APPENDIX A

Mixed Waste Landfill Alternative Cover Construction Quality Assurance Report January 2010

Volume 1
Main Text and Tabbed Sections

Sandia is a multiprogram laboratory managed and operated by Sandia Corporation, a wholly-owned subsidiary of Lockheed Martin Corporation, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Mixed Waste Landfill
Alternative Cover Construction
Quality Assurance Report

Submitted to

Sandia National Laboratories
P.O. Box 5800
Albuquerque, NM 87185

January 2010

Submitted by

URS Group, Inc.
One Park Square
6501 Americas Parkway NE, Suite 900
Albuquerque, NM 87110

This page left intentionally blank.

MIXED WASTE LANDFILL
ALTERNATIVE COVER
CONSTRUCTION QUALITY ASSURANCE REPORT

JANUARY 2010

This page left intentionally blank.

Table of Contents

Tabbed Sections at the end of Appendix A – Volume 1

List of Tables

List of Figures

List of Figures (cont'd.)

List of As-Built Drawings

2006 Subgrade As-Built Drawing (11 x 17 Drawing)

2009 Alternative Cover As-Built Drawings (11 x 17 Figures)

List of Quality Assurance Verification Survey Plates

List of Photographic Logs

End of Appendix A – Volume 1

Appendix A – MWL Alternative Cover CQA Report – Volume 2

Separately bound hard copies of the attachments in Volume 2 are available in the NMED Hazardous Waste Bureau document library (Santa Fe, New Mexico); the DOE/Sandia document repository (Public Reading Room, Zimmerman Library at the University of New Mexico, Albuquerque, New Mexico); and the SNL/NM Customer Funded Records Center (formerly known as the ES&H and Security Records Center).

List of Attachments

(provided electronically on a CD at the end of the report)

Attachment	***Title***
1	Record of Meetings and Approvals 2006 Meetings 2009 Meetings
2	CQA Submittals and Approvals 2009 QA Submittal Cover Pages 2009 Cover Layer Approval Forms
3	Daily Quality Control Reports 2006 Daily Quality Control Reports 2009 Daily Quality Control Reports
4	Receiving Inspection Forms and Documentation 2005 Biointrusion Rock 2009 Biointrusion Rock 2009 Aggregate 2009 Seed and Mulch 2009 Seed Bag Labels
5	Construction Inspection Forms 2006 Construction Inspection Forms 2009 Construction Inspection Forms
6	Testing Inspection Forms 2006 Testing Inspection Forms 2009 Testing Inspection Forms

List of Attachments (cont'd.)

End of Appendix A – MWL Alternative Cover CQA Report – Volume 2

List of Abbreviations/Acronyms

AMEC	AMEC Earth and Environmental, Inc.
ASTM	American Society for Testing and Materials (ASTM International)
CD	compact disc
CMI	Corrective Measures Implementation
CMIP	Corrective Measures Implementation Plan
cm/s	centimeter(s) per second
CQA	Construction Quality Assurance
CQC	Construction Quality Control
cy	cubic yard(s)
DOE	U.S. Department of Energy
EDi	Environmental Dimensions, Inc.
EPA	U.S. Environmental Protection Agency
ES&H	Environment, Safety, and Health
ET	Evapotranspirative
IR	Ingersoll-Rand
JD	John Deere
KAFB	Kirtland Air Force Base
LTMMP	Long-Term Monitoring and Maintenance Plan
MKM	MKM Engineers, Inc.
MWL	Mixed Waste Landfill
NMED	New Mexico Environment Department
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
Sandia	Sandia Corporation
SCR	Sandia Construction Representative
Shaw	Shaw Environmental, Inc.
SNL/NM	Sandia National Laboratories/New Mexico
SWPPP	Storm Water Pollution Prevention Plan
TA	Technical Area
URS	URS Group, Inc.

Executive Summary

Sandia National Laboratories/New Mexico (SNL/NM) is located within the boundaries of Kirtland Air Force Base (KAFB), immediately south of the city of Albuquerque in Bernalillo County, New Mexico. SNL/NM is owned by the U.S. Department of Energy (DOE) and managed and operated by Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation. Sandia performs research and development in support of various energy, weapons, and national security programs. Sandia also performs work for the U.S. Department of Defense, the U.S. Nuclear Regulatory Commission, and other government agencies.

The Mixed Waste Landfill (MWL) at SNL/NM is designated as an Underground Radioactive Materials Area under DOE requirements and a Hazardous and Solid Waste Amendments Solid Waste Management Unit subject to New Mexico Environment Department (NMED) corrective action regulations as delegated by the U.S. Environmental Protection Agency (EPA). The NMED is authorized by the EPA to implement and enforce the corrective action requirements for the MWL. The MWL is located within the boundaries of KAFB on federal land controlled by the DOE. The MWL consists of two distinct disposal areas; the classified area in the northeast portion occupies 0.6 acres and the unclassified area occupies 2.0 acres. Approximately 100,000 cubic feet of low-level radioactive and mixed waste containing approximately 6,300 curies of activity (at the time of disposal) were disposed of in the MWL from March 1959 through December 1988.

The MWL alternative evapotranspirative (ET) cover (hereafter referred to as the ET Cover) was deployed from October 2006 through September 2009 and consists of four main layers: compacted subgrade, biointrusion barrier, compacted native soil, and topsoil (Figure ES-1). The Subgrade varies in thickness from 0 to 3.3 feet, and the combined average thickness of the overlying ET Cover layers (Biointrusion, Native Soil, and Topsoil Layers) is 5.37 feet. The overall footprint of the ET Cover is 4.1 acres including side slopes. The ET Cover was constructed with approximately 33,000 cubic yards (cy) of soil fill and 6,800 cy of rock (in-place, compacted volumes) that meet the specifications provided in the MWL Corrective Measures Implementation Plan (CMIP) (SNL/NM, November 2005) based upon 113 laboratory tests (Standard Proctor, Gradation, Classification, and Saturated Hydraulic Conductivity), 271 field tests (in-place density and moisture), and visual inspections. All MWL ET Cover construction activities were observed, inspected, and documented by an independent third-party Construction Quality Assurance (CQA) contractor.

This MWL Alternative Cover CQA Report documents the implementation of the MWL CMIP (SNL/NM, November 2005) that was conditionally approved by the NMED (Bearzi, December 2008) and addresses all requirements for the MWL Corrective Measures Implementation Report as defined in the NMED Final Order for the MWL (NMED, May 2005); the CMIP (SNL/NM, November 2005); the SNL/NM Resource Conservation and Recovery Act Permit (as modified for the MWL after the Final Order); the Compliance Order on Consent (NMED, April 2004); and the NMED conditional approval of the MWL CMIP (Bearzi, December 2008). The CMIP contains the Construction Specifications (Appendix A) and CQA Plan (Appendix B) that define the construction, design, and quality assurance requirements for construction of the MWL Alternative Cover (i.e., MWL ET Cover).

Deployment of the MWL ET Cover was conducted in two main construction phases, the 2006 Subgrade Construction and 2009 ET Cover Construction. The 2006 Subgrade Construction phase began on October 2, 2006, following the NMED approval received in September 2006 (Bearzi, September 2006), and was completed on April 11, 2007. This phase involved MWL Borrow Pit activities to generate soil fill material for cover construction, preparation of the existing disposal area surface, construction of the Subgrade, and installation of erosion control measures to protect the Subgrade surface while awaiting final NMED approval of the CMIP. The 2009 ET Cover Construction phase was performed from May 20 through September 3, 2009, and involved preparation of the Subgrade surface, construction of the ET Cover layers (Biointrusion, Native Soil, and Topsoil Layers) and site drainage features, installation of the administrative security fence, and site revegetation activities. Minor variances in construction and/or design specifications that did not adversely affect the quality of the cover were documented as design changes and approved by the CQA Engineer. Overall, the final MWL ET Cover as constructed provides a thicker, more protective ET Cover relative to the CMIP minimum design specifications. The completed ET Cover is shown schematically in Figure ES-1.

Third-party CQA services were provided by MKM Engineers, Inc. during the 2006 Subgrade Construction phase (under subcontract to URS Group, Inc. [URS]), and by URS during the 2009 ET Cover Construction phase. This report and the attachments provide the construction quality control and CQA data and documentation required to verify that the MWL ET Cover meets the construction and design specifications of the NMED-approved CMIP (SNL/NM, November 2005). All aspects of the MWL ET Cover deployment are addressed in this stand-alone report and have been certified by a New Mexico-registered Professional Engineer.

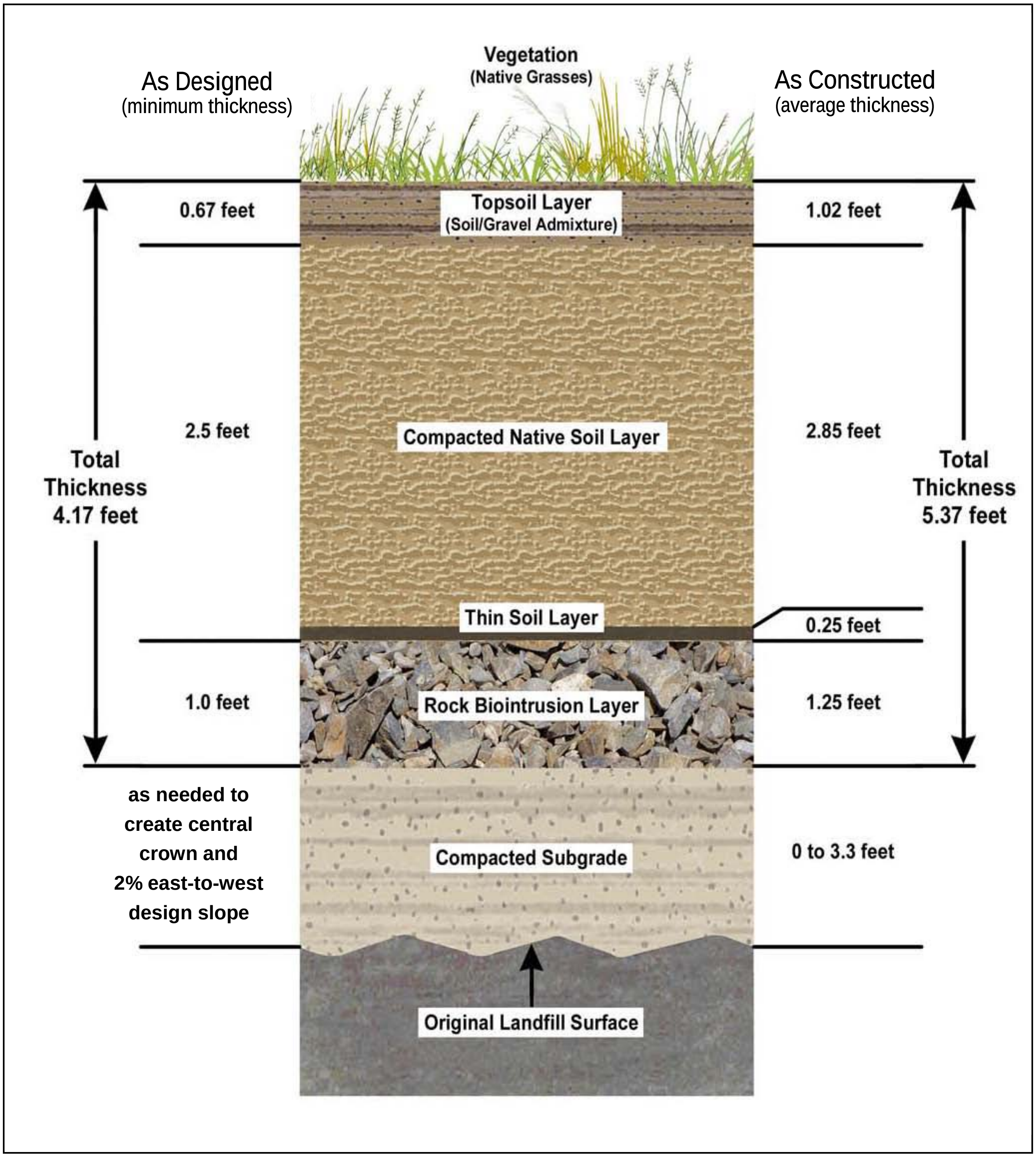


Figure ES-1

Schematic Profile of the Mixed Waste Landfill Alternative Evapotranspirative Cover

This page left intentionally blank.

1.0 Introduction

The Mixed Waste Landfill (MWL) at Sandia National Laboratories/New Mexico (SNL/NM) is designated as an Underground Radioactive Materials Area under U.S. Department of Energy (DOE) requirements and a Hazardous and Solid Waste Amendments Solid Waste Management Unit subject to New Mexico Environment Department (NMED) corrective action regulations as delegated by the U.S. Environmental Protection Agency (EPA). The NMED is authorized by the EPA to implement and enforce the corrective action requirements for the MWL. The MWL is located approximately 4 miles south of SNL/NM central facilities and 5 miles southeast of Albuquerque International Sunport within Technical Area (TA)-3. SNL/NM facilities and TA-1 through TA-5 are located within the boundaries of Kirtland Air Force Base (KAFB) on federal land controlled by the DOE. The location of KAFB, TA-3, TA-5, and the MWL are shown in Figures 1 and 2.

The MWL Corrective Measures Implementation Plan (CMIP) (SNL/NM, November 2005) was submitted to the NMED in November 2005 and incorporates the remedy selected by the Secretary of the NMED on May 26, 2005 (NMED, May 2005). It was conditionally approved by the NMED in December 2008 (Bearzi, December 2008), and conditions related to construction of the remedy were incorporated into the CMIP through replacement pages submitted to the NMED (Davis, February 2009). The MWL CMIP details the deployment of the selected remedy, which is the MWL Alternative Evapotranspirative (ET) Cover with a biointrusion barrier (hereafter referred to as the ET Cover). The MWL ET Cover construction specifications are provided in Appendix A of the CMIP, and the Construction Quality Assurance (CQA) Plan is presented in Appendix B (SNL/NM, November 2005).

The MWL ET Cover was deployed from October 2006 through September 2009 and consists of four main layers: compacted subgrade, biointrusion barrier, compacted native soil, and topsoil. The Subgrade varies in thickness from 0 to 3.3 feet and is the base layer that established the broad, central crown and 2-percent east-to-west surface design slope. The combined average thickness of the overlying ET Cover layers (Biointrusion, Native Soil, and Topsoil Layers) is 5.37 feet, and the overall cover footprint is 4.1 acres including side slopes. The ET Cover was constructed with approximately 33,000 cubic yards (cy) of soil fill and 6,800 cy of rock (in-place, compacted volumes) that meet CMIP specifications (SNL/NM, November 2005) based upon 113 laboratory tests (Standard Proctor, Gradation, Classification, and Saturated Hydraulic Conductivity), 271 field tests (in-place density and moisture), and visual inspections.

All MWL ET Cover construction activities were observed, inspected, and documented by an independent third-party CQA contractor.

Deployment of the MWL ET Cover is detailed in this MWL Alternative Cover CQA Report (Volumes 1 and 2), which incorporates all construction quality control (CQC) and CQA data and documentation requirements for the MWL Corrective Measures Implementation (CMI) Report as defined in the NMED Final Order for the MWL (NMED, May 2005); the CMIP (SNL/NM, November 2005); the SNL/NM Resource Conservation and Recovery Act (RCRA) Permit (as modified for the MWL after the Final Order); the Compliance Order on Consent (NMED, April 2004); and the NMED conditional approval of the MWL CMIP (Bearzi, December 2008).

Volume 1 includes the main text (Chapters 1.0 through 10.0) and tabbed sections located at the end of this report. Chapter 1.0 provides background information and the purpose and scope of this report. Chapter 2.0 presents the roles and responsibilities of the organizations, contractor teams, and key personnel. Chapter 3.0 presents project communications, the construction approval process, and related CQA documentation. The CQC and CQA programs that were implemented to test, control, and verify construction of the ET Cover according to the specifications and design drawings in the CMIP are presented in Chapter 4.0, along with the associated CQC and CQA data. Chapter 5.0 provides a detailed summary of the 2006 Subgrade and 2009 ET Cover Construction earthwork. Chapter 6.0 discusses the extension of groundwater monitoring well MWL-MW4 and the installation of two required soil-vapor monitoring wells; these tasks were completed in 2009 during installation of the ET Cover. Chapter 7.0 summarizes design changes (i.e., minor variances in construction and/or design specifications that do not affect the quality of the cover) to the CMIP specifications and design drawings. Chapters 8.0 and 9.0 provide the conclusions and CQA Engineering Certification of ET Cover construction, respectively. Report references are provided in Chapter 10.0. Tabbed sections at the end of Volume 1 include all tables, figures, as-built drawings, quality assurance (QA) verification survey plates, and photographic logs. Volume 2 contains Attachments 1 through 8 that include supporting CQC and CQA documentation. Volume 2 is provided in electronic format (PDF files) on a compact disc (CD) at the end of this report. Separately bound hard copies of the attachments in Volume 2 are available in the NMED Hazardous Waste Bureau document library (Santa Fe, New Mexico), the DOE/Sandia document repository (Public Reading Room, Zimmerman Library at the University of New Mexico, Albuquerque, New Mexico), and the SNL/NM Customer Funded Records Center (formerly known as the ES&H [Environment, Safety, and Health] and Security Records Center).

1.1 Subgrade and ET Cover Construction Background

The MWL consists of two distinct disposal areas that include the classified area (northeast portion of the MWL occupying 0.6 acres) and the unclassified area (occupying 2.0 acres). The waste was buried in pits and trenches that were backfilled with the excavated soil and capped with more soil at the completion of operation. This capped condition was the existing surface prior to the 2006 Subgrade Construction phase. A complete summary of all MWL construction preparation, 2006 Subgrade, and 2009 ET Cover Construction activities is provided in Table 1 and in the following discussion.

Prior to the 2006 Subgrade Construction phase, rock needed to construct the Biointrusion Layer was selected in consultation with NMED representatives and delivered to the Bulk Waste Staging Area located near the MWL Borrow Pit from October 4 through November 14, 2005. In addition, from June 14 to July 17, 2006, surface water and site controls were implemented at the MWL Borrow Pit (hereafter referred to as the Borrow Pit), and soil fill material needed for construction of the Subgrade and ET Cover layers was excavated, screened to 2-inch minus, and stockpiled following the specifications in the CMIP (SNL/NM, November 2005). Screened soil fill was hauled and stockpiled at the MWL for the Subgrade Construction phase from July 31 through November 5, 2006. The location of the Bulk Waste Staging Area, Borrow Pit, and the haul routes used to transport materials to the MWL site are shown in Figure 3.

