, and shall be compatible with drainage geotextile(s) (filter fabrics) used in conjunction with this work.

602.25 Gabions.

602.251 Stone for Gabions. Rock used in constructing gabions shall meet the quality requirements in accordance with Subsection 602.221 Stone for Riprap and the requirements of Subsection 602.21 Classifications.

602.252 Wire Mesh For Gabions. Wire mesh and connectors for gabions shall meet the requirements of Subsection 602.222 Wire Mesh.

602.26 Drainage Geotextiles. Drainage geotextile(s) (filter fabric) shall conform to the requirements of Section 604—Soils & Drainage Geotextiles., and the requirements shown in the contract.

602.3 CONSTRUCTION REQUIREMENTS.

602.31 General Placement Requirements. Slope and erosion protection structures shall be constructed in accordance with the details shown in the contract or established by the Project Manager.

Riprap stones shall be placed to form a continuous blanket of the minimum thickness shown in the contract. Stones shall be placed with their long axis parallel to the toe of the slope and such that they have stable bearing upon the underlying soil or stones.

The joints between the larger stones shall be as close as practicable and shall be chinked with smaller stones except when Class E or F (grouted) riprap is called for.

The finished surface of the riprap shall not vary more than three (3) inches from the designated slope, except that derrick stone riprap shall not vary more than eight (8) inches from the designated plane.

Unless otherwise specified, the foundation course shall be placed in a trench excavated to a depth of two (2) feet below the toe of the slope of the embankment or side of channel.

A layer of drainage geotextile (filter fabric) shall be placed at the interface between all slope and erosion protection structures and the supporting soil or backfill material or placed as shown in the contract. Slope and erosion protection structures shall be placed in a manner which will not tear or otherwise damage the geotextile.

602.311 Grouted Riprap Placement. Voids in grouted riprap shall be completely filled with grout for the full thickness of the riprap. After the grout is placed, the surface of the riprap shall be swept with a stiff broom.

Grout shall be protected from freezing for at least four (4) days after placement.

Grouted riprap placed in hot, dry weather shall be cured in accordance with the requirements of Subsection 511.39 Curing.

(a) Proportioning & Mixing Grout. Grout used in riprap shall consist of one (1) part portland cement and three (3) parts fine aggregate by volume. The cement and fine aggregate shall be mixed with water to a thick workable consistency.

602.312 Class A Riprap Placement. The stones in Class A (wire enclosed) riprap shall be enclosed on all sides with wire mesh. The wire mesh shall be drawn tightly against the stone on all sides. Edges of wire mesh may be connected using approved fasteners or lacing wire, but shall be double loop woven to adjacent edges at least once with lacing wire to ensure that strength and flexibility at the point of connection is equal to or greater than that of the mesh.

Lacing shall be continuous as far as is practicable and shall pass through each mesh opening. Where splicing is necessary, an overlap of lacing of at least one (1) foot shall be provided.

Galvanized wire ties to connect the top and bottom layers of mesh shall be spaced approximately two (2) feet on centers and shall be anchored to the bottom layer of wire fabric, extended through the rock layer, and tied securely to the top layer of wire fabric. When indicated in the contract, wire enclosed riprap shall be anchored to the slopes by steel stakes driven through the riprap into the embankment. Stakes shall be spaced as shown in the contract.

602.32 Sacked Concrete Revetment Placement. Placement of sacked concrete revetment shall conform to the details and requirements shown in the contract or as directed by the Project Manager. Sacked concrete revetment shall be placed within a tolerance of 0.2 feet of the established grade and slope.

Unless otherwise specified, the foundation course shall be placed in a trench excavated to a depth of two (2) feet below the toe of the slope of the embankment or side of channel. The remaining courses shall be placed as shown in the contract and shall be

placed in a manner such that sack ends and steel staple anchors in succeeding courses are staggered.

Each row of sacks shall be tamped sufficiently to round out the bags, eliminate wrinkles, minimize voids and prepare an even surface for the next row.

The Contractor shall place and compact the backfill behind each row of sacked concrete revetment before placing the next row. The method of compaction shall be as approved by the Project Manager. Backfill adjacent to the bags shall be free of large stones and jagged objects.

Sacked concrete revetment shall be anchored using steel staples. Anchoring shall be done in such a manner so as not to damage the bags excessively. All bags damaged to the point that the integrity of the bag is compromised, will be rejected and shall be replaced at no additional cost.

After placement of sacked concrete revetment, the Contractor shall wet it thoroughly and keep it moist for at least three (3) days unless otherwise directed by the Project Manager.

602.33 Concrete Block Revetment Placement. Concrete block revetment systems shall be constructed in strict accordance with the manufacturer's recommendations and the details shown in the contract.