In September 2006, the NMED approved the portions of the CMIP that addressed removal of the administrative security fence and subgrade construction (i.e., ET Cover preparation work) (Bearzi, September 2006). Subgrade construction was performed from October 2 through December 21, 2006, and consisted of clearing and grubbing, grading, and compacting the existing surface followed by placement and compaction of subgrade soil lifts to establish a surface over the MWL that mirrored the final CMIP design surface (i.e., a broad, central crown or high area with a 2-percent east-to-west slope across most of the disposal area). Subgrade construction was completed on April 11, 2007, after finishing installation of erosion control matting (i.e., straw blankets) on the completed Subgrade surface and verifying that the completed drainage swale on the east side of the Subgrade diverted run-on surface water around the perimeter as intended.

After receiving conditional approval of the CMIP from the NMED in December 2008 (Bearzi, December 2008), the MWL ET Cover Construction contracting process was initiated by Sandia Corporation (Sandia) and completed in March 2009. The Environmental Dimensions, Inc. (EDi) Team was selected as the Construction Contractor for the MWL ET Cover and URS Group, Inc. (URS) was selected to perform independent third party CQA under a separate contract. The

NMED was notified of the start of ET Cover Construction fieldwork on April 10, 2009 (Davis, April 2009). The EDi Construction Team and the URS CQA Team mobilized to the field to begin initial site activities in mid-May 2009 after an updated Health and Safety Plan was completed and approved by Sandia. A schematic profile of the completed MWL Subgrade and ET Cover layers is shown in Figure 4.

1.2 Purpose and Scope

The purpose of this report is to provide the required data and documentation that demonstrates the deployment of the MWL ET Cover was performed in accordance with the CMIP (SNL/NM, November 2005) requirements, specifications, and design drawings. This report presents details of construction activities as well as CQA activities associated with the 2006 Subgrade Construction phase (October through December 2006) and the 2009 ET Cover Construction phase (May through September 2009).

The scope includes all required CQC and CQA data and documentation to provide a comprehensive, integrated report that addresses all requirements for the MWL CMI Report as defined in the NMED Final Order for the MWL (NMED, May 2005); the CMIP (SNL/NM, November 2005); the SNL/NM RCRA Permit (as modified for the MWL after the Final Order); the Compliance Order on Consent (NMED, April 2004); and the NMED conditional approval of the MWL CMIP (Bearzi, December 2008). All required Subgrade and ET Cover Construction deployment data and documentation are presented in Volume 1 of this MWL Alternative Cover CQA Report, including all laboratory and field test results, QA verification survey results, as-built drawings, and photographic logs provided in tabbed sections at the end of this report. Volume 2 of this report contains supporting CQC and CQA documentation in Attachments 1 through 8 and is provided in electronic format on a CD in a tabbed section at the end of this report.

1.3 2006 and 2009 CQA Teams and CQA Report Progression

Third-party CQA services were provided by MKM Engineers, Inc. (MKM), under subcontract to URS for the 2006 Subgrade Construction phase, and by URS for the 2009 ET Cover Construction phase. The CQA personnel were responsible for the following activities:

- Ensuring the design drawings and specifications were followed during the construction effort
- Inspecting and observing material preparation and placement
- Accepting materials used in the construction process
- Verifying testing in the field and laboratory

- Maintaining team communication of construction sequence, progress, and changes
- Documenting any nonconformances affecting cover quality in a Corrective Action Report and verifying implementation of corrective action(s)
- Evaluating and approving design changes (i.e., minor variances in construction and/or design specifications that do not affect the quality of the cover)
- Preparing and maintaining documentation related to achieving performance requirements
- Preparing the final CQA Report

For the 2006 Subgrade Construction only, the CQA Engineer was responsible for the preparation of an independent CQA Plan (SNL/NM, May 2006) that incorporated the CMIP construction and design specifications and requirements for the MWL Subgrade, essentially duplicating and building upon the CQA Plan included as Appendix B in the CMIP (SNL/NM, November 2005). The CQA Plan was based upon guidance from the EPA, NMED, and CMIP. The CMIP CQA Plan was used for the 2009 ET Cover Construction phase.

Following the NMED approval received in September 2006 (Bearzi, September 2006), the 2006 Subgrade Construction phase began on October 2, 2006, and was completed on April 11, 2007. This phase involved the generation of soil fill material, preparation of the existing surface, construction of the Subgrade, and installation of the east-side drainage swale and erosion control matting on the Subgrade surface. At that time, the DOE and Sandia were awaiting final NMED approval of the CMIP and ET Cover design. Construction of the ET cover did not proceed because final CMIP approval was not received from the NMED until December 2008.

The MWL Alternative Cover Subgrade CQA Report (MKM, August 2007) was prepared as a draft and included the documentation required by the CQA Plan (SNL/NM, May 2006) and CMIP (SNL/NM, November 2005) and the certification by the MKM CQA Engineer that the Subgrade construction conformed to the CMIP specifications and design drawings. The draft Subgrade CQA Report was completed in August 2007 (MKM, August 2007) and has been revised to incorporate the 2009 ET Cover Construction activities conducted from May 20 through September 3, 2009. This MWL Alternative Cover CQA Report, Volumes 1 and 2, represents the final CQA report for all MWL ET Cover construction activities, which are summarized in Table 1.

This page left intentionally blank.

2.0 Responsibility, Authority, and Qualifications

The principal organizations involved in construction of the Subgrade and ET Cover are listed below, along with the Construction and CQA Teams for both the 2006 Subgrade and 2009 ET Cover Construction phases of the project. Information concerning their roles and responsibilities is presented in Sections 2.1 through 2.7.

Principal Organizations

- NMED – Lead Regulatory Agency
- DOE – Owner
- Sandia – Designer and Operator, Construction Oversight

2006 Subgrade Construction and CQA Contractors

- Shaw Environmental, Inc. (Shaw)/GRAM, Inc. – Construction Team
- MKM – CQA Contractor
  - URS – Field Surveyor
  - AMEC Earth & Environmental, Inc. (AMEC) – Testing Laboratory

2009 ET Cover Construction and CQA Contractors

- EDi – Construction Team, Prime Construction Contractor (hereafter referred to as the EDi Team or Construction Team) – The main EDi Team subcontractors and their roles are listed as follows:
  - North Wind, Inc – Heavy Equipment, Soil Moving and Placement
  - AMEC – Project CQC and Testing Laboratory
  - Albuquerque Surveying – CQC Field Surveyor
  - Pioneer Industries – Pug Mill Equipment and Operations
  - Lee Landscapes – Revegetation
  - ACME Fencing Company, Inc. – Administrative Fence Installation

- URS – CQA Contractor
  - AMEC – Testing Laboratory
  - URS – CQA Field Surveyor

The responsibilities of the principal organizations, Construction Teams, and CQA Teams and team members are summarized in the following sections.

2.1 Review/Permitting Agency

The NMED is the Administrative Authority overseeing corrective action at the MWL. The NMED is responsible for reviewing and approving this MWL Alternative Cover CQA Report as part of the MWL CMI Report.

2.2 U.S. Department of Energy (Owner)

The DOE has the authority to accept or reject the construction of the MWL cover. Based upon DOE oversight during the two construction phases and review of this report, the DOE accepts the construction of the MWL ET Cover.

2.3 Sandia Corporation (Designer and Operator)

Sandia Environmental Restoration Project Staff designed the MWL ET Cover that fulfills the closure needs of the Owner and the regulatory requirements of the NMED, as confirmed by the NMED conditional approval of the CMIP. Sandia has the responsibility and authority for implementation of the CMIP (SNL/NM, November 2005), oversight of construction, and review of related documentation. The Sandia Construction Representative (SCR) has the responsibility and authority for all project-related contracting and formal approval of all aspects of Subgrade and ET Cover Construction phases, including modifications to the construction specifications and design drawings and corrective actions (if needed) for any deviations from the design. The DOE and Sandia are responsible for the long-term monitoring and maintenance of the site, which will be formalized and documented in the MWL Long-Term Monitoring and Maintenance Plan (LTMMP). The LTMMP will be prepared and submitted to the NMED for approval within 180 days after approval of the MWL CMI Report, which includes this MWL Alternative Cover CQA Report as Appendix A.

2.4 Construction Contractor Team

The Construction Team was responsible for Subgrade preparation and construction (Shaw/GRAM, Inc.) and ET Cover construction (EDi Team) in accordance with the construction specifications, design drawings, and CQA Plan (SNL/NM, November 2005–Appendix B). For the 2006 Subgrade Construction phase, all CQC laboratory testing, field testing, and surveying were performed by the CQA Team. For the 2009 ET Cover Construction phase, the EDi Team performed all CQC laboratory testing, field testing, and surveying.

2.5 Surveying Contractor

The Surveying Contractor was responsible for performing land surveys to guide, control, and verify the Subgrade and ET Cover Construction process, as well as providing the survey data used to prepare the Subgrade and ET Cover as-built drawings. For the 2006 Subgrade Construction phase, one Surveying Contractor was part of the CQA Team and responsible for all land surveying and preparation of the as-built drawing. For the 2009 ET Cover Construction phase, both a CQC (Albuquerque Surveying – part of the EDi Team) and a CQA (URS – part of the CQA Team) Surveying Contractor participated in the project. The EDi Team surveyor was responsible for all surveying performed to guide, control, and verify the construction process, as well as all final Subgrade and ET Cover layer surface surveys used to prepare the 2009 as-built drawings. The CQA Team surveyor performed QA verification surveys on the surface of each ET Cover layer (Biointrusion, Native Soil, and Topsoil Layers) to validate the more extensive CQC survey data. Additional information on surveying is provided in Section 4.4.

2.6 CQA Contractor

The responsibility of the CQA personnel was to perform the activities specified in the CQA Plan (SNL/NM, November 2005–Appendix B), consisting of oversight, inspection, sampling/testing, and documentation. The CQA personnel roles and responsibilities were generally the same for both the 2006 and 2009 construction phases. However, some differences reflect a more robust CQC and CQA program for the 2009 ET Cover Construction phase (i.e., construction of the Biointrusion, Native Soil, and Topsoil Layers).

During the 2006 Subgrade Construction phase, the CQA Team was responsible for all CQC laboratory testing (i.e., Standard Proctor, Gradation, and Classification soil data), field testing (i.e., in-place density and moisture testing), as well as associated oversight of the testing laboratory.

During the 2009 ET Cover Construction phase, the CQA Team was responsible for oversight and approval of the CQC laboratory testing (i.e., Standard Proctor, Gradation, Classification, and Saturated Hydraulic Conductivity) performed by the EDi Team, as well as performing independent CQA in-place field density and moisture tests to confirm the CQC testing (minimum 5 percent frequency) specified in the CQA Plan (SNL/NM, November 2005–Appendix B). A similar approach was implemented for surveying, as explained in Section 2.5. This approach provided additional CQA data and documentation that supported and verified the ET Cover Construction phase CQC results.

Table 2 presents the CQA personnel and summarizes their qualifications and their responsibilities are presented in the following sections.

2.6.1 CQA Inspection Personnel

The CQA inspectors were responsible for daily independent oversight and inspection of the work in progress to assess compliance with design criteria and to attend progress meetings. They were on site daily, attended daily tailgate safety and project meetings, and worked closely with Sandia Oversight personnel and the Construction Contractor as part of an integrated team approach. Their work was documented through Daily Quality Control (QC) Reports supplemented with inspection forms/checklists, testing forms, photographs, and other supporting documentation. The Daily QC Reports and inspection forms are discussed in Sections 4.1 and 4.2, and photographic documentation is discussed in Section 4.5.

2.6.2 CQA Certifying Engineer

The CQA Certifying Engineer also served as the CQA Engineer. The CQA Engineer reviewed the CQA inspectors' documentation for clarity and completeness and observed the field-testing procedures. He met with the inspectors, the SCR, Sandia Oversight personnel, and the Construction Team to discuss progress, testing and survey results, technical issues, and any deviations from specifications and/or design drawings (i.e., design changes). In conjunction with the SCR, the CQA Certifying Engineer was responsible for final approval of all construction work for the Subgrade, each ET Cover layer, and the completed ET Cover. He was also responsible for CQA documentation until it was submitted to Sandia. A certifying statement and Professional Engineer Seal are provided in Chapter 9.0 of this report for both the Subgrade and overall ET Cover construction.

2.7 Testing Laboratory

The testing laboratory was responsible for its own QC Plan and the assurance that the tests were performed in accordance with the applicable American Society for Testing and Materials (ASTM International) (ASTM) standards and chain-of-custody requirements for the samples. The testing laboratory was also responsible for maintaining equipment calibration and operating information to ensure all results are defensible. The laboratory and field testing performed to verify MWL Subgrade and ET Cover construction are discussed in Section 4.3. The results are summarized in the referenced tables, and supporting laboratory and field documentation are provided in attachments to this report.

For the 2006 Subgrade Construction phase, there was only one CQC laboratory and field-testing program, performed by the CQA Team, that utilized one testing laboratory. The 2009 ET Cover Construction phase also used one testing laboratory but had two independent field-testing programs that included a CQC (Construction Team) and CQA (CQA Team) testing program.

Although only one testing laboratory was used, the laboratory set up internal procedures to ensure that the CQC and CQA results were independent. This approach was implemented by using separate personnel and different equipment to perform the CQC and CQA field tests. Internal processing and reporting of the field measurement data were also performed separately to create a “firewall” between the CQC and CQA testing programs.

This page left intentionally blank.

3.0 Project Communications

Project communication was an important component of ET Cover construction and was facilitated through a team approach. Project communications were maintained with the entire project team on a daily basis. Field operations were centralized in one field office trailer used by Sandia Oversight, CQA Team, and Construction Team personnel. Meetings were held at the start of every workday and throughout the project to ensure effective communication, coordination of activities, and safe implementation of all construction tasks. These meetings addressed plans, progress, specific construction issues, and CQC and CQA data related to ET Cover layer approval as described in the following sections. The daily reports prepared by the CQA Team document these meetings, team interactions, and the overall team approach. Notes and agendas from preconstruction, weekly progress (2006 Subgrade Construction phase), and quality resolution meetings (2009 ET Cover Construction phase) were documented on project forms and/or in daily reports and project log books.

3.1 Preconstruction Meeting

The Preconstruction Meeting for the 2006 Subgrade Construction phase was held on June 5, 2006, with representatives from Sandia, the Construction Team, and the CQA Team present. A record of this meeting is included in Attachment 1. The following major items were reviewed:

- Project organization and responsibilities
- Design drawings
- Soil testing requirements and specifications
- Fugitive emissions permit and excavation permit
- Construction plan and schedule
- Health and safety requirements
- CQA Plan review

The 2009 ET Cover Construction phase of the project included three Preconstruction Meetings conducted on April 30 (Project Kickoff), May 6 (Project Readiness Review), and May 19, 2009 (Project Operational Readiness). Records of these meetings are included in Attachment 1. The first meeting included Sandia Project Staff, SNL/NM ES&H personnel, the SCR, and project personnel as well as representatives from the CQA and Construction Teams. Topics addressed at this meeting consisted of the team approach, roles and responsibilities, permitting and premobilization requirements, construction scope, and technical approach for the Biointrusion Layer void space filling. Biointrusion Layer void space filling was not addressed in the CMIP (SNL/NM, November 2005). The second meeting, held on May 6, 2009, involved all key project personnel, including SNL/NM ES&H representatives, and addressed a complete Readiness Review agenda for project mobilization and fieldwork startup, including the recently approved Project Health and Safety Plan and associated requirements. The third meeting was attended by Construction Team and Sandia Oversight personnel and addressed the completion of all project-required training, documentation, and mobilization tasks (i.e., Operational Readiness for the start of construction). The 2009 ET Cover Construction activities started on May 20, 2009, after completion of the Project Operational Readiness meeting on May 19, 2009.

3.2 Progress Meetings

Weekly Construction Progress Meetings were held to discuss progress, plans, safety, and Subgrade construction issues during the 2006 Subgrade Construction phase. Any issues were resolved at the meeting and/or assigned actions. The agendas for these meetings are part of the CQA project record maintained in the SNL/NM Customer Funded Records Center.

As part of the 2009 ET Cover Construction phase, progress was discussed every day during the morning Daily Tailgate Meetings. The Daily Tailgate Meetings were documented by the Construction Team on a standard form that included a sign-in sheet listing all personnel working on the site. These forms are maintained in the Customer Funded Records Center along with other supporting project documentation.

3.3 Quality Resolution Meetings

During the 2006 Subgrade Construction phase, QC issues were discussed with the SCR and Sandia Oversight personnel, the Construction Team Supervisor, and CQA Team personnel. The discussions and resolutions typically occurred in the field. If a meeting were required, the CQA Engineer initiated the meeting, invited the attendees, and documented the meeting. Documentation of the meetings and issue resolution are provided in Attachment 1 and in the daily reports and/or CQA personnel logbooks.

During the 2009 ET Cover Construction phase, Quality Resolution Meetings were held and documented for the following two main reasons:

- To evaluate data, discuss and resolve issues, and obtain CQA Engineer and SCR approval of each ET Cover Layer
- To evaluate, resolve, and obtain CQA Engineer and SCR approval of specific QC issues, including technical issues and design changes to the CMIP specifications and/or design drawings

The 2009 Quality Resolution Meetings were held in the field office trailer and attended by the SCR and Sandia Oversight, CQA Team, and Construction Team representatives. These meetings are summarized in Table 3 and documented in Attachment 1. Additional discussion of these meetings is provided in Section 3.4 and Chapter 7.0.

3.4 Approvals and Submittals

The CQA Engineer approval of the 2006 Subgrade Construction phase activities is documented in Chapter 9.0 (*Engineering Certification).* For the 2009 ET Cover Construction phase, all field and laboratory test results were conveyed to the CQA Engineer for approval in the form of Submittals. Throughout the project, 42 Submittals were generated. The Submittal cover pages are included in Attachment 2. Individual test results are presented in Section 4.3 and have been removed from the Submittals and organized into a separate attachment by the type of test for ease of access and review (see Sections 4.3.1 and 4.3.2 for more information).

Each ET Cover layer constructed in 2009 was approved by the CQA Engineer through Quality Resolution Meetings prior to the construction of the next cover layer as required by the CQA Plan in Appendix B of the CMIP (SNL/NM, November 2005). This process allowed the construction of the subsequent ET Cover layer to proceed with minimal delay. In addition, construction was often approved in phases for some layers to allow construction to proceed on the next layer in one area while final verification and/or adjustments were implemented and confirmed in another area. An example of this phased approach is documented in Table 3 for approval of the Biointrusion Layer, which was approved in three phases or areas (i.e., south, northwest, and northeast portions of the MWL). This allowed installation of the thin soil layer to proceed while the Biointrusion Layer was being completed.

Table 3 provides a detailed chronological summary of the Quality Resolution Meetings and Cover Layer Approval. Cover layer approval involved the approval of associated laboratory and field-testing data (preliminary laboratory testing and in-place field density and moisture results) and final CQC and CQA verification survey data (layer thickness and slope information). The Quality Resolution Meetings are documented in Attachment 1, and approval forms for each cover layer are provided in Attachment 2. Approval of the Native Soil Layer laboratory and field-testing data through the formal Submittal process occurred after Native Soil Layer approval due to the time lag between receipt of preliminary and final laboratory results. However, all preliminary results were confirmed by final laboratory results. Both CQC and CQA surveying activities are discussed in more detail in Section 4.4.

This page left intentionally blank.

4.0 Observations, Inspections, Tests and Surveys

The CQC and CQA observations, inspections, testing (laboratory and field), surveying, and photographic reporting performed to control, verify, and document that the materials and earthwork for the MWL Subgrade and ET Cover Construction phases conformed to the CMIP construction and design specifications are presented in this chapter. This documentation supports the detailed summary of the Subgrade and ET Cover Construction phases presented in Chapter 5.0 and forms the basis for the ET Cover layer approval (Section 3.4) and the engineering certification for the Subgrade and ET Cover Construction phases (Chapter 9.0). All required CQC and CQA documentation is included in the tables, figures, as-built drawings, QA verification survey plates, photographic record, and Attachments 1 through 8 of this report. Additional supporting documentation is retained in the SNL/NM Customer Funded Records Center. The CQA documentation of project meetings and 2009 CQC data submittals and CQA cover layer approval documentation are presented in Chapter 3.0.

Daily QC reporting and inspection forms are discussed in Sections 4.1 and 4.2, respectively. The CQC data (collected to verify that ET Cover construction meets CMIP construction and design specifications), CQA data (collected to verify the CQC data), and associated documentation are presented in Section 4.3. Data and documentation associated with CQC and CQA surveying are discussed in Section 4.4, and photographic reporting is presented in Section 4.5.

In general, CQC and CQA data and documentation can be collected by either the Construction Team or the CQA Team or a combination of both. However, for the MWL Subgrade and ET Cover deployment, CQA data and documentation were exclusively the responsibility of the independent third party CQA Team.

4.1 Daily Quality Control Reports

The CQA Inspectors prepared the Daily QC Reports consistent with the information requirements itemized in the CQA Plan in Appendix B of the CMIP (SNL/NM, November 2005). The CQA Engineer reviewed and approved the reports on a regular basis. Each report provided the date, summary of weather conditions, location of construction activities, list of on-site personnel, summary of meetings and attendees, description of materials/equipment used, references to testing or sampling performed, and inspection forms completed. For the 2009 ET Cover Construction phase, some of this information was addressed through cross-referencing other project documentation, such as Daily Tailgate Meeting Forms for on-site personnel. Other information, such as field maps of in-place density and moisture test locations, are not included because the information is superseded by maps provided in this report. The Daily QC Reports for the 2006 Subgrade and 2009 ET Cover Construction phases are included in Attachment 3. The Construction Team also completed daily reports during the 2009 ET Cover Construction phase, which are maintained in the SNL/NM Customer Funded Records Center.

4.2 Inspection Forms

All CQA inspection forms are provided in the CQA Plan in Appendix B of the CMIP (SNL/NM, November 2005) and were developed to include checklists to ensure consistent documentation for all ET Cover construction activities. The testing inspection forms documented the inspections performed by the CQA Inspectors for the samples collected and tests performed by the testing laboratory. Each form was signed by the CQA Inspector, reviewed and signed by the CQA Engineer, and contained the following information.

- Date and time of each inspection
- Location
- Weather conditions
- Type of inspection
- Procedure used for testing
- Test data
- Results of the activity
- Personnel involved in the inspection and sampling activities
- Signature of the inspector indicating approval

The inspection forms discussed in Sections 4.2.1 through 4.2.3 were completed as applicable during construction of the Subgrade and ET Cover to document daily activities and supplement the Daily QC Reports.

4.2.1 Receiving Inspection Forms

No Receiving Inspection Forms were used during the 2006 Subgrade Construction phase as no materials were received from outside vendors during this phase of the project. Approximately 8,100 tons (6,000 cy) of angular crushed rock for the Biointrusion Layer were delivered to SNL/NM from October 4 through November 4, 2005, and stockpiled in the TA-3 Bulk Waste Staging Area (Figure 3) by the 2006 Subgrade Construction Team. Approximately 1,100 tons (800 cy) of additional biointrusion rock from the same source were delivered directly to the MWL site from June 8 through June 12, 2009, to complete construction of the Biointrusion Layer in the northeast, classified disposal area of the MWL. Approximately 2,400 tons of aggregate (3/8-inch crushed gravel) were delivered to the Borrow Pit (Figure 3) from June 29 through July 22, 2009, to be admixed with the topsoil fill using the Pug Mill in accordance with the specifications in the CMIP (SNL/NM, November 2005). Delivery ticket information for the biointrusion rock and aggregate is summarized in tables provided in Attachment 4. A Receiving Inspection Form for the seed and copies of the seed bag labels are also included in Attachment 4. The CQA Engineer's approval of the biointrusion rock and 3/8-inch crushed gravel is documented in Table 3 and Attachment 2.

4.2.2 Construction Inspection Forms

Construction Inspection Forms were completed during daily field inspection activities as required by the CQA Plan in Appendix B of the CMIP (SNL/NM, November 2005). The appropriate forms were used for the inspection of the existing surface and perimeter area, the Subgrade, and the erosion control matting installation activities completed as part of the 2006 Subgrade Construction phase. Similar project-specific forms were completed in 2009 for the Subgrade surface (the "existing surface form" was used for the 2009 Subgrade surface inspection), Biointrusion Layer, Native Soil Layer, Topsoil Layer, and Reclamation Seeding and Mulching. The activities for each of the construction tasks were determined to be acceptable based upon the inspections conducted during the activities. The Construction Inspection Forms are presented in Attachment 5.

4.2.3 Testing Inspection Forms

Testing Inspection Forms were completed during in-place density and moisture testing of the compacted existing disposal area surface and Subgrade and for the laboratory analyses of the Subgrade soil fill during the 2006 Subgrade Construction phase. All of this testing was performed by the CQA Team. The 2009 ET Cover Construction phase included both CQC and CQA in-place field density and moisture testing (i.e., field testing). Testing Inspection Forms were completed for the in-place density and moisture tests performed by the CQA Team (i.e., CQA field tests). All CQC laboratory and field tests conducted by the Construction Team were submitted to the CQA Engineer for approval (Section 3.4). All 2006 and 2009 Testing Inspection Forms are presented in Attachment 6.

4.3 Laboratory and Field Testing

Laboratory and field testing were performed throughout construction to verify that the materials used met specifications and that the existing surface, Subgrade, and installed ET Cover layers met the construction and design specifications in the CMIP (SNL/NM, November 2005). Stockpiled fill material was sampled and analyzed in the laboratory to document that the fill materials used met gradation and classification specifications and to develop Proctors for field testing. Field testing included in-place density and moisture content measurements of the compacted soil layers. Native Soil Layer fill material was also sampled and tested for saturated hydraulic conductivity. The frequency of all required testing was performed in accordance with the construction specification (Section 02200) in Table 3.1 of the CMIP (SNL/NM, November 2005–Appendix A).

The CQC data are the laboratory and field-testing results that are used to verify the materials meet specifications. The CQA data is generally used to spot-check and verify the CQC data.

For the 2006 Subgrade Construction phase, all CQC laboratory and field testing was performed and documented by the CQA Team. For the 2009 ET Cover Construction phase a more robust program was implemented. The Construction Team was responsible for all CQC laboratory and field testing, and the CQA Team performed oversight and CQA verification field testing to supplement and confirm the CQC data generated by the Construction Team.

Consistent with this approach, all 2006 Subgrade Construction phase laboratory and field-testing data are considered CQC data. All 2009 ET Cover Construction phase laboratory and field-testing results generated by the Construction Team are CQC data that were reviewed and approved by the CQA Engineer through Submittals, Quality Resolution Meetings, and Cover Layer Approval Forms (Section 3.4 and Attachments 1 and 2). The CQA field-testing data were collected at a frequency greater than 5 percent, as stipulated by the CQA Plan in Appendix B of the CMIP (SNL/NM, November 2005) to confirm the CQC results (typically 50 percent). The following sections present the laboratory and field-testing activities that were performed to verify that each phase of Subgrade and ET Cover Construction met the CMIP construction and design specifications.

4.3.1 Laboratory Testing

The laboratory testing of soil fill material was performed according to the following methods:

- Standard Proctor, ASTM Method D698-07 (ASTM, 2007a)
- Gradation, ASTM Method C136-06 (ASTM, 2006a)
- Classification, ASTM Methods D2487 (ASTM, 2006b) and D4318 (ASTM, 2005)
- Saturated hydraulic conductivity, ASTM Method D5856-95 (ASTM, 2007b)

Standard Proctor (ASTM Method D698)

At the start of the 2006 Subgrade Construction phase, one composite sample of the existing surface was collected to support field density and moisture testing of the existing MWL surface (MWL-ES-001). Three additional Proctor samples (MWL-ES-002 through MWL-ES-004) were collected from different areas of the existing surface within the disposal area boundary to compare with the original sample. There were no significant differences in the Proctor results.

Standard Proctor (ASTM Method D698) soil sampling of Subgrade and Native Soil fill material was conducted at a frequency of 1 sample per 500 cy (loose) as specified in the CMIP (SNL/NM, November 2005). Four samples were also collected from the topsoil material to support moisture and density testing of the Topsoil Layer after installation, which was not required by the CMIP.

Standard Proctor results are summarized for the existing MWL surface and Subgrade in Table 4, and for the Native Soil Layer and Topsoil Layer in Table 5. Complete Standard Proctor laboratory testing supporting documentation is included in Attachment 7.

Gradation (ASTM Method C136) and Classification (ASTM Methods D2487 and D4318)

Gradation (ASTM Method C136) and Classification (ASTM Methods D2487 and D4318) soil testing was performed on all Subgrade, Native Soil Layer, and Topsoil Layer fill material at a frequency of 1 sample per 500 cy (loose) as specified in the CMIP (SNL/NM, November 2005). Gradation and Classification results for all samples are included on laboratory testing forms provided in Attachment 7 and summarized in Tables 4 and 5 for the 2006 Subgrade and 2009 ET Cover Construction phases, respectively. Native Soil Layer and Topsoil Layer results are summarized in Tables 6 and 7, respectively. Complete laboratory results are included in Attachment 7 on the same cover sheet that presents the Standard Proctor results, with the exception of the topsoil fill samples that were analyzed for only Gradation and Classification; separate forms are provided for these sample results in Attachment 7. All Gradation and Classification results met the associated specifications (Tables 4 through 7).

Saturated Hydraulic Conductivity (ASTM Method D5856-95 [2007])

Saturated hydraulic conductivity (ASTM Method D5856-95 [2007]) testing was conducted on all of the Native Soil Layer lifts at a frequency of 1 sample per acre per lift as specified in the CMIP (SNL/NM, November 2005). Samples of the soil fill used to construct each Native Soil Layer lift were collected, compacted in a mold at the testing laboratory, and then tested for saturated hydraulic conductivity following ASTM Method D5856 procedures (ASTM, 2007b). The CMIP specification (Section 02200 in Appendix A) referenced a target maximum value of 4.6×10^{-4} centimeters per second (cm/s) with an acceptable failure rate of 5 percent. A total of 20 saturated hydraulic conductivity sampling results were collected from the eight Native Soil Layer lifts. The results are summarized in Table 8, and complete laboratory results are provided in Attachment 7. Most results are less than the target value (i.e., met specifications); however, four samples (20 percent) did not pass initially. These samples were recompacted to a density of approximately 95 percent to reflect actual field compaction results and retested. The results for the recompacted samples, which are more representative of the in-place compacted lift as determined by in-place density and moisture testing, met specifications (i.e., are less than the target value). The passing samples have an average of 1.62×10^{-4} cm/s and a geometric mean of 4.72×-10^{-5} cm/s. The average compaction of all 20 samples is 90.2 percent, with a range of 81.2 to 95.3 percent.

4.3.2 Field Testing

The CMIP (SNL/NM, November 2005) required in-place density and moisture testing by nuclear methods according to ASTM Methods D2922 ("Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods") and D3017 ("Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods [Shallow Depth]) using a Troxler™ Gauge at the rate of five tests per acre per lift for the Subgrade and Native Soil Layer. These ASTM methods were superseded in 2007 and combined into the new standard, ASTM D6938-08a (ASTM, 2008); however, the methods did not change. Field-testing results were used to demonstrate compliance with Section 02200 in Appendix A of the CMIP, which requires compaction of not less than 90 percent of the maximum dry density at +/- 2 percent of optimum moisture content, as determined by ASTM D698 (Standard Proctor testing) (ASTM, 2007a). Field density and moisture content of compacted soil were determined by comparing field measurements to a specified, representative Proctor that has a theoretical maximum dry density and optimum moisture content. Following standard construction industry practices, if any field-testing results indicated that compaction and/or moisture content specifications were not achieved, additional compaction and/or moisture conditioning of the soil material was performed until testing results met specifications. The 2006 Subgrade and 2009 ET Cover Construction field-testing programs are discussed in the following sections.

4.3.2.1 2006 Subgrade Construction Phase

Field density and moisture testing were performed on both the existing surface and each lift during the 2006 Subgrade Construction phase at the required frequency of five tests per acre per lift. The existing surface was graded and compacted with a vibratory roller and then field density and moisture readings were obtained to verify compaction of not less than 90 percent of the maximum dry density. After discussions with the SCR and Sandia Oversight, Construction Team, and CQA Team personnel, this approach was approved by the CQA Engineer for verification of a stable surface, rather than counting the number of passes over an area using a roller with a ballasted weight of 25 tons, as stipulated in Section 02200 in Appendix A of the CMIP (SNL/NM, November 2005). Due to moisture being added to the surface rather than mixed into the soil prior to placement, the optimum moisture content goal of +/- 2 percent could not be attained using either compaction method. However, the field-testing results provided a more quantitative method and verified adequate compaction of the existing surface.

The spatial extent of most Subgrade Construction phase lifts was highly variable due to the uneven existing surface, so many of the lifts were significantly smaller than 1 acre. Therefore, the number of tests per lift was generally less than five. The field test locations were selected to be representative of each lift and were surveyed, recorded on an inspection checklist, and plotted on maps. Figures 5 through 17 show the locations of all existing surface and Subgrade field tests, Table 9 summarizes the results, and Attachment 7 provides the associated field and laboratory documentation. Testing inspection forms completed in the field are included in Attachment 6.

For the 2006 Subgrade Construction phase field-testing program, the native soil fill material was tracked as it was sampled, hauled, and placed. The associated Proctor result for every 500 cy was used to support the in-place density and moisture field tests of that 500 cy of fill material as it was placed and tested. The Subgrade lifts were relatively small making this approach feasible, although verifying the Proctor result characterizing each 500 cy of fill material that was placed, compacted, and tested was challenging. In one situation, this approach could not be followed due to laboratory reporting delays. The CQA Engineer approved proceeding with the previous Proctor results because the physical properties of the native soil fill were consistent. As more Standard Proctor results became available it was evident that the Borrow Pit fill material was relatively uniform in terms of its geotechnical characteristics, especially after screening and stockpiling.

4.3.2.2 2009 Evapotranspirative Cover Construction Phase

Field density and moisture testing were performed on the existing Subgrade surface and each lift of the Native Soil Layer during the 2009 ET Cover Construction phase at the required frequency of five tests per acre per lift. To ensure a representative spatial distribution of in-place density and moisture tests, the 2.6-acre cover surface was divided into thirteen 100-foot-square grid blocks (Figure 18). For each lift that extended over the entire cover surface, one in-place density and moisture test was conducted at a randomly selected location within each of the 13 grid blocks. For lifts that were spatially limited or of variable thickness (i.e., Native Soil Layer Wedge Lifts 1 and 2 and Lift 3, respectively), density and moisture tests were performed for each grid block where the compacted soil was thick enough for testing (i.e., nominally 4 inches). Figure 19 shows the extent of Native Soil Layer Wedge Lifts 1 and 2 with respect to the grid blocks. Lift 3 was placed across the entire cover surface, but the thickness of this lift was variable and not adequate for testing in some grid blocks (i.e., less than a nominal 4-inch thickness). All 13 grid blocks were tested for Lifts 4 through 8. Testing of the side slopes, which extended beyond the 2.6-acre cover surface, was conducted following the same procedure used for the Native Soil Layer lifts.

In-place density and moisture tests performed on the Subgrade in 2009 to confirm that it still met compaction specifications were compared with a Proctor sample from the soil excavated, screened, and stockpiled during the 2006 Subgrade Construction phase (MWL-SG-018, Table 4). This 2006 Proctor was selected by the CQA Engineer after review of the 30 results characterizing soil fill material excavated from the Borrow Pit in 2006 (Table 4). Initial tests indicated that the soil was similar to the selected 2006 Proctor and within an acceptable compaction and moisture range.

As shown in Tables 4 and 5 and Figure 20, the Standard Proctor results for all of the fill material sampled in 2006 and 2009 are generally consistent, with a relatively narrow range of maximum dry density and optimum moisture content. For this reason, the CQA Engineer approved the use of three representative Proctor results throughout the 2009 Subgrade and Native Soil Layer field-testing program, with one of the samples being the 2006 MWL-SG-018. This decision by the CQA Engineer was based on experience gained during 2006 Subgrade Construction phase, a review of all available data (2006 and incoming 2009 results), ongoing field-testing results, field Proctor compaction tests, and visual inspections of the fill material during placement and testing. The method used to change the Proctor used for in-place density and moisture testing is described as follows.