Slopes shall be prepared by removing all obstructions and by filling voids with approved material or by contouring slopes so that sudden or sharp variations in contour are eliminated.

602.34 Gabions. Gabions shall be supplied in the dimensions shown in the contract. Gabion dimensions are subject to a tolerance limit of plus or minus five percent ($\pm 5\%$) of manufacturer's stated sizes.

602.341 Assembly of Gabion Baskets. Gabions shall be fabricated so that the sides, ends, lids and diaphragms can be assembled at the construction site into rectangular baskets of the specified sizes. Gabions shall be of single unit construction.

Where the length of the gabion exceeds one and one half ($1\frac{1}{2}$) times the horizontal width, the gabion shall be equally divided by diaphragms composed of the same mesh as the body of the gabions, into cells whose length does not exceed the horizontal width. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base section so that no additional tying at this juncture will be necessary.

Perimeter edges shall be securely selvaged or bound so that the joints formed by tying the selvages have strength equal to or greater than that of the body of the mesh.

Perimeter edges of the gabion baskets and diaphrams shall be assembled using approved fasteners or lacing wire. Fasteners, other than lacing wire, shall be placed in each mesh opening. Lacing shall be done by double looping tightly through every other mesh opening.

In all cases gabions shall be assembled by either:

1. Double looped lacing twice; or,
2. Connected with approved fasteners and then double looped lacing once.

602.342 Foundation Preparation. The top six (6) inches of the gabion foundation shall be leveled and compacted to at least ninety five percent (95%) of maximum density. Density requirements will be determined by AASHTO T 99 and field densities will be determined by AASHTO T 205.

602.343 Placement of Gabion Baskets. Assembled, empty gabion baskets shall be set into position as shown in the contract or directed by the Project Manager. To ensure proper alignment gabion stretching shall be effected in a manner approved by the Project Manager. Each unit shall be securely wired to adjacent units along the top and vertical edges prior to placing the stone.

602.344 Placement of Gabion Stone. The aggregate shall be placed to eliminate as many open pockets as possible in equal lifts of nine (9) inches to twelve (12) inches depending on the desired finished gabion height. In order to minimize local deformations, gabions shall be filled in stages and shall not be filled to a height exceeding one (1) foot more than an adjoining gabion. Stone at exposed surfaces shall be hand placed to provide an aesthetic appearance.

Cross connecting wires shall be provided on gabions whose cells are eighteen (18) inches in height or greater. These cross connecting wires shall be inserted directly above each lift of stone in a manner shown in the contract or as directed by the Project Manager. Two (2) connecting wires in each direction for each lift, shall be equally spaced horizontally and tightly tied through two (2) mesh openings at opposite faces of each gabion cell.

Gabions shall be filled in a manner which will result in minimum of voids or bulges and which will provide the proper alignment and will give the gabion a neat, square appearance.

After filling the gabion lid shall be bent over and shall be tightly bound to the perimeters and diaphragms in accordance with Subsection 602.341 Assembly of Gabion Baskets.

Gabions having poor alignment or construction will be rejected and shall be reconstructed at no additional cost to the Department.

602.345 Gabion Marking. Each gabion shall be clearly marked by color code or some other readily identifiable means to indicate size.

602.35 Wire Mesh Testing & Certification. A section of wire mesh, six (6) feet by three (3) feet minimum, shall have the ends securely clamped for three (3) feet along the width of the sample. When the width of the section under test exceeds three (3) feet, the clamps shall be placed at the center of the width and the excess width shall be allowed to fall free on each side of the clamped section.

602.351 Elongation Test. The clamped sample shall be subjected to tension sufficient to cause ten percent (10%) elongation of the length of the sample.

To be acceptable, after elongation, the diameter of individual wire strands shall not be reduced to values less than those for similar wire one (1) gage smaller in diameter. Additionally, the tested mesh sample shall not exhibit breakage of any individual wire strand nor shall the integrity of the sample have been impaired.

602.352 Rupture Test. After elongation and while clamped and otherwise unsupported, the section shall be subjected to a 6000 pound load applied in the approximate center of the sample section between the clamps and in a direction perpendicular to the direction of the tension force. The ram head used in the test shall be circular, not more than 13.5 inches in diameter and shall have its edges beveled or rounded to prevent cutting of the wire strands.

To be acceptable, the sample shall withstand the applied load without rupture of any strand.

602.353 Non-Raveling Test. Wire mesh shall be tested for non-raveling properties by having a single wire strand of mesh cut and then subjecting the section of mesh to the elongation test as described herein.

To be acceptable, the mesh shall be able to resist pulling apart at any of the twists or connections forming the mesh or other unraveling under these conditions.

602.354 Certification. The Contractor shall furnish certified test reports made by an independent testing laboratory indicating that a sample of the same manufacture as the product to be supplied, equals or exceeds these specifications.