During placement of Native Soil Layer Wedge Lift 1, the soil appeared to contain higher amounts of clay and silt than the materials previously tested in 2006 based upon visual inspection. Moisture and density readings confirmed slight variations in soil composition and, as a result, the Proctor was revised to more accurately reflect density and moisture percentage of the fill material being used. The revised Proctor was determined by collecting a sample of soil from the area of Wedge Lift 1 where the change was noted. This soil was then compacted using a Proctor mold in the field in accordance with ASTM standards (ASTM, 2007b). The compacted sample provided a theoretical maximum wet density at current moisture levels. The theoretical maximum density and moisture was plotted on a graph with all available Proctor curves (i.e., Figure 20). The plotted point lined up on a Proctor curve that indicated which Proctor was most appropriate for that specific fill material.

The field-molded compactions were not used as a single point Proctor but were used to identify the most representative Proctor curve for the given soil from the already established data set. Because of the overall general consistency of the native soil fill material, most of which came from the same source (i.e., Borrow Pit), the Proctor result used for field testing changed only three times during the 2009 ET Cover Construction field activities.

The 2009 ET Cover Construction field-testing program included both CQC and CQA field testing. All CQC in-place moisture and density tests are summarized in Table 10. Approximately 50 percent of the CQC field tests were duplicated by independent CQA field tests performed under the direction of the CQA Contractor, although only a 5-percent testing frequency was specified in the CQA Plan in Appendix B of the CMIP (SNL/NM, November 2005; Section 2.6.2). CQA tests were typically performed within 3 feet of the CQC test location for the purpose of checking and confirming the CQC results. The CQA field test results are summarized in Table 11 and confirmed the CQC results. Complete testing reports are included in Attachment 7 for both the CQC and CQA field tests. Figures 21 through 29 illustrate the surveyed locations of each CQC and CQA field test. Topsoil Layer field testing was not required by the CMIP, but was conducted to support revegetation efforts. The results are included in Table 10; however, the locations were neither surveyed nor included in a figure.

4.4 Surveys and As-Built Drawings

Surveys were performed to guide, control, and verify the Subgrade and ET Cover Construction fieldwork. For the 2006 Subgrade Construction phase, one Surveying Contractor (URS) was integrated as part of the CQA Team and responsible for all CQC land surveying and preparation of the final Subgrade Construction phase as-built drawing. The as-built drawing for the 2006 Subgrade (Drawing No. 1) is provided in a tabbed section at the end of this report.

For the 2009 ET Cover Construction phase, Albuquerque Surveying (part of the EDi Team) served as the CQC Surveying Contractor, and URS (part of the URS CQA Team) served as the

CQA Surveying Contractor. CQC surveys were performed throughout the ET Cover Construction phase to support the following objectives:

- Check and control layer and lift thickness
- Install grade staking for the Native Soil and Topsoil Layer construction
- Record final elevations, surface slope, and side slopes of each lift and layer
- Record side slopes and drainage features around the perimeter of the cover
- Record the location of field density tests, fencing installation, and other miscellaneous site features

The CQC survey data were more extensive, performed for the purpose of documenting the entire ET Cover construction process, and were used as the basis for the ET Cover as-built drawings. Final CQC elevation surveys were conducted for each layer system to verify layer thickness and slope as required by Section 02210 in Appendix A of the CMIP (SNL/NM, November 2005) and for each lift of the Native Soil Layer. A 50-foot-spaced verification grid was established for collection of elevation measurements during the final CQC and CQA surveys. The verification grid map is illustrated in Figure 18 in relation to the grid blocks established for field density testing. The approximate limit of the 2-percent east-to-west cover surface design slope, the original disposal area boundary, and the 6 (horizontal) to 1 (vertical) side slopes surrounding the disposal area are also shown in Figure 18. The final CQC elevation survey data for each layer and the thin soil layer above the Biointrusion Layer are provided in Table 12. The final MWL surface and ET Cover cross-sections, which include the existing surface, Subgrade, drainage features, fencing installation, and other site features; are illustrated in the 2009 ET Cover As-Built Drawings (Figures No. 1 through 4) in a tabbed section at the end of this report.

All Construction Team CQC surveys were performed by Albuquerque Surveying and conducted using GPS [global positioning system]/RTK [real-time kinematic]-capable TOPCON GR-3 systems with GEODIMETER 600 SERIES Total Stations. Specifications for the survey equipment are on file in the SNL/NM Customer Funded Records Center. All elevation measurements were obtained as static measurements. Accuracy for static measurements is estimated at approximately ± 3 millimeters horizontal and ± 5 millimeters vertical.

The CQA surveys were more limited and performed on the surface of each ET Cover layer (Biointrusion, Native Soil, and Topsoil Layers). The purpose of the CQA surveys was to verify the precision and accuracy of the CQC survey results and confirm that the cover layers complied with the design specifications (i.e., thickness, surface slope, and side slope). The CQA verification surveys are documented in Plates No. 1 through 3 in a tabbed section at the end of this report. These plates provide all CQA survey information, including tabular data (elevation and layer thickness) and a QA verification survey grid map, and are certified by a New Mexico Professional Surveyor.

4.5 Photographic Reporting

A digital camera was used to compile comprehensive photographic logs of the 2006 Subgrade and 2009 ET Cover Construction phases. A man lift or scissors lift was maintained on site to facilitate aerial photographic documentation of the construction effort. Each photo was identified with the following information:

- The date, time, and location of the photograph
- The name of the photographer
- A brief description of the activity

The photographic logs for the 2006 Subgrade (Log No. 1) and 2009 ET Cover Construction (Log No. 2) phases represent CQA documentation and are presented in a tabbed section at the end of this report.

This page left intentionally blank.

5.0 Earthwork

This chapter provides a detailed summary of all MWL construction preparation, 2006 Subgrade, and 2009 ET Cover Construction activities. The CQC and CQA programs implemented to control and verify the Subgrade and ET Cover earthwork are documented in Chapters 3.0 and 4.0 and only briefly summarized in this chapter. The information presented in Chapters 3.0 through 5.0 documents that the 2006 Subgrade and 2009 ET Cover Construction earthwork conforms to the specifications and requirements of the NMED-approved CMIP (SNL/NM, November 2005). Table 1 summarizes all activities related to both phases of the MWL ET Cover construction project.

Deployment of the MWL ET Cover was conducted in two main phases consisting of the 2006 Subgrade Construction phase and the 2009 ET Cover Construction phase. The main earthwork activities associated with the two phases of construction are summarized as follows:

2006 Subgrade Construction Phase Earthwork

- Clearing, grubbing, grading, moisture-conditioning, compacting, and testing of the existing MWL surface and perimeter
- Placing, moisture-conditioning, compacting, and testing screened soil fill in lifts to create the Subgrade for the ET Cover layers with a central crown and 2-percent east-to-west design slope over the MWL disposal area
- Surveying to control and guide the construction process and verify final cover layer thickness and slope angles
- Constructing a partial drainage swale on the east side of the Subgrade
- Final surveying and installing erosion control matting to protect the Subgrade surface until ET Cover Construction was approved by the NMED

2009 ET Cover Construction Phase Earthwork

- Clearing, moisture-conditioning, compacting, and testing of the 2009 Subgrade surface
- Placing and compacting the Biointrusion Layer
- Placing loose, dry soil in Biointrusion Layer voids and compacting a thin soil layer on the rock surface to create a relatively smooth surface upon which the Native Soil Layer was constructed
- Placing, moisture-conditioning, compacting, and testing screened soil fill in lifts to create the Native Soil Layer

- Placing and minimal compacting of the Topsoil Layer
- Surveying to control and guide the construction process and verify final cover layer thickness and slope angles
- Constructing the final drainage swale on the east perimeter of the ET Cover
- Performing revegetation activities (ripping, tilling, seeding, mulching, and crimping) for the Topsoil Layer

Equipment used during the 2006 Subgrade Construction phase and 2006 supporting activities at the Borrow Pit are summarized below and in Sections 5.1 and 5.2.1. Equipment used for the 2009 ET Cover Construction phase is summarized in Table 13, and 2009 supporting activities at the Borrow Pit are summarized below and in Sections 5.4 and 5.5. For all dust suppression and soil moisture-conditioning activities performed during both phases of construction, potable water without supplementary chemicals or additives from a local TA-3 source was used. The Borrow Pit, Bulk Waste Staging Area, and associated haul routes to the MWL are shown in Figure 3.

In preparation for 2006 Subgrade and 2009 ET Cover Construction phases, rock needed to construct the Biointrusion Layer was selected and delivered to the Bulk Waste Staging Area. Rock delivery occurred from October 4 through November 14, 2005. In addition, from June 14 through July 17, 2006, Storm Water Pollution Prevention Plan (SWPPP) surface water and site controls were implemented at the Borrow Pit in TA-3 (i.e., soil berm was installed around the perimeter of the site and a cobble drive-off pad for equipment was installed at the site entrance) and soil fill material needed for construction of the Subgrade and ET Cover layers was excavated, screened to 2-inch minus, and stockpiled following the specifications of Section 02200 in Appendix A of the CMIP (SNL/NM, November 2005). Screened soil fill was hauled and stockpiled at the MWL for the Subgrade Construction phase from July 31 through November 5, 2006. This preconstruction preparation work was completed by the same Construction Contractor Team that performed the 2006 Subgrade Construction.

To support the 2009 ET Cover construction phase, Borrow Pit Area activities were performed that included loading haul trucks with existing soil fill stockpiled at the Borrow Pit in 2006 and rock stockpiled at the nearby Bulk Waste Staging Area in 2005; soil sampling of fill material according to CMIP specifications; excavation, screening to 2-inch minus, stockpiling, and loading of additional native soil and topsoil material; screening and stockpiling berm material hauled to the Borrow Pit from the MWL for use as fill material; and Pug Mill setup, calibration, and operation to blend 3/8-inch gravel with the topsoil fill material.

5.1 Existing Mixed Waste Landfill Surface

Preparation of the existing MWL surface was conducted as the first part of the 2006 Subgrade Construction phase. From October 2 through October 26, 2006, the security fence was removed and the MWL surface was cleared of vegetation. After clearing, the existing surface was graded, watered, compacted, and tested in preparation for the Subgrade Construction phase. As part of site preparation work, an area immediately south of the MWL was cleared and used as the staging area for the soil stockpile, the roll-off containers for waste and recyclable metal, the container for shredded vegetation, and equipment storage. The work area boundary was marked with a rope and signs to designate the radiation control area that was in effect for the 2006 Subgrade Construction phase. After completion of the Subgrade Construction phase, which involved placement of clean soil fill over the disposal area surface, the radiological posting of the MWL was changed to an Underground Radioactive Materials Area. This allowed the 2009 ET Cover Construction phase to proceed without formal radiological controls, although SNL/NM Radiological Control Technicians continued to be involved in the early construction phases to confirm clean operations.

Soil berms were constructed around the perimeter work area as a best management practice required by the project SWPPP for the control of storm water run-on and to control runoff from the site. The berms were inspected after each significant rainfall event (i.e., more than 0.5 inches) or semimonthly at a minimum, according to the project SWPPP requirements, and repairs were made as necessary. The existing administrative security fencing was removed and stockpiled on site for radiological clearance before disposal or recycling. The vegetation removed from the existing MWL surface and the perimeter area was shredded and containerized for future disposition. The material was sampled for radiological contamination and approved for reuse. Any material on the surface larger than 2 inches was removed and stockpiled. One remaining concrete pad pit cover was reduced to rubble in place and backfilled with stockpiled soil.

The existing surface was uneven due to the previously backfilled disposal trenches. The surface was graded, compacted with a vibratory roller, and water was added using a water truck to complete existing surface preparation activities.

5.1.1 Existing Surface Laboratory and Field Testing

After the surface was graded and compacted, in-place field density and moisture testing were performed to verify compaction of not less than 90 percent of the maximum dry density. Standard Proctor soil testing to support the in-place density and moisture field testing was performed and is discussed in Section 4.3.2. This approach was used for verification of a stable surface rather than counting the number of passes over the surface using a roller with a ballasted weight of 25 tons, as stipulated by Section 02200 in Appendix A of the CMIP (SNL/NM, November 2005). Due to moisture being added to the surface rather than mixed into the soil prior to placement, the optimum moisture content goal of +/- 2 percent could not be attained. This approach and the results verified adequate compaction of the existing surface, and both were approved by the CQA Engineer as a design change. Laboratory results are presented in Table 4 and field-testing results are presented in Table 9.

5.1.2 Existing Surface Survey

A survey of the existing disposal area surface was performed on May 10, 2006, prior to construction activities. This survey was used to document the existing (preconstruction) MWL surface (i.e., construction starting datum) for as-built drawings, and documentation is maintained in the SNL/NM Customer Funded Records Center.

5.2 Subgrade Construction

After receiving NMED approval (Bearzi September 2006), the Subgrade Construction phase began on October 2, 2006, and was completed on April 11, 2007. Because of the delay between completion of the Subgrade Construction phase in December 2006 and the start of the ET Cover Construction in May 2009, erosion control matting was installed over the Subgrade surface as a protective measure. This activity was completed on April 11, 2007. In addition, some final Subgrade activities were required as part of the ET Cover Construction phase in May 2009. The 2006 and 2009 Subgrade construction and preparation activities are discussed in the following sections.

5.2.1 2006 Subgrade Construction

From June 14 through July 17, 2006, the soil fill material used for the Subgrade was excavated and screened to 2-inch minus according to the CMIP specifications (SNL/NM, November 2005). The soil fill material was loaded and hauled to the site from July 31 through November 5, 2006, where it was stockpiled for use in constructing the Subgrade lifts. The CQA Inspector performed visual inspections during placement of the soil at the MWL to ensure the absence of debris and material (primarily rocks) greater than 2 inches.

The following equipment was used for 2006 Subgrade Construction phase earthwork:

- Dump trucks to haul the soil
- Two front-end loaders to haul and spread the soil in lifts
- An excavator at the soil stockpile to mix the soil with water before placing it on the MWL surface
- A grader to spread the soil to the required thickness (grader later replaced with a tracked bulldozer)
- One water truck to moisture-condition the soil and to control dust in the work area
- One vibratory roller for compacting the soil lifts
- A skid steer to spread the soil in tight areas and around groundwater monitoring well MWL-MW4

The Subgrade was installed on top of the prepared existing surface using approximately 11,000 cy (loose) of native soil fill placed in a total of 12 lifts. The subgrade soil was placed in 8-inch loose, 6-inch compacted lifts beginning with the topographically lowest areas. In general, the lower northern side of the MWL was augmented to match the higher southern grade. The goal of the Subgrade Construction phase was to establish a surface over the MWL that mirrored the final CMIP design surface of the ET Cover (i.e., a broad, central crown or high area with a 2-percent east-to-west slope across most of the MWL).

The initial seven lifts were spatially limited and largely placed to bring depressions across the site to a level grade. Lifts 8 through 12 were placed in increasingly larger areas across the MWL. A total of 12 lifts were applied, with the total depth varying from a few inches to 40 inches (approximately 3.3 feet) at the lowest spots. To guide and control lift thickness across the area, the surveyors installed grade stakes marked in 8-inch thickness levels for each lift. Each lift was compacted to meet the CMIP specification of compaction of not less than 90 percent of the maximum dry density at +/- 2 percent of optimum moisture content, as determined by ASTM D698 (Standard Proctor testing) (ASTM, 2007a). Compaction with the vibratory roller resulted in an approximate 6-inch lift. The in-place, compacted volume of the Subgrade is approximately 7,700 cy indicating a compaction factor of approximately 30 percent.

The quantity of soil was tracked by the volume per loader bucket and the number of loads per day. A total volume of soil was recorded for each lift and the locations of each laboratory and field test were surveyed. The CQA Inspector oversaw the spreading and compaction of the soil and noted observations on the inspection forms. A loader moved the soil from the stockpile to the work area, and the grader or bulldozer leveled the soil to the lift mark on the survey stake. The vibratory roller made several passes over the work area to achieve the required compaction, which was verified through in-place field density and moisture testing.

5.2.1.1 2006 Laboratory and Field Testing

The laboratory and field-testing activities performed for the Subgrade Construction phase are discussed in Sections 4.3.1 and 4.3.2. The CQC results verified that the fill material and the constructed Subgrade met CMIP specifications and were approved by the CQA Engineer. Laboratory results are presented in Table 4 and field-testing results are presented in Table 9.

5.2.1.2 2006 Survey Verification

A final survey was performed in April 2007 to locate the corners of the Subgrade footprint, the final topographical slope, and the protective drainage swales on the southeast and northeast corners of the Subgrade perimeter. The final data is reflected in the as-built drawing provided in a tabbed section at the end of this report (2006 Subgrade As-Built Drawing No. 1).

5.2.1.3 2006 Subgrade Layer Protection

The construction delay resulting from not receiving NMED approval to proceed with the ET Cover Construction phase in late-2006/early-2007 resulted in the DOE/Sandia decision to protect the Subgrade surface from erosion as a best management practice. Sandia Oversight, Construction Team, and CQA Team personnel met to discuss the Subgrade protection alternatives, which included no action, a rock layer, and erosion control matting (i.e., straw blankets). The decision to install erosion control matting was based upon the capability of this alternative to accomplish the following objectives:

- Absorb the impact of raindrops and reduce soil loosening
- Minimize runoff and the resulting soil displacement and transport
- Absorb shear forces of overland flow
- Trap soil particles beneath straw blanket
- Reduce potential wind erosion

The CMIP design (SNL/NM, November 2005) requires an earthen swale along the eastern perimeter of the site to divert storm water run-on around the cover. The swale collects the water from the east and diverts it around the MWL to the north and south ends of the Subgrade, and then westward toward the surrounding landscape. A portion of the swale (i.e., partial drainage swales on the east side of the Subgrade) was constructed in the locations specified in the CMIP design drawing to protect the Subgrade surface until construction of the ET Cover in 2009.

The CQA Team inspected the installation of the erosion control matting and the eastern perimeter drainage swale on April 11, 2007. The matting was installed in accordance with the manufacturer's instructions. The mats were placed from west to east, and the ends and sides were anchored in an earthen trench to reduce the effects of the prevailing winds. The swale was constructed to collect water from the east of the site and direct it around the MWL with discharges to the west. The flow in the partial swale was observed to split directions from north and south approximately at the middle of the MWL. The inspection forms are provided in Attachment 5.

5.2.1.4 2006 Subgrade Approval

After completion of all construction activities, the CQA Team surveyor completed a final survey of the Subgrade surface and surrounding area in April 2007. The CQA Team documented the 2006 Subgrade Construction phase activities in a Draft Subgrade CQA Report (MKM, August 2007). Based upon a review of all construction data and documentation, the CQA Engineer approved and certified all aspects of the 2006 Subgrade Construction on August 31, 2007 (Chapter 9.0). The Draft Report was used as the starting point for this MWL Alternative Cover CQA Report.

5.2.2 2009 Subgrade Preparation

The 2009 ET Cover Construction phase began with preparation of the Subgrade surface on May 20, 2009. Mobilization activities conducted prior to the cover construction fieldwork included completing personnel training, mobilizing equipment and materials to the site, site grading and setting up temporary office/storage trailers and a water tower, rebuilding the drive-off pad and installing a silt fence as detailed in the SWPPP, and removing the existing perimeter security fence (installed after completion of the 2006 Subgrade Construction phase). Care was taken to minimize disturbance to the Subgrade surface; some of the erosion control matting remaining from 2006 and vegetation were removed by hand. Specific areas of the surface (including all of the side slopes and areas within the MWL footprint only where needed) were "back-dragged" with a John Deere (JD) 644 wheel loader to remove vegetation and remnants of the erosion control matting and to repair minor surface erosion. A 4,000-gallon water truck was used for dust suppression and to add moisture for compaction. An Ingersoll-Rand (IR) SD100 vibratory smooth drum roller was then used to compact the existing Subgrade surface.

5.2.2.1 2009 Laboratory and Field Testing

The laboratory and field testing for the 2009 Subgrade construction activities were performed in accordance with CMIP specifications (SNL/NM, November 2005–Appendix A, Section 02200) and are discussed in Sections 4.3.1 and 4.3.2. The results verified that the 2009 existing Subgrade met the CMIP specifications and were approved by the CQA Engineer. Laboratory results are presented in Table 4, and field-testing results are presented in Tables 10 (CQC) and 11 (CQA).

5.2.2.2 2009 Survey Verification

The 2009 survey approach is discussed in Section 4.4. A CQC survey was performed on the Subgrade surface to establish a baseline for subsequent cover surveys to establish thicknesses and slope according to design specifications. The survey revealed that the Subgrade surface did not meet the 2-percent east-to-west surface design slope across the eastern side of the cover from the central to the southern end of the MWL (the slope ranged from 1.8 to 1.9 percent in this area). Also, the side slopes around the northern end of the MWL were steeper than the 6 to 1 ratio specified in the CMIP (SNL/NM, November 2005). Because the side slopes of the Subgrade extend beyond the original MWL boundary and provide adequate protection of the disposal areas, at the Quality Resolution Meeting held on May 22, 2009, the decision was made to proceed with the Biointrusion Layer installation and adjust both the surface design and side slopes during construction of the overlying layers. This path forward and the Subgrade surface were approved by the CQA Engineer on May 22, 2009 (Section 3.4 and Tables 3 and 14).

5.3 Biointrusion Layer

The Biointrusion Layer was constructed from May 26 through June 17, 2009, and consisted of nominal 4- to 6-inch crushed; angular, highly siliceous, dense contact, metamorphic rock (i.e., hornfels) from the San Lazarus Gulch located in the San Pedro Mountains. This rock was selected by Sandia Project Staff after completing an evaluation of several potential rock sources and consulting with NMED representatives in 2005. Approximately 6,000 cy of rock (8,100 tons) were delivered to the Bulk Waste Staging Area from October 4 through November 14, 2005.

5.3.1 Biointrusion Layer Construction Field Tests

Prior to full-scale installation, a series of small-scale construction tests were performed at the southern end of the MWL to determine the installation method that would be most effective in achieving the following goals:

- Compacting the rock into a structurally sound, interlocking layer
- Filling void space within the Biointrusion Layer with native soil fill
- Creating an even surface to begin construction of the Native Soil Layer
- Creating an even surface to measure and verify Native Soil Layer thickness

Although filling of the void space and creation of a relatively even surface to construct the Native Soil Layer were not addressed in the CMIP, the Sandia Project Staff, Construction Team, and CQA Team identified these issues prior to construction. All parties agreed to a field-testing approach, to be approved by the CQA Engineer based upon engineering judgment, at the preconstruction meeting held on April 30, 2009 (Section 3.1 and Attachment 1).

5.3.1.1 Biointrusion Test Area I

The first test area was designed to evaluate an approach for filling the void space that consisted of placing a loose lift of native soil fill on the Subgrade surface and then placing and compacting the biointrusion rock down into the loose soil. Two truckloads of dry, loose soil were placed over an approximate 20- by 20-foot area to create a 6- to 8-inch layer prior to placing the rock. The soil was initially spread using a JD 670 motor grader, but this was later switched to a JD 650 bulldozer in an attempt to reduce the soil compaction.

The biointrusion rock was then placed on top of the 6- to 8-inch loose soil layer. Using the JD 650 bulldozer, the biointrusion rock was spread to an approximate thickness of 1 foot and compacted by tracking over the layer with the bulldozer in an attempt to push the rock down into the soil layer. After several passes with the bulldozer, it was clear that the biointrusion rock was not being pressed down through the loose soil layer to the existing Subgrade surface as intended. Instead, the rock appeared to be "free-floating" on the loose soil layer and not fully interlocking. It was determined this procedure was not adequate to meet the stated goals and CMIP specifications (SNL/NM, November 2005–Appendix A, Section 02115).

5.3.1.2 Biointrusion Test Area II

A second test area was created and the process was changed. Instead of applying a 6- to 8-inch loose soil layer on the surface of the Subgrade prior to placing the rock, the Subgrade surface was scarified using the tracks of the JD 650 bulldozer. This created a rough texture on the Subgrade surface and a thin, irregular layer of loose soil (approximately 1 to 2 inches), which was ideal for filling some of the lower void space in the rock layer without causing the rock to free-float. The final outcome was a stable, interlocking rock structure at the base of the Biointrusion Layer. The rock was compacted using a minimum of four passes with the JD 650 bulldozer. Loose, dry, soil was then placed on top of the rock layer, spread with the JD 650 bulldozer, and worked into the voids through initial spreading and tracking with the bulldozer.

Field observations revealed that the dry, loose soil flowed into the upper rock void space similar to the way sand flows through the restriction in an hourglass. The final two steps after spreading the dry, loose soil involved first compacting a thin (nominally 3-inch) layer of soil over the rock layer with a minimum of four passes with the IR SD100 vibratory roller, and then adding water to the surface of the compacted thin layer to moisture-condition it and the underlying soil that penetrated into the rock void space. After the test, part of the test area was excavated and removed, and soil could be observed penetrating all the way through the 1-foot thick rock layer. Based upon visual inspections and engineering judgment, this second method proved to be the most effective at achieving the stated goals. The revised procedure for the installation of the Biointrusion Layer was approved on May 26, 2009 (Section 3.4 and Table 3). Both test areas were reworked using the approved installation method.

5.3.2 Biointrusion Layer Construction

Loading and hauling of the biointrusion rock material from the Bulk Waste Staging Area occurred from May 26 through June 8, 2009. The Construction Team utilized 12-cy tandem dump trucks to haul material and unload it directly onto the scarified Subgrade surface. A JD 650 bulldozer was used to spread and compact the rock with a target thickness of 1.25 feet to ensure that the 1-foot minimum thickness was achieved.

The biointrusion rock was placed and compacted with a minimum of four passes by the JD 650 bulldozer to ensure compaction and interlocking of the rock. Surveys were performed continually to control and verify thickness. Due to a biointrusion rock volume shortfall, an additional 800 cy (1,100 tons) of rock material were purchased from the original quarry (material still remained from the 2005 stockpiles) and delivered directly to the east side of the site from June 8 through June 12, 2009. This rock was inspected by the CQA Engineer and approved prior to completing the Biointrusion Layer over the northeast, classified portion of the MWL (Section 3.4 and Table 3). A JD 644 wheel loader was used to place the material onto the scarified cover surface and side slopes and the JD 650 bulldozer was used to spread and compact the material.

Visual inspections of the biointrusion crushed rock and loose, dry soil were conducted throughout installation by the CQA Inspector to verify that the biointrusion rock and soil conformed to the CMIP specifications and that no organic matter, rubble, trash, or deleterious material was identified. Only hand-operated compaction equipment was used within 3 feet of groundwater monitoring well MWL-MW4.

The Biointrusion Layer was completed, surveyed, and approved in three phases by area (South, Northwest, and Northeast). Each individual area of the Biointrusion Layer thickness was verified and approved by the CQA Engineer prior to the placement of any soil on the layer. As each area was surveyed and approved; the installation steps of dry loose soil placement, spreading, and compaction proceeded. All construction was performed in accordance with the revised Biointrusion Layer installation procedure.

5.3.3 Void Space Filling and Thin Soil Layer

After each area of the Biointrusion Layer was compacted, surveyed, and approved, dry, loose soil was placed on the surface and spread and worked into rock void space using a JD 650 bulldozer (minimum four passes to spread and track the soil into the void space). After this step was completed and the overlying soil layer thickness was approximately 3 to 4 inches, an IR SD100 vibratory drum roller was then used (minimum of four passes) to compact the remaining soil on the surface of the rock to form a smooth surface for the construction of the Native Soil Layer. Only hand-operated compaction equipment was used within 3 feet of groundwater monitoring well MWL-MW4.

Water was applied to moisture-condition the applied soil (thin layer and soil in the rock void space). All construction was performed in accordance with the revised Biointrusion Layer installation procedure.

Approximately 3,100 cy of dry, loose soil were used; the majority of which was worked into the Biointrusion Layer voids, while the remaining soil created a nominal 3-inch-thick (average) soil layer on the surface of the Biointrusion Layer. The thin soil layer created a stable surface and reference datum upon which to build and measure thickness of the Native Soil Layer. This approach was important due to the unavoidable irregularities of the biointrusion rock surface caused by the coarse (predominantly 4- to 6-inch) and angular nature of the rock material.

5.3.4 Laboratory and Field Testing, Survey Verification, and Approval

There are no laboratory or field-testing requirements for the Biointrusion Layer and overlying thin soil layer. However, compaction of the thin soil layer was performed following the same process used for Subgrade and Native Soil lifts (except the loose soil layer was thinner than a typical 8-inch loose Subgrade or Native Soil lift).

The rock material was selected in consultation with representatives of the NMED and approved by Sandia Project Staff and the CQA Engineer based upon visual observations and material measurements made in the field. Small-scale field tests and engineering judgment were used to develop a structurally sound approach to filling rock void space and to create an even surface upon which the Native Soil Layer could be constructed and its thickness determined. In-place density and moisture testing of the thin soil layer was not feasible due to the thinness of the soil layer (i.e., less than 4 inches thick) and the presence of rocks immediately below the surface.

The primary specification was Biointrusion Layer thickness of 1 foot minimum with a + 0.25-foot upper tolerance level. This was verified through both the final CQC and CQA verification surveys. The Biointrusion Layer was constructed, surveyed, and approved by the CQA Engineer in three phases by area as previously discussed (Section 5.3.2). The CQC and CQA surveys were performed for each phase/area and used to determine any grid point locations where adjustments were required to meet the thickness specification. Identified grid point locations requiring adjustment were reworked (i.e., additional rock was added and compacted following the same construction process or rock was removed if it was too thick) and resurveyed to verify corrections. After adjustment, the thickness at all grid points was equal to or greater than the 1-foot minimum requirement. The final average thickness of the completed Biointrusion Layer was 1.25 feet (Table 12). This average thickness equals the CMIP upper tolerance thickness of 1.25 feet, although the thickness at some grid points exceeds the 1.25-foot maximum.

In addition, the 2-percent east-to-west surface design slope along the eastern boundary and the side slopes around the northern end of the MWL did not meet specifications. The entire Biointrusion Layer was approved by the CQA Engineer on June 15, 2009 (Section 3.4 and Table 3). No further adjustments were required for the following reasons:

- The maximum thickness resulted in a more protective layer.
- The coarseness of the rock material made fine-tuning the surface to more than 0.25-foot precision very difficult without the risk of compromising the already achieved interlocking lattice structure and void filling.
- The decision had already been made after completion of the Subgrade to correct the 2-percent surface design slope and 6 to 1 side slopes as part of construction of the Native Soil Layer.

A CQC survey was performed on the thin soil layer overlying the Biointrusion Layer to verify the thickness, determine the surface slope, and establish a datum from which to measure the thickness of the Native Soil Layer. The thickness of this soil layer is not considered part of the Biointrusion Layer or the Native Soil Layer, both of which meet minimum thickness specifications of the CMIP without including this layer. Grid points and surrounding areas where the thin soil layer exceeded 3 inches were rechecked and adjusted using the JD 670 motor grader where feasible. If the soil layer could not be scraped and thinned without encountering the underlying rock, no further adjustment was made.

All grid points that were altered were resurveyed, and the final average thickness of the thin soil layer overlying the Biointrusion Layer was 0.25 feet (Table 12). Final approval of the thin soil layer occurred on June 17, 2009 (Section 3.4 and Table 3).

The final average thickness of the completed Biointrusion Layer was 1.25 feet, which equals the CMIP upper tolerance thickness. The complete volume of rock used for the Biointrusion Layer is estimated at 6,800 cy. The in-place surveyed volume is approximately 5,800 cy. The 1,000-cy discrepancy (approximately 15 percent reduction) is most likely attributable to the fact that the Subgrade surface elevation was lowered approximately 1 to 2 inches during the scarification process prior to installing the Biointrusion Layer rock material. Initial volume estimates of the received rock may have also been biased slightly high.

5.4 Native Soil Layer

Construction of the Native Soil Layer was conducted from June 16 through August 4, 2009. Construction started on the side slopes around the northern end of the MWL, which were built up in lifts to meet the 6 to 1 slope requirement from June 16 through June 22, 2009. Construction of the Native Soil Layer on the surface of the MWL started on June 18, 2009, after the thin soil layer overlying the Biointrusion Layer was approved on June 17, 2009 (Table 3). Construction of the side slopes around the northern end of the MWL and the first Native Soil lift (Wedge Lift 1) on the MWL surface proceeded concurrently from June 18 through June 22, 2009.

To support construction of the Native and Topsoil Layers, additional soil fill material was excavated, screened to 2-inch minus, and stockpiled at the Borrow Pit from June 12 to July 24, 2009. During this time period, the soil berm around the MWL site originally installed as part of the 2006 Subgrade Construction phase SWPPP was excavated, hauled to the Borrow Pit, and screened for use as native soil fill (a perimeter silt fence had been installed around the berm in late May 2009). Soil fill stockpiled at the Borrow Pit in 2006 based on CMIP estimates was not sufficient to complete construction of the Native Soil and Topsoil Layers. During the Quality Resolution Meeting held on July 14, 2009, estimates were finalized for additional soil fill needed for Native Soil and Topsoil Layer construction (Table 3). All required native and topsoil fill was excavated from the Borrow Pit, screened to 2-inch minus, and stockpiled by July 24, 2009.

The CMIP side slope specification and design required that the side slopes extend out from the MWL boundary at a 6 to 1 slope. During initial construction of the Native Soil Layer, the side slopes around the northern end of the MWL were built up using a wedge lift approach, and the final cover toe-of-slope catch points were established, so that at completion of the Topsoil Layer the final side slopes would meet the 6 to 1 CMIP specification (SNL/NM, November 2005–Appendix A, Section 02200). The soil placed and compacted to provide the appropriate side slopes was identified as 'slope lifts' and installed following the same procedure as the Native Soil Layer lifts (maximum 8-inch loose, 6-inch compacted lifts). Because the slope thickness tapered toward the toe, the thickness of each lift was also tapered, and therefore these lifts are referred to as "wedge lifts" with the maximum compacted thickness not exceeding 6 inches.

Native soil fill material was hauled from the Borrow Pit in 20-cy dump trucks and unloaded directly onto the MWL surface from June 18 through August 4, 2009. The material was placed, spread, and graded with a JD 670 motor grader; and then compacted using an IR SD100 vibratory roller (minimum four passes). The Native Soil Layer involved the placement and compaction of approximately 17,300 cy of soil (compacted, in-place cy) in eight lifts. Each lift was constructed following the specifications of the CMIP, with a maximum thickness of 8-inch loose, 6-inch compacted. Two wedge lifts (Wedge Lifts 1 and 2) were installed along with two polishing lifts (Lifts 3 and 4) to establish the 2-percent east-to-west surface design slope across the eastern side of the cover from the central to southern end of the MWL. This was necessary because neither the Subgrade nor Biointrusion Layers had the required 2-percent east-to-west surface slope in this part of the MWL (Sections 5.2.2.2 and 5.3.4).

Wedge Lifts 1 and 2 were spatially limited to the eastern side of the cover, as shown in Figure 19. Lifts 3 and 4 are referred to as polishing lifts because, although they extended across the disposal area surface, their thickness was variable, which was necessary to complete the adjustment for the 2-percent east-to-west surface design slope. After installation of Wedge Lifts 1 and 2, some areas of the cover surface required slightly more than a 6-inch compacted thickness. In order to meet the CMIP lift thickness specifications, Lifts 3 and 4 were constructed as generally thinner than 8-inch loose, 6-inch compacted lifts across the entire surface of the MWL. Survey grade stakes were used to guide the construction process for these first four lifts.

Lifts 5 through 8 were more standardized lifts that were installed across the entire cover surface as 8-inch loose, 6-inch compacted lifts. Grade stakes were set across the entire cover surface at or near the 50-foot grid points for each lift to guide the process and allow for visual confirmation that specifications were being followed.

5.4.1 Laboratory and Field Testing

The laboratory and field-testing activities for the Native Soil Layer side slopes and lifts were performed in accordance with CMIP specifications (SNL/NM, November 2005) and are discussed in Sections 4.3.1 and 4.3.2. The results verified that the Native Soil Layer met the CMIP specifications and were approved by the CQA Engineer. Laboratory results are presented in Tables 5 and 6, and field-testing results are presented in Tables 10 and 11.

Because of the limited spatial distribution of Wedge Lifts 1 and 2, only three CQC and two CQA in-place field density moisture tests were performed on Wedge Lift 1, and two CQC tests and one CQA test were performed on Wedge Lift 2 (total of eight tests for Wedge Lifts 1 and 2). Lift 3 was not thick enough across the surface for field testing in all 13 grid blocks. Four CQC tests and two CQA tests were conducted for Lift 3. All 13 grid blocks were tested for Lifts 4 through 8 as discussed in Section 4.3.2. Figures 21 through 29 show all CQC and CQA field-testing locations for the Native Soil Layer side slopes (Figure 21) and lifts (Figures 22 through 29).