602.4 METHOD OF MEASUREMENT

602.41 Riprap, except Class G, will be measured by the cubic yard.

Riprap Class G will be measured by the square yard.

Sacked concrete revetment will be measured by the cubic yard.

Concrete block revetment will be measured by the square yard.

Gabions will be measured by the cubic yard.

602.42 Measurement of riprap will be based on the thickness shown in the contract and the area measured on the surface of the riprap.

Measurement of concrete block revetment will be based on the area measured on the surface of the revetment.

Measurement of gabions will be based on basket dimensions shown in the contract.

602.5 BASIS OF PAYMENT.

602.51 Riprap, except Class G, will be paid for at the contract unit price per cubic yard.

Riprap Class G will be paid for at the contract unit price per square yard.

Sacked concrete revetment will be paid for at the contract unit price per cubic yard.

Concrete block revetment will be paid for at the contract unit price per square yard.

Gabions will be paid for at the contract unit price per cubic yard.

Payment will be made under:

Pay Item	Pay Unit
Riprap Class _____	Cubic Yard
Riprap Class G	Square Yard
Sacked Concrete Revetment	Cubic Yard
Concrete Block Revetment	Square Yard

SLOPE & EROSION PROTECTION STRUCTURES

Gabions ..... Cubic Yard

602.52 Work Included in Payment. The following work and items will be considered as included in the payment for the main item(s) and will not be measured or paid for separately:

Excavation, backfilling and disposal of material required for placement of slope and erosion protection structures;

Stakes and steel staples required; Drainage geotextile(s).

SECTION 623—DROP INLETS

623.1 DESCRIPTION.

623.11 This work shall consist of furnishing and installing drop inlets and junction boxes and adjustng existing drop inlets in compliance with the specifications and to the lines, grades and locations shown in the contract.

623.2 MATERIALS.

623.21 Concrete shall be Class A and shall conform to the requirements of Section 510—Portland Cement Concrete.

Reinforcing steel shall conform to the requirements of Section 540—Steel Reinforcement.

Structural steel shall conform to the requirements of Section 541—Steel Structures.

Coatings for structural steel shall conform to the requirements of Section 545—Protective Coating of Miscellaneous Structural Steel.

Preformed expansion joint filler shall conform to the requirements of AASHTO M 213.

623.3 CONSTRUCTION REQUIREMENTS.

623.31 Drop inlets shall be constructed in accordance with the applicable provisions of Section 511—Concrete Structures, Section 540—Steel Reinforcement and Section 541—Steel Structures.

The drop inlets and junction boxes may be precast units or cast in place. If precast units are supplied they must be of a design and type preapproved by the Bridge Design Section and must be listed on the NMDOT "Approved Products Listing."

The Contractor shall raise the existing drop inlets by removing the top six (6) inches of the existing structure and reconstructing as shown in the contract. Adjustments will be paid for under the appropriate concrete and steel items.

623.32 Foundation Requirements. Drop inlets and junction boxes shall be placed on foundations compacted to at least 100 percent of maximum density, in accordance with Section 207—Subgrade Preparation.

Where unstable material is encountered in foundations, the unstable material shall be removed and replaced with structurally adequate material as approved by the Project Manager.

623.33 Backfilling. Backfilling shall be performed in accordance with Section 206—Excavation and Backfill for Culverts and Minor Structures.

623.34 Coating of Structural Steel. Structural steel for drop inlets shall be coated in accordance with the requirements of Section 545—Protective Coating of Miscellaneous Structural Steel.

623.4 METHOD OF MEASUREMENT.

623.41 Drop inlets will be measured by the unit per each.

Junction boxes will be measured by the unit per each.

623.5 BASIS OF PAYMENT.

623.51 Drop inlets will be paid for at the contract unit price per each.

Junction boxes will be paid for at the contract unit price per each.

Payment will be made under:

Pay Item	Pay Unit
Median Drop Inlet, Type I, ____' to ____'	Each
Median Drop Inlet, Type ____	Each
Modified Median Drop Inlet, Type ____	Each
Curb Drop Inlet Type ____- ____, to ____'	Each
Curb Drop Inlet Type ____- ____, Over ____'	Each
Drop Inlet Type ____, ____ to ____'	Each
Drop Inlet Type ____, Over ____'	Each
Transverse Drop Inlet Type ____, ____' to ____'	Each
Transverse Drop Inlet Type ____, Over ____'	Each
Junction Box	Each

623.52 Work Included in Payment. The following work and items will be considered as included in the payment for the main items and will not be measured or paid for separately:

Subgrade preparation; Replacement of unsuitable foundation material; Excavation and backfilling for drop inlets; and, Coating of structural steel; reinforcing steel; and structural steel.