During field testing of Lift 5, Grid Blocks 2, 3, 5, and the east edge of Grid Block 7 failed moisture and density tests. The east slope of Grid Block 7 met specifications after water was added. Grid Blocks 1 through 5 of Lift 5 were ripped using the scarifier shanks on the JD 670 motor grader to a depth of approximately 6 inches, moisture-conditioned, recompacted, and retested. The retest results met specifications. The 3-foot perimeter around groundwater monitoring well MWL-MW4 was compacted using a manually operated compactor and tested in addition to Grid Block 9 for Lifts 6 through 8. Lifts 6 and 8 failed the moisture content tests, so additional water was applied to the material. The area was retested and met specifications. Lift 8 and Grid Blocks 8 and 10 also failed initial tests for moisture content, so the same procedure was followed (i.e., additional water was applied) and passing results were obtained from the repeated tests.

5.4.2 Survey Verification and Approval

The thickness, surface slope, and side slopes of the Native Soil Layer were verified through both CQC and CQA surveys using the 50-foot-spaced verification grid (Figure 18). The CQC survey data is provided in Table 12. During this verification process, nine points were identified by both the CQC and CQA surveys that were slightly less than the minimum 2.5-foot thickness, with two of these points falling outside the cover surface on the northern side slope. The range of values below the minimum thickness was 2.09 to 2.42 feet, which appears to be related to irregularities (i.e., high spots) in the Biointrusion Layer. A thin layer of additional soil was placed and compacted in these areas to increase the thickness to 2.55 feet, with the thickest fill layer being 0.46 feet (compacted). After adjustments, the corresponding grid points were resurveyed and all grid points met the specification of 2.5-foot minimum thicknesses.

The final average thickness of the completed Native Soil Layer was 2.85 feet, which reflects the buildup on the eastern side of the cover to correct the 2-percent east-to-west surface design slope inherited from the Subgrade and Biointrusion Layer (Table 12; Sections 5.2.2.2 and 5.3.4). Eleven grid points exceeded 3 feet in thickness (D7, E1, E4–E7, F5, G5, H5, I5, and G4); all of these grid points are located at or near the eastern boundary of the MWL where Wedge Lifts 1 and 2 were installed (Table 12; Figures 18 and 19). The two grid points with the thickest measurements, E6 and E7 at 3.66 and 3.98 feet, respectively, are located just south of the MWL boundary (Figure 18). The Native Soil Layer thickness at these two points is greater because they are located over the side slope. The 2-percent east-to-west surface design slope was verified across the central and southern portion of the Native Soil Layer surface, and the side slopes were verified to be 6 to 1 or slightly flatter, with the exception of the northwestern corner where the side slope was 4.4 to 1 (Native Soil Layer QA Verification Survey Plate No. 2 in tabbed section at end of report). No adjustment was required at this one location; final adjustment was made during installation of the Topsoil Layer. Final approval of the Native Soil Layer occurred on August 4, 2009 (Section 3.4 and Table 3).

Based on the final survey data, the final in-place compacted volume of the Native Soil Layer is estimated at 17,300 cy.

5.5 Topsoil Layer

Construction of the Topsoil Layer was conducted from August 3 through August 12, 2009. Topsoil material consisted of topsoil (upper 6 inches of the in situ Borrow Pit Area soil) and native soil (soil from below 6 inches) excavated from the Borrow Pit, screened to 2-inch minus, then admixed with 3/8-inch crushed gravel, 25 percent by volume according to the specifications of Section 02200 in Appendix A of the CMIP (SNL/NM, November 2005). A Pug Mill was mobilized to the Borrow Pit Area in late June 2009 and then set up, calibrated, tested, and operated to blend 3/8-inch crushed gravel with the topsoil fill material. Pug Mill operations were conducted from July 6 through July 24, 2009. The gravel was delivered and stockpiled at the Borrow Pit just prior to and during the Pug Mill operation period.

Approximately 7,300 cy (loose) of topsoil material with 25 percent by volume, 3/8-inch crushed gravel were hauled from the Borrow Pit in 20-cy dump trucks and unloaded directly onto the MWL surface (approximately 5,500 cy of topsoil and 1,800 cy of 3/8 inch gravel). The material was spread with a JD 670 motor grader in a single, approximately 12-inch loose lift. Hubs and whiskers were used instead of grade stakes for the Topsoil Layer (blue top approach). No compaction was performed on the loose lift beyond that accomplished by the equipment placing the material to facilitate seedling growth and root development.

Visual inspections of the topsoil fill containing 25 percent by volume 3/8-inch crushed gravel were conducted throughout the installation by the CQA Inspector to verify that the topsoil fill conformed to the CMIP specifications. No organic matter, rubble, trash, rocks, or deleterious material greater than 2 inches in dimension was identified.

Due to the larger footprint of the as-constructed ET Cover (versus the 2005 CMIP design [SNL/NM, November 2005]), the toe of the cover slope on the west side extended to the three MWL groundwater monitoring well pads (MW-7 through MW-9) and two shallow vadose zone moisture monitoring access tube pads (MWL-VZ-1 and VZ-2). Soil drainage diversions immediately east (i.e., upslope) of the three monitoring well locations were constructed to create a localized east-west ridge (i.e., localize high point) parallel to the slope angle. These small ridges or high points divert water to the north and south of the monitoring well/access tube pads, protecting them from surface runoff. These features are shown in the 2009 as-built drawing (Figure No. 2, Mixed Waste Landfill Alternative Evapotranspirative Cover Site Plan, provided in a tabbed section at the end of this report) and represent a design change that was approved by the CQA Engineer as part of the Topsoil Layer.

The eastern perimeter boundary drainage swale that was designed to divert surface water run-on around the northern and southern ends of the final ET Cover was completed during Topsoil Layer installation and is shown in the 2009 as-built drawing (Figure No. 2, Mixed Waste Landfill Alternative Evapotranspirative Cover Site Plan, provided in a tabbed section at the end of this report).

Following CQC and CQA verification surveying that confirmed proper layer thickness and slope angles, the Topsoil Layer surface was ripped to loosen the soil and then tilled to break up larger soil clumps in preparation for seeding. The initial ripping was accomplished using scarifier shanks on the JD 670 motor grader. Additional surface preparations were conducted as part of the revegetation activities discussed in Section 5.6.

5.5.1 Laboratory and Field Testing

The laboratory and field-testing activities performed for the Topsoil Layer are discussed in Sections 4.3.1 and 4.3.2. The Gradation and Classification results verified that the topsoil fill material met the CMIP specifications (SNL/NM, November 2005) and were approved by the CQA Engineer. Laboratory results are presented in Tables 5 and 7 and field-testing results (not required by the CMIP) are presented in Table 10.

Although there were no in-place field density and moisture testing requirements for the Topsoil Layer, field tests were performed for the layer to document the compaction achieved prior to the revegetation effort. Four topsoil Standard Proctor samples were collected to support field testing. Four grid block locations were tested (CQC tests only) at two depths per location, for a total of eight in-place density and moisture tests ranging in depth from 4 to 10 inches. Percent of maximum dry density achieved ranged from 75 percent (at a 4-inch testing depth) to 96 percent (at an 8-inch testing depth), and the moisture content ranged from 3.7 to 5.4 percent.

5.5.2 Survey Verification and Approval

The thickness, surface slope, and side slopes of the Topsoil Layer were verified through both the CQC and CQA surveys using the 50-foot-spaced verification grid (Figure 18). The average thickness of the Topsoil Layer after placement was 1.02 feet, and the thickness at each grid point exceeded the minimum CMIP specification of 8 inches (Table 12). Correction of the side slope at the northwestern corner was verified by both the CQC and CQA surveys. The final CQC and CQA survey data, including the thickness and slopes (surface design and side slopes), were approved by the CQA Engineer on August 12, 2009 (Section 3.4 and Table 3).

Based on the final survey data, the final in-place volume of the Topsoil Layer is 5,400 cy.

5.6 Revegetation Activities and Administrative Security Fence Installation

Revegetation activities were initiated on August 12, 2009, with the installation of an aboveground sprinkler irrigation system that covered the entire surface of the MWL. Tilling, seeding, and crimping operations were conducted from August 19 through September 2, 2009, using a Kubota M7040 agricultural tractor. The tiller was towed by the tractor to till the soil on the cover, slopes, and surrounding area, which broke up the larger soil clumps present after the surface was ripped using scarifier shanks on the JD 670 motor grader. Tilling on side slopes was conducted perpendicular to the slope direction to minimize surface erosion and was completed on August 20, 2009. After tilling, personnel walked the site to break up clumps near irrigation piping that the tiller did not reach.

After rain delays, seeding operations began on August 25, 2009, and were completed on September 2, 2009. Based on recommendations from the SNL/NM Staff Biologist that were approved by the CQA Engineer on August 25, 2009 (Section 3.4 and Table 3), the following modifications were implemented to the Reclamation Seeding and Mulching Specification of the CMIP (SNL/NM, November 2005–Appendix A, Section 02930):

- Uniform seeding rate of 80 pounds of seed mix per acre (4 times the minimum specified rate of 20 pounds per acre)
- No fertilizer added due to timing of seeding
- Supplemental watering to assist seed germination and root development

The seed drill equipment set at the maximum output rate was capable of applying 20 pounds of seed mix per acre. At this rate, the seed drill equipment would have required a minimum of four passes to achieve the 80-pounds-per-acre requirement. This approach would have resulted in an unacceptable amount of compaction to the topsoil, so the decision was made and approved by the CQA Engineer to spread half of the seed by hand. The remaining seed was applied using two passes with the seed drill equipment. Following placement of seed, straw was blown over the site at the rate of 2 tons per acre and crimped in. Seed and mulch placement were approved by the CQA Engineer on September 2, 2009 (Section 3.4 and Table 3).

Supplemental watering of the seeded Topsoil Layer is not addressed in the CMIP and is not considered part of the alternative cover construction scope. The NMED was notified of the supplemental watering schedule and approach on August 13, 2009. On September 3, 2009, supplemental watering began using the aboveground irrigation system. Watering continued through October 20, 2009, to facilitate the establishment of a native plant community. Consistent with the NMED conditional approval of the CMIP (Bearzi, December 2008), detailed supplemental watering information will be included in the revised LTMMP for the MWL.

As seeding and mulching activities were being completed, the three-strand barbed wire administrative security fence was installed around the cover as specified in the CMIP (SNL/NM, November 2005–Appendix A, Section 02445) from August 31 through September 2, 2009. One access gate was placed at the northern end. Due to the slightly larger footprint of the as-constructed cover, the fence is positioned on the 6 to 1 side slope on the west side of the ET Cover, just east of three groundwater monitoring wells located on this side of the MWL. The location of the administrative security fence is shown in the 2009 As-Built Drawing No. 2 in a tabbed section at the end of this report.

The final CQA Engineer approval of revegetation occurred on September 2, 2009 (Section 3.4 and Table 3).

The Borrow Pit Area was graded for proper drainage from August 18 to August 24, 2009. It will be seeded and reclaimed during the 2010 growing season if it is not transferred to the SNL/NM Facilities organization for continued use as required by the CMIP. Documentation will be provided in the MWL LTMMP.

6.0 Monitoring Well (MWL-MW4) Extension

The outer protective casing and the well casing of groundwater monitoring well MWL-MW4 were raised on May 27, 2009, prior to installation of the ET Cover layers, as specified in the CMIP (SNL/NM, November 2005). The two casings were extended to a height approximately 3 feet above the estimated completion surface of the ET Cover assuming the overlying ET cover layers would meet the minimum thickness specifications. Because the three ET Cover layers were constructed with a thickness greater than the minimum specifications (Sections 5.3 through 5.5), the final height of the MWL-MW4 well casing above the surface of the completed ET Cover is approximately 1 foot, 4 inches, which is less than the minimum specification in the CMIP of 2 feet, 6 inches above the final grade of the constructed cover. The final height of the well casing was approved by the CQA Engineer as a design change instead of extending the well casings an additional 1 foot, 2 inches to meet the minimum specification because there were no adverse impacts to the cover quality or performance of the monitoring well. A new concrete well pad and protective bollards were installed around MWL-MW4 on August 13, 2009, after completion of the Topsoil Layer installation. A report summarizing the extension of monitoring well MWL-MW4 is provided in Attachment 8.

Two soil-vapor monitoring wells, required by the NMED and referred to as "soil-vapor sampling points" (Bearzi, December 2008), were installed from August 5 to August 7, 2009, during construction of the Topsoil Layer. The wells were installed through the Topsoil Layer prior to seeding and mulching activities to eliminate damage to both the surface and plants that would result from driving the drilling equipment over the Topsoil Layer surface after having seeded and mulched it. Although required by the NMED, installation of these soil-vapor monitoring wells is not part of cover construction requirements as defined in the CMIP (SNL/NM, November 2005); therefore, the soil-vapor monitoring well installation will be documented in a separate report to be submitted to the NMED for approval.

This page left intentionally blank.

7.0 Cover Layer Approvals and Design Changes

Documentation associated with the 2009 Quality Resolution Meetings and ET Cover layer approval is summarized in Sections 3.3 and 3.4, Table 3, and Attachments 1 and 2. Based upon the final CQC survey data (Table 12) and 2009 as-built drawings (Figures No. 2 and 3 in tabbed section at the end of this report), the final ET Cover surface meets the 2-percent east-to-west surface design slope, and all side slopes meet or exceed (i.e., are flatter) than the 6 to 1 specification. All cover layers were approved prior to starting construction of the next layer as stipulated in the CMIP CQA Plan (SNL/NM, November 2005–Appendix B).

Consistent with the CMIP CQA Plan, nonconformances are defined as deviations or changes to construction and/or design specifications that have an adverse impact on quality and therefore require a corrective action plan and documentation of corrective action implementation. Design changes are minor variances from construction and/or design specifications that do not have an adverse impact on quality and therefore do not require corrective action. However, design changes must be documented.

There were no ET Cover construction nonconformances. All design changes are summarized in Table 14, along with a brief explanation of why they had no adverse quality impact. For both the 2006 Subgrade and 2009 ET Cover Construction phases, all technical issues and design changes were addressed by the respective project teams and resolved through a team approach in documented meetings and project-specific approval forms as discussed in Chapter 3.0. The project teams included Sandia Oversight, CQA Team, and Construction Team representatives. The design changes were approved by the CQA Engineer and did not result in an adverse impact on the quality of the final cover. In all instances, the implemented design changes had a neutral or positive impact on ET Cover quality.

For the 2006 Subgrade construction activities, the compaction and in-place density and moisture field-testing approach for the existing MWL surface, supported by Standard Proctor results, provided a more quantitative approach for verifying adequate compaction than the CMIP-specified approach of “counting 10 passes of a roller with ballasted weight of 25 tons and a minimum tire pressure of 90 psi.” The overall relative uniformity of the Borrow Pit soil fill material, particularly after screening and stockpiling procedures, is demonstrated by the large number of Standard Proctor, Gradation, and Classification results collected throughout the 2006 and 2009 construction phases (Tables 4, 5, 6, and 7; Figure 20). These data support the conclusion that the existing MWL surface soil is very similar to the Borrow Pit soil. In addition, the data support the use of relatively few Proctors for the 2009 in-place density and moisture field-testing program, as well as the use of one Proctor to cover approximately 1,500 cy of soil fill during the 2006 Subgrade Construction phase field-testing program, as approved by the respective CQA Engineers.

On May 22, 2009, a Quality Resolution Meeting was held to discuss the 2009 existing Subgrade surface, which did not meet the 2-percent east-to-west surface design slope across the eastern side of the cover from the central portion to the southern end of the MWL (slopes ranged from 1.8 to 1.9 percent in this area). After evaluating the CQC survey data and discussing possible solutions, Sandia Oversight, Construction Team, and CQA Team representatives determined that the most technically sound and protective engineering solution was to make the surface slope correction (i.e., increase the elevation of the eastern side of the ET Cover surface) during construction of the Native Soil Layer.

Although it was recognized that adjusting the surface slope as part of Native Soil Layer construction would result in an exceedence of the upper tolerance thickness of 2.75 feet, the resulting layer and overall thicker ET Cover would be more protective, both as a physical barrier (between the surface and the waste) and a water storage layer (greater water storage capacity above the waste). The main design purpose of this layer is to act as a water storage reservoir retaining water until it can be removed by evapotranspiration. The thicker Native Soil Layer has a larger capacity for holding water. In addition to these advantages, establishing and/or maintaining the 2-percent surface design slope on the Biointrusion Layer surface would have been difficult due to the coarse, angular nature of the material (predominantly 4- to 6-inch crushed rock). Although the goal was to maintain the 2-percent surface design slope on each ET Cover layer, this slope is most important on the surface of the ET Cover (i.e., the Topsoil Layer) for the purpose of surface water drainage. After careful consideration, the project team agreed that making the 2-percent east-to-west surface design slope correction during Native Soil Layer construction was the best approach.

The issue of the Subgrade side slopes around the northern end of the MWL being steeper than the 6 to 1 ratio specified in the CMIP was also addressed at the Quality Resolution Meeting held on May 22, 2009. Because the side slopes of the Subgrade extend beyond the original MWL boundary, the decision was made and approved by the CQA Engineer to proceed with the Biointrusion Layer installation and correct both the surface design and northern end side slopes during the construction of the overlying layers. Adjusting the side slope angles to 6 to 1 as part of the Subgrade would have extended the overall ET Cover footprint well beyond the design footprint and required a considerable amount of additional biointrusion rock, as well as native soil and topsoil fill material. The groundwater monitoring wells on the west side of the MWL would have been significantly impacted, creating additional design change issues.

Table 15 compares the CMIP in-place, compacted soil and rock volume estimates to the as-constructed estimates based on the final CQC survey data (Table 12) and 2009 as-built drawings (Figures No. 2 and 3 in tabbed section at the end of this report). The as-constructed rock and soil volumes are approximately 27 percent greater than the CMIP estimates, in large part due to the final average thickness of each cover layer exceeding the minimum thickness specified in the CMIP (SNL/NM, November 2005), as discussed in Sections 5.2 through 5.5.

The CMIP cover layer volume estimates are based upon the minimum thickness specifications and assumed a compaction factor (i.e., reduction in volume from loose to compacted soil fill) of approximately 25 percent. The percent compaction achieved during construction appears to be approximately 30 percent instead of 25 percent as estimated in the CMIP based upon comparing loose volume estimates to compacted, in-place volume estimates. The main points related to this design change (i.e., thicker ET Cover that required more materials than estimated in the CMIP) are summarized as follows:

- The thicker overall ET Cover with a larger footprint was necessary to achieve the 2-percent east-to-west cover surface design slope and the 6 to 1 side slopes in accordance with the CMIP specifications and drawings.
- In all cases, the ET Cover layers were constructed to exceed the minimum thickness specifications to ensure a protective final ET Cover (i.e., a conservative construction approach).
- The as-constructed ET Cover is approximately 1.2 feet thicker than the CMIP design minimum thickness specifications, as shown schematically in Figure 4.
- The thicker, more protective final ET Cover was achievable within the estimated project budget and schedule.

The final as-constructed ET Cover meets or exceeds the CMIP (SNL/NM, November 2005) construction and design specifications. Although a higher cover profile does increase cover exposure to wind and water erosion, these factors are mitigated by the design surface and side slopes, as well as the long-term monitoring and maintenance requirements for the ET Cover that will be formalized in the MWL LTMMP.

This page left intentionally blank.

8.0 Conclusions

For the 2006 Subgrade Construction phase only, an independent MWL CQA Plan (SNL/NM, May 2006) was prepared that incorporated the regulatory guidance and design and specification requirements for the construction of the MWL cover as defined in the CMIP (SNL/NM, November 2005). For the 2009 ET Cover Construction phase, the CQA Plan in Appendix B of the CMIP (SNL/NM, November 2005) was used directly.

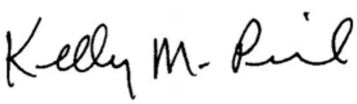
For both the 2006 and 2009 phases, a representative of the CQA team was at the site each workday to inspect and oversee construction activities and the field and laboratory testing. The results of the inspections and oversight are provided on the inspection forms, daily reports, and approval forms attached to this report. This report also presents a summary of the construction activities, CQC and CQA laboratory and field-testing results, CQC and CQA survey results, as-built drawings documenting cover construction, and photographic records of the activities.

All design changes are documented and were made in consultation between the Construction Team, Sandia Project Staff, and the CQA Team. Design changes did not result in an adverse impact on the quality of the final cover, were not considered nonconformances, and did not require corrective action. All cover layers were approved as stipulated by the CQA Plan in Appendix B of the CMIP (SNL/NM November 2005) prior to starting construction of the next layer, and all cover-related design changes resulted in a more protective cover. This report and the attachments provide the required documentation to verify that the MWL existing surface, Subgrade, ET Cover layers (Biointrusion, Native Soil, and Topsoil Layers), and site drainage features were prepared and installed in accordance with the CMIP (SNL/NM, November 2005) construction and design specifications. A New Mexico-registered Professional Engineer has certified that the MWL alternative cover construction was performed in accordance with the plans and specifications (Chapter 9.0).

This page left intentionally blank.

9.0 Engineering Certification

During construction of the 2006 Subgrade installation, I have performed tasks required of the CQA Engineer in accordance with the CQA Plan for the MWL Alternative Cover construction at SNL/NM (SNL/NM, May 2006). I certify that the MWL Subgrade has been prepared and constructed in accordance with construction plans and specifications provided in the MWL CMIP (SNL/NM, November 2005). I certify that to the best of my knowledge the "MWL Alternative Cover Construction, Subgrade, Draft Quality Assurance Report" (MKM, August 2007), which has been incorporated into this report, accurately documents the CQA activities conducted under my responsible charge as the CQA Engineer.



Kelly M. Peil, PhD, P.E.
MKM Engineers, Inc.

Title: CQA Certifying Engineer
Date: August 31, 2007

State: New Mexico

Registration No. 9718

During the construction of the 2009 ET Cover, I have performed tasks required of the CQA Engineer in accordance with the CQA Plan in Appendix B of the MWL CMIP (SNL/NM, November 2005). I was also involved in an oversight role during the 2006 Subgrade Construction phase and have reviewed the associated CQC and CQA data and documentation. I certify that both the 2006 Subgrade and the 2009 ET Cover for the MWL have been prepared and constructed in accordance with the construction plans, drawings, and specifications contained in the MWL CMIP (SNL/NM, November 2005), including Appendix A (MWL Landfill Alternative Cover Construction Specifications Revision 2 [July 29, 2005]) and Appendix B (CQA Plan). I certify that to the best of my knowledge this MWL Alternative Cover CQA Report accurately documents the construction, CQC, and CQA activities conducted under my responsible charge as the CQA Certifying Engineer.

Donald T. Lopez, PE
URS Group. Inc.

Title: CQA Certifying Engineer
Date: January 14, 2010

State: New Mexico

Registration No. 5122

10.0 References

ASTM International, 2005. "Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils," ASTM Method D4318-05, ASTM International, West Conshohocken, Pennsylvania.

ASTM International, 2006a. "Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates," ASTM Method C136-06, ASTM International, West Conshohocken, Pennsylvania.

ASTM International (ASTM), 2006b. "Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)," ASTM Method D 2487-06, ASTM International, West Conshohocken, Pennsylvania.

ASTM International, 2007a. "Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 [600 kN-m/m3])," ASTM Method D698-07, ASTM International, West Conshohocken, Pennsylvania.

ASTM International, 2007b. "Standard Test Method for Measurement of Hydraulic Conductivity of Porous Material Using a Rigid-Wall, Compaction-Mold Permeameter," ASTM Method D5856-95 (2007), ASTM International, West Conshohocken, Pennsylvania.

ASTM International, 2008. "Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)," ASTM Method D6938-08a (formerly ASTM Methods D2922 and D3017), ASTM International, West Conshohocken, Pennsylvania.

Bearzi J.P. (New Mexico Environment Department), September 2006. Letter to P. Wagner (U.S. Department of Energy) and P. Davies (Sandia Corporation), "Fence Removal and Subgrade Preparation, Sandia National Laboratories EPA ID #NM5890110518." September 18, 2006.

Bearzi, J.P. (New Mexico Environment Department), December 2008. Letter to K. Davis (U.S. Department of Energy) and F. Nimick (Sandia Corporation), "Conditional Approval, Mixed Waste Landfill Corrective Measures Implementation Plan, November 2005, Sandia National Laboratories NM5890110518, SNL-05-025." December 22, 2008.

Davis, K. (U.S. Department of Energy), February 2009. Letter to J. Bearzi (New Mexico Environment Department), submitting requested changes in the form of replacement pages in response to the Mixed Waste Landfill Conditional Approval letter from the New Mexico Environment Department dated December 22, 2008. February 12, 2009.

Davis, K. (U.S. Department of Energy), April 2009. Letter to J. Bearzi (New Mexico Environment Department), notifying the New Mexico Environment Department of the start of Mixed Waste Landfill Evapotranspirative Cover construction fieldwork. April 10, 2009.

MKM Engineers, Inc. (MKM), August 2007. "Mixed Waste Landfill Alternative Cover Construction, Subgrade, Draft Quality Assurance Report," prepared for Sandia National Laboratories by MKM Engineers, Inc. under subcontract to URS Group, Inc., Albuquerque, New Mexico.

New Mexico Environment Department (NMED), April 2004. "Compliance Order on Consent Pursuant to the New Mexico Hazardous Waste Act 74-4-10: Sandia National Laboratories Consent Order," New Mexico Environment Department, April 24, 2004.

New Mexico Environment Department (NMED), May 2005. "Final Order, State of New Mexico Before the Secretary of the Environment in the Matter of Request for a Class 3 Permit Modification for Corrective Measures for the Mixed Waste Landfill, Sandia National Laboratories, Bernalillo County, New Mexico," EPA ID #5890110518." May 26, 2005.

Sandia National Laboratories/New Mexico (SNL/NM), November 2005. "Mixed Waste Landfill Corrective Measures Implementation Plan," Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), May 2006. "MWL Cover Construction Quality Assurance Plan," Environmental Restoration Program, Sandia National Laboratories, Albuquerque, New Mexico.

Tables

Table 1
Summary of Mixed Waste Landfill Subgrade and ET Cover Construction Activities

Activity	Start	Finish	Description
2005 and 2006 Preparation Activities			
Biointrusion Rock Delivery	October 4, 2005	November 14, 2005	Approximately 8,100 tons (6,000 cubic yards) of biointrusion rock delivered to the Bulk Waste Staging Area.
Preconstruction Land Survey	May 10, 2006	May 10, 2006	Existing MWL site surface surveyed to document the preconstruction existing land surface. This survey used to construct the Subgrade and ET Cover as-built drawings.
MWL Borrow Pit Activities	June 14, 2006	July 17, 2006	Surface water and site controls were implemented and soil fill material for construction of the Subgrade and ET Cover layers was excavated, screened to 2-inch minus, and stockpiled.
Hauling Soil for Subgrade	July 31, 2006	November 5, 2006	Screened soil fill stockpiled at the MWL Borrow Pit was hauled and stockpiled at the MWL site for Subgrade construction.
2006 Subgrade Construction Activities			
Existing Land Surface Preparation	October 2, 2006	October 26, 2006	Site security fence was removed, MWL site surface water controls were implemented, and the existing MWL surface was cleared of vegetation, graded, watered, compacted, and field tested.
Subgrade Construction	October 27, 2006	December 21, 2006	Subgrade constructed in 12 lifts to create the central crown and 2% east-to-west design slope over the MWL. Laboratory and field testing conducted for each lift. Final survey completed in April 2007.
Subgrade Protective Measures	April 3, 2007	April 11, 2007	Erosion matting installed over the completed Subgrade surface as a protective measure due to delay in NMED-approval of CMIP and ET Cover implementation. Eastern surface drainage swale and erosion control matting inspected and approved by the CQA Engineer on April 11.
2009 ET Cover Construction Activities			
Mobilization and Training	May 11, 2009	May 18, 2009	Resources, equipment, and office trailer mobilized to site and personnel training completed. Installed new perimeter boundary, silt fence, and drive-off pad. Removed administrative fence.
Subgrade Layer	May 20, 2009	May 22, 2009	Cleared vegetation, watered and compacted surface, and performed field testing and verification survey. Subgrade approved on May 22.

Table 1 (cont'd.)

Summary of Mixed Waste Landfill Subgrade and ET Cover Construction Activities

Activity	Start	Finish	Description
2009 ET Cover Construction Activities (cont'd.)			
Biointrusion Layer	May 26, 2009	June 16, 2009	Construction tests conducted on May 26. Hauled and placed existing rock to create 1.25-foot-thick layer, then placed dry, loose soil on top to fill voids and create a thin soil layer above the rock (~3 inches). New rock material hauled directly to site from vendor June 8-12 to complete installation. Verification surveys for thickness of rock layer performed in 3 phases (South, Northwest, Northeast) to allow installation of the overlying thin soil layer to proceed concurrently with Biointrusion Layer installation. Entire Biointrusion Layer approved on June 15, and thin soil layer approved on June 17.
MW4 Extension	May 27, 2009	August 13, 2009	Well casing and protective outer steel casing extended to accommodate surface elevation increase associated with construction of the cover. Concrete pad and well bollards installed on August 13.
Native Soil Layer	June 15, 2009	August 4, 2009	Placed and compacted soil in lifts for side slopes (June 16-22) and cover surface (June 18-August 4). Constructed side slopes to 6 to 1 ratio around north end June 16-22. Construction of Native Soil Layer on cover surface did not proceed until thin soil layer approval on June 17. Wedge lifts used to establish 2% east-to-west surface design slope on cover surface. Verification surveys performed for thickness and slopes – Native Soil Layer approved on August 4.
Borrow Pit Area Activities	June 12, 2009	July 24, 2009	Excavated and screened (2-inch minus) additional soil fill material, including SWPPP berm soil excavated and hauled to the Borrow Pit from the MWL site. Pug Mill operations set up and calibrated to blend topsoil and 3/8-inch crushed gravel – blending performed July 6-24.
Soil-Vapor Monitoring Points	August 6, 2009	August 7, 2009	Two soil-vapor monitoring points (MWL-SV1 and -SV2) installed through the ET Cover to an approximate depth of 35 feet below the original ground surface. Concrete pad and well bollards installed on August 13, 2009.
Topsoil Layer	August 3, 2009	August 12, 2009	Placed topsoil on cover and side slopes, verification survey performed for thickness and slopes – Topsoil Layer approved on August 12. Then surface was ripped and tilled in preparation for seeding. Topsoil not placed on the Native Soil Layer in 9 locations that required final adjustment until they were approved on August 4.
Seeding and Mulching	August 19, 2009	September 2, 2009	Tilled and drill-seeded entire cover surface, side slopes, and disturbed areas. Approximately ½ the seed was hand-broadcasted to minimize compaction caused by multiple passes with the tractor. After rain delays, seeding began on August 25 and the final step of crimping straw mulch into surface was completed and approved on September 2.

Table 1 (cont'd.)

Summary of Mixed Waste Landfill Subgrade and ET Cover Construction Activities

Activity	Start	Finish	Description
2009 ET Cover Construction Activities (cont'd.)			
Supplemental Watering	August 12, 2009	October 20, 2009	Temporary irrigation system set up and tested August 12 through September 2. System operated from September 3 through October 20 to help establish native vegetation.
Administrative Fence	August 31, 2009	September 2, 2009	Perimeter administrative security fence installed around MWL.
Grading and Revegetation of the Borrow Pit	August 18, 2009	August 24, 2009	Borrow Pit Area graded for proper drainage from August 18-24. Will be seeded and reclaimed during the 2010 growing season if it is not transferred to SNL/NM Facilities for continued use.

CMIP = Corrective Measures Implementation Plan
CQA = Construction Quality Assurance.
ET = Evapotranspirative
MWL = Mixed Waste Landfill
NMED = New Mexico Environment Department
SNL/NM = Sandia National Laboratories/New Mexico
SWPPP = Storm Water Pollution Prevention Program

Table 2
Summary of CQA Personnel Qualifications
Mixed Waste Landfill ET Cover Construction Project

Position	Individual(s)	Qualifications
2006 Subgrade Construction		
CQA Engineer	Kelly Peil, PhD, P.E.	Employed by MKM Engineers, Inc.; registered Professional Engineer in the State of New Mexico.
CQA Inspector	Corey Woods, E.I.T.	Employed by MKM Engineers, Inc.; experienced in performing appropriate field tests and making observations during construction activities.
CQA Certifying Engineer	Kelly Peil, PhD, P.E.	Employed by MKM Engineers, Inc.; registered Professional Engineer in the State of New Mexico.
2009 ET Cover Construction		
CQA Certifying Engineer	Donald T. Lopez, PE	Employed by URS Group, Inc.; registered Professional Engineer in the State of New Mexico.
CQA Inspector	Paul Molina, E.I.T.	Employed by URS Group, Inc.; experienced in performing appropriate field tests and making observations during construction activities.
CQA Engineers	Harry Buckner, P.E.	Employed by URS Group, Inc.; experienced in land surveying and is a registered Professional Engineer in the State of New Mexico.
	Marshall W. Nay, PhD, P.E., PLS	Employed by URS Group, Inc.; registered Professional Engineer in the State of New Mexico.

CQA = Construction Quality Assurance
ET = Evapotranspirative

Table 3
Mixed Waste Landfill 2009 ET Cover Construction
Quality Resolution Meetings and Cover Layer Approval

Date	Meeting[1]/Form	Topic	Comments
Existing Subgrade			
5/22/2009	Quality Resolution	Approval of Subgrade	QA and QC moisture/density testing results and QC survey reviewed and approved by the CQA Engineer. Subgrade approved - construction of the Biointrusion Layer may proceed.
5/22/2009	*APPROVAL FORM*	*Subgrade Approval Form AP# 001*	*Subgrade surface approved. See approval form in Attachment 2 for additional information.*
Biointrusion Layer			
5/26/2009	Quality Resolution	Construction field tests and thickness verification	Biointrusion Layer installation method determination and decision to place all of rock prior to adding dry, loose soil to surface to fill voids.
5/26/2009	*APPROVAL FORM*	*Biointrusion Rock, Installation Procedure, and Thickness Verification Approval Form AP# 002*	*Biointrusion rock, installation procedure, and thickness verification requirement approved. See approval form in Attachment 2 for additional information.*
6/1/2009	Quality Resolution	QC survey and QA verification survey coordination	50-foot verification grid system established.
6/4/2009	Quality Resolution	Rock volume and thickness issues	Additional rock required to complete the Biointrusion Layer. Thickness of the layer in relation to the construction method and nature of rock material was addressed.
6/5/2009	Quality Resolution	QA verification survey and approval for soil placement on the Biointrusion Layer surface	South portion of Biointrusion Layer approved - placement of soil over the rock can proceed except at 4 grid points on the west slope at the south end. Thickness at these points will be adjusted and resurveyed prior to approval.
6/5/2009	*APPROVAL FORM*	*Biointrusion Thickness Approval Form AP# 003*	*Biointrusion Layer thickness approved (South). See approval form in Attachment 2 for additional information.*
6/8/2009	*APPROVAL FORM*	*Additional Biointrusion Rock Approval Form AP# 004*	*Additional Biointrusion Layer rock approved. See approval form in Attachment 2 for additional information.*
6/9/2009	Quality Resolution	QA verification survey and approval for soil placement on the Biointrusion Layer surface	The thickness at the 4 points on the west slope at south end adjusted, resurveyed, and approved – placement of soil over the rock at these 4 grid points approved. Northwest portion of Biointrusion Layer approved except for 2 points on the north slope that will be adjusted, resurveyed, and approved prior to placement of soil.
6/9/2009	*APPROVAL FORM*	*Biointrusion Thickness Approval Form AP# 005*	*Biointrusion Layer thickness approved (Northwest and South corrections). See approval form in Attachment 2 for additional information.*

Table 3 (cont'd.)
Mixed Waste Landfill 2009 ET Cover Construction
Quality Resolution Meetings and Cover Layer Approval

Date	Meeting[1]/Form	Topic	Comments
Biointrusion Layer (cont'd.)			
6/10/2009	Quality Resolution	Biointrusion Layer east-to-west surface design slope	Discussion whether to use the thin soil layer covering the Biointrusion Layer or the actual Biointrusion Layer rock surface as the new datum for establishing the 2% east-to-west surface design slope. It was decided the 2% surface design slope would be corrected during construction of the Native Soil and Topsoil Layers.
6/15/2009	Quality Resolution	QA verification survey and approval for soil placement on the Biointrusion Layer surface	Northeast portion of Biointrusion Layer approved – placement of soil over the rock can proceed. 2 points on the north slope at the northwest end of the Biointrusion Layer were corrected, resurveyed, and approved – placement of soil over the rock at these 2 points approved.
6/15/2009	*APPROVAL FORM*	*Biointrusion Layer Approval Form AP# 006*	*Biointrusion Layer (Northeast and Northwest corrections) approved. Entire Biointrusion Layer approved, see approval form in Attachment 2 for additional information.*
Thin Soil Layer above Biointrusion Layer			
6/16/2009	Quality Resolution	Biointrusion Layer and overlying thin soil layer thickness, construction of Native Soil Layer, establishing a new datum for the 2% east-to-west surface design slope, establishing the 6:1 side slopes, and K-sat testing	Thin soil layer over Biointrusion Layer to be new construction datum. Thin soil layer thickness to be a nominal 3 inches or less. Native Soil Layer construction procedure (using wedge lifts) to establish the 2% east-to-west surface design slope and 6:1 side slopes. K-sat testing requirements and potential schedule impacts discussed and clarified.
6/17/2009	Quality Resolution	QC survey of thin soil layer overlying the Biointrusion Layer and 2% surface design slope correction.	Review and approval of the thin soil layer QC survey results (average 3 inches thick). Correction of the 2% east-to-west surface design slope to be implemented using wedge lifts.
6/17/2009	*APPROVAL FORM*	*Biointrusion Layer/Thin Soil Layer Approval Form AP# 007*	*Thin soil layer overlying the Biointrusion Layer approved. See approval form in Attachment 2 for additional information.*
Native Soil Layer			
6/22/2009	Quality Resolution	Review of QC survey for Wedge Lifts 1 and 2, construction approach for Polishing Lifts 3 and 4, and QA density/moisture retest	Review and approval of Wedge Lifts 1 and 2. Approach for constructing Polishing Lifts 3 and 4 developed. QA density/moisture retest and approval of North Side Slope Lift 8.
6/22/2009	*APPROVAL FORM*	*Wedge Lifts 1 and 2 Approval Form AP# 008*	*Wedge Lifts 1 and 2 approved. See approval form in Attachment 2 for additional information.*

Table 3 (cont'd.)
Mixed Waste Landfill 2009 ET Cover Construction
Quality Resolution Meetings and Cover Layer Approval

Date	Meeting[1]/Form	Topic	Comments
Native Soil Layer (cont'd.)			
6/30/2009	Quality Resolution	QC survey results for Polishing Lifts 3 and 4	QC survey results reviewed and Native Soil Polishing Lifts 3 and 4 approved. Installation of Native Soil Lift 5 approved.
6/30/2009	*APPROVAL FORM*	*Polishing Lifts 3 and 4 Approval Form AP# 009*	*Polishing Lifts 3 and 4 approved. See approval form in Attachment 2 for additional information.*
7/1/2009	Quality Resolution	Lift 5 low area	Low area on east side of Grid Block 7 located. Procedure to address consistent with CMIP developed and implemented. Area resurveyed and confirmed prior to installing Lift 6.
7/14/2009	Quality Resolution	Soil fill material shortfall for Native and Topsoil Layers addressed - QA review of EDi soil volume estimates for additional material needed	Stockpiled soil fill material based on CMIP estimates is not sufficient to complete construction of the Native Soil and Topsoil Layers. QA review of EDi additional soil material estimates completed, and path forward resolved.
7/30/2009	Quality Resolution	Native Soil Layer QA and QC verification surveys	Review of Native Soil QA and QC verification survey. Native Soil Layer approved with the exception of 9 locations to be corrected, resurveyed, and approved.
7/30/2009	*APPROVAL FORM*	*Native Soil Layer Approval Form AP# 010*	*Native Soil Layer thickness approval except for 9 locations requiring adjustment. See approval form in Attachment 2 for additional information.*
8/4/2009	Quality Resolution	Native Soil Layer Final QA and QC verification surveys	Corrections at the 9 grid points that required correction reviewed and verified.
8/4/2009	*APPROVAL FORM*	*Native Soil Layer Approval Form AP# 011*	*Final Native Soil Layer approval, including 9 grid point corrections, 2% east-to-west surface design slope, and 6:1 side slopes. See approval form in Attachment 2 for additional information.*
Topsoil Layer			
6/25/2009	Quality Resolution	Review of sieve results for available 3/8-inch crushed gravel to admix with topsoil fill material	No available aggregate met specifications for percent passing through the #4 sieve. Aggregate approved by the CQA Engineer in the formal submittal process.
8/12/2009	Quality Resolution	Topsoil Layer QA and QC verification surveys	QA and QC verification survey results reviewed and the Topsoil Layer approved.
8/12/2009	*APPROVAL FORM*	*Topsoil Layer Approval Form AP# 012*	*Topsoil Layer approved. See approval form in Attachment 2 for additional information.*
Reclamation Seeding and Mulching			
8/19/2009	Quality Resolution	Seed and mulch material inspections and elimination of starter fertilizer	Seed was visually inspected, labels checked, and approved. Mulch also approved. Elimination of fertilizer approved.

Table 3 (cont'd.)
Mixed Waste Landfill 2009 ET Cover Construction
Quality Resolution Meetings and Cover Layer Approval

Date	Meeting[1]/Form	Topic	Comments
Reclamation Seeding and Mulching (cont'd.)			
8/25/2009	Quality Resolution	Increased seeding rate and application method	Approval of increased seeding rate (from 20 to 80 pounds per acre) and placement method (hand-broadcasting combined with drill-seeding).
8/25/2009	*APPROVAL FORM*	*Seed, Fertilizer, and Mulch Approval Form AP# 013*	*Increased seeding rate and method, elimination of starter fertilizer, and mulch approved. See approval form in Attachment 2 for additional information.*
9/2/2009	Quality Resolution	Inspection and approval of the seeding and mulch	QA approval of seed and mulch as placed on Topsoil Layer.
9/2/2009	*APPROVAL FORM*	*Reclamation Seeding and Mulching Approval Form AP# 014*	*Seed and mulch placement approved based on visual inspection. See approval form in Attachment 2 for additional information.*

[1] All Quality Resolution Meetings are documented in Attachment 1.
CQA = Construction Quality Assurance
EDi = Environmental Dimensions, Inc.
ET = Evapotranspirative
QA = Quality assurance
QC = Quality control

Table 4
Mixed Waste Landfill 2006 Subgrade Construction
Standard Proctor CQC Laboratory Results

Test Number	Date Sampled	Description	Gradation/ Classification Meet Specification[1]	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Testing Laboratory[2]
MWL-ES-001	10/2/2006	Existing Surface	NA[3]	115.5	13.4	AMEC
MWL-ES-002	10/27/2006	Existing Surface	NA[3]	116.5	11.5	AMEC
MWL-ES-003	10/27/2006	Existing Surface	NA[3]	114.5	11.7	AMEC
MWL-ES-004	10/27/2006	Existing Surface	NA[3]	114.1	14.2	AMEC
MWL-SG-001	10/2/2006	Subgrade Stockpile	YES	113.2	10.9	AMEC
MWL-SG-002	10/31/2006	Subgrade Stockpile	YES	113.3	13.2	AMEC
MWL-SG-003	10/31/2006	Subgrade Stockpile	YES	117.4	12.9	AMEC
MWL-SG-004	10/31/2006	Subgrade Stockpile	YES	118.3	12.7	AMEC
MWL-SG-005	11/2/2006	Subgrade Stockpile	YES	116.7	12.9	AMEC
MWL-SG-006	11/2/2006	Subgrade Stockpile	YES	119.6	11.0	AMEC
MWL-SG-007	11/2/2006	Subgrade Stockpile	YES	115.4	12.9	AMEC
MWL-SG-008	11/8/2006	Subgrade Stockpile	YES	116.6	12.8	AMEC
MWL-SG-009	11/8/2006	Subgrade Stockpile	YES	113.6	12.9	AMEC
MWL-SG-010	11/8/2006	Subgrade Stockpile	YES	113.6	12.6	AMEC
MWL-SG-011[4]	11/14/2006	Existing Soil	YES	121.2	10.0	AMEC
MWL-SG-012[4]	11/14/2006	Existing Soil	YES	121.5	9.6	AMEC
MWL-SG-013	11/14/2006	Subgrade Stockpile	YES	116.0	12.3	AMEC
MWL-SG-014	11/16/2006	Subgrade Stockpile	YES	117.9	13.0	AMEC
MWL-SG-015	11/16/2006	Subgrade Stockpile	YES	116.7	12.9	AMEC
MWL-SG-016[5]	11/20/2006	Subgrade Stockpile	YES	116.4	13.2	AMEC
MWL-SG-017[5]	11/20/2006	Subgrade Stockpile	YES	116.2	13.1	AMEC
MWL-SG-018[5]	11/20/2006	Subgrade Stockpile	YES	120.1	11.6	AMEC
MWL-SG-019	11/27/2006	Stockpile at Borrow Area[6]	YES	112.4	13.6	AMEC
MWL-SG-020	11/27/2006	Stockpile at Borrow Area	YES	118.4	12.7	AMEC
MWL-SG-021	11/27/2006	Stockpile at Borrow Area	YES	119.0	12.0	AMEC
MWL-SG-022	12/5/2006	Newly Excavated Soils[7]	YES	115.9	12.2	AMEC
MWL-SG-023	12/12/2006	Newly Excavated Soils[7]	YES	117.9	12.1	AMEC
MWL-SG-024	12/12/2006	Newly Excavated Soils[7]	YES	116.7	11.8	AMEC
MWL-SG-025	12/14/2006	Newly Excavated Soils[7]	YES	114.1	12.8	AMEC
MWL-SG-026[8]	12/14/2006	Newly Excavated Soils[7]	YES	113.8	13.5	AMEC

[1] Gradation and Classification results are on same laboratory cover sheet with Standard Proctor results in Attachment 7.
[2] Testing laboratory is AMEC Earth & Environmental, Albuquerque, New Mexico (AMEC).
[3] NA = not applicable; there was no gradation specification for the existing surface.
[4] These samples were collected from TA-3 soil that was stockpiled at the MWL prior to Subgrade construction activities. Although the soil met the gradation/classification specifications, it was not used during Subgrade construction. This soil was later used during 2009 ET Cover construction.
[5] These samples were collected but the results were not used; previous samples were sufficient to cover the soil volume used for Subgrade construction.
[6] This soil was excavated and screened along with the initial subgrade material but was not hauled to the MWL until needed.
[7] This soil was excavated and screened after start of Subgrade installation due to additional volume needs.
[8] Proctor not used; soil volume related to Proctor not used until 2009 ET Cover construction.
CQC = Construction Quality Control
lb/ft^3 = pounds per cubic foot

Table 5
Mixed Waste Landfill 2009 ET Cover Construction
Standard Proctor CQC Laboratory Results

Test Number	Date Sampled	Description	Gradation/ Classification Meet Specification[1]	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Testing Laboratory[2]
SNL MWL 052009-1	5/20/2009	Native Soil	YES	116.7	10.6	AMEC
SNL MWL 052009-2	5/20/2009	Native Soil	YES	119.1	10.3	AMEC
SNL MWL 052009-3	5/20/2009	Native Soil	YES	119.3	10.3	AMEC
SNL MWL 052909-4	5/29/2009	Native Soil	YES	117.0	12.0	AMEC
SNL MWL 052909-5	5/29/2009	Native Soil	YES	115.7	12.6	AMEC
SNL MWL 052909-6	5/29/2009	Native Soil	YES	116.2	12.8	AMEC
SNL MWL 052909-7	5/29/2009	Native Soil	YES	115.8	12.3	AMEC
SNL MWL 052909-8	5/29/2009	Native Soil	YES	117.0	12.0	AMEC
SNL MWL 060909-9	6/9/2009	Native Soil	YES	116.2	12.5	AMEC
SNL MWL 060909-10	6/9/2009	Native Soil	YES	113.2	13.5	AMEC
SNL MWL 060909-11	6/9/2009	Native Soil	YES	112.2	14.6	AMEC
SNL MWL 060909-12	6/9/2009	Native Soil	YES	113.9	13.6	AMEC
SNL MWL 060909-13	6/9/2009	Native Soil	YES	115.9	12.3	AMEC
SNL MWL 062409-14	6/24/2009	Native Soil	YES	114.7	13.3	AMEC
SNL MWL 062409-15	6/24/2009	Native Soil	YES	117.7	11.8	AMEC
SNL MWL 062409-16	6/24/2009	Native Soil	YES	116.6	12.4	AMEC
SNL MWL 062409-17	6/24/2009	Native Soil	YES	116.9	11.0	AMEC
SNL MWL 062409-18	6/24/2009	Native Soil	YES	117.6	11.6	AMEC
SNL MWL 062909-19	6/29/2009	Native Soil	YES	117.7	12.0	AMEC
SNL MWL 062909-20	6/29/2009	Native Soil	YES	116.9	12.2	AMEC
SNL MWL 062909-21	6/29/2009	Native Soil	NO	115.9	12.7	AMEC
SNL MWL 062909-22	6/29/2009	Native Soil	YES	117.8	11.8	AMEC
SNL MWL 062909-23	6/29/2009	Native Soil	YES	116.6	11.6	AMEC
SNL MWL 062909-24	6/29/2009	Native Soil	YES	117.7	11.3	AMEC
SNL MWL 063009-25	6/30/2009	Native Soil	YES	118.4	11.7	AMEC
SNL MWL 063009-26	6/30/2009	Native Soil	YES	118.0	11.8	AMEC
SNL MWL 063009-27	6/30/2009	Native Soil	YES	118.3	11.2	AMEC
SNL MWL 063009-28	6/30/2009	Native Soil	YES	118.1	10.8	AMEC
SNL MWL 063009-29	6/30/2009	Native Soil	YES	118.2	11.6	AMEC
SNL MWL 063009-30	6/30/2009	Native Soil	YES	117.8	12.5	AMEC
SNL MWL Berm-1[3]	6/30/2009	Native Soil	YES	115.0	10.0	AMEC
SNL MWL Berm-2[3]	6/30/2009	Native Soil	YES	117.0	10.4	AMEC
SNL MWL Berm-3[3]	6/30/2009	Native Soil	YES	116.2	10.2	AMEC
SNL MWL Berm-4	7/10/2009	Native Soil	YES	117.8	11.1	AMEC
SNL MWL Berm-5	7/10/2009	Native Soil	YES	117.0	11.1	AMEC
SNL MWL Berm-6	7/14/2009	Native Soil	YES	116.2	12.3	AMEC

Table 5 (cont'd.)
Mixed Waste Landfill 2009 MWL ET Cover Construction
Standard Proctor CQC Laboratory Results

Test Number	Date Sampled	Description	Gradation/ Classification Meet Specification[1]	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Testing Laboratory[2]
SNL MWL Berm-7	7/14/2009	Native Soil	YES	116.6	12.7	AMEC
SNL MWL Berm-8	7/14/2009	Native Soil	YES	118.6	11.3	AMEC
SNL MWL Berm-9	7/16/2009	Native Soil	YES	114.6	13.0	AMEC
SNL MWL Berm-10	7/16/2009	Native Soil	YES	116.0	11.2	AMEC
SNL MWL Berm-11	7/16/2009	Native Soil	YES	115.3	13.2	AMEC
SNL MWL Berm-12	7/16/2009	Native Soil	YES	117.7	12.1	AMEC
SNL MWL Berm-13	7/16/2009	Native Soil	YES	115.0	13.0	AMEC
SNL MWL Berm-14	7/16/2009	Native Soil	YES	114.2	13.5	AMEC
SNL MWL Berm-15	7/16/2009	Native Soil	YES	115.9	11.3	AMEC
SNL MWL Berm-16	7/16/2009	Native Soil	YES	116.0	14.4	AMEC
SNL MWL Berm-17	7/23/2009	Native Soil	YES	114.9	15.0	AMEC
SNL MWL Berm-18	7/23/2009	Native Soil	YES	114.7	11.6	AMEC
SNL MWL Berm-19	7/23/2009	Native Soil	YES	117.5	10.9	AMEC
SNL MWL 060209-4	6/2/2009	Topsoil	YES	118.9	9.6	AMEC
SNL MWL 060209-6	6/2/2009	Topsoil	YES	116.2	10.9	AMEC
SNL MWL 071009-8	7/10/2009	Topsoil	YES	117.8	11.8	AMEC
SNL MWL 071409-10	7/14/2009	Topsoil	YES	118.0	11.2	AMEC

[1] Gradation and Classification results are presented in Tables 6 and 7, and are on same laboratory cover sheet with Standard Proctor results in Attachment 7.
[2] Testing laboratory is AMEC Earth & Environmental, Albuquerque, New Mexico (AMEC).
[3] Sample identification number on laboratory data sheet in Attachment 7 incorrectly spells 'berm' as 'burm' for these samples.
CQC = Construction Quality Control
ET = Evapotranspirative
lb/ft^3 = Pounds per cubic foot
MWL = Mixed Waste Landfill

Table 6
Mixed Waste Landfill 2009 ET Cover Construction
Native Soil Layer Gradation and Classification CQC Laboratory Results

Test Number	Date Sampled	Material Description	% Passing Sieve Size						Soil Classification
			3/4 inch	1/2 inch	3/8 inch	#10	#40	#200	
SNL MWL 052009-1	5/20/2009	Native Soil Stockpile[1]	100	100	100	95	87	34	SC-SM
SNL MWL 052009-2	5/20/2009	Native Soil Stockpile[1]	100	98	97	90	81	26	SC-SM
SNL MWL 052009-3	5/20/2009	Native Soil Stockpile[1]	100	98	98	90	82	26	SC-SM
SNL MWL 052909-4	5/29/2009	Native Soil Stockpile[1]	99	98	98	90	81	31	SM
SNL MWL 052909-5	5/29/2009	Native Soil Stockpile[1]	98	98	97	92	86	36	SC-SM
SNL MWL 052909-6	5/29/2009	Native Soil Stockpile[1]	100	100	99	96	90	38	SC
SNL MWL 052909-7	5/29/2009	Native Soil Stockpile[1]	100	100	100	96	90	37	SC-SM
SNL MWL 052909-8	5/29/2009	Native Soil Stockpile[1]	99	99	98	94	87	32	SC-SM
SNL MWL 060909-9	6/9/2009	Native Soil Stockpile[1]	99	99	98	93	87	36	SC
SNL MWL 060909-10	6/9/2009	Native Soil Stockpile[1]	100	100	99	95	88	38	SC
SNL MWL 060909-11	6/9/2009	Native Soil Stockpile[1]	99	99	98	94	88	29	SC-SM
SNL MWL 060909-12	6/9/2009	Native Soil Stockpile[1]	100	100	99	94	87	35	SC-SM
SNL MWL 060909-13	6/9/2009	Native Soil Stockpile[1]	100	100	99	93	86	27	SC-SM
SNL MWL 062409-14	6/24/2009	Native Soil Stockpile[1]	100	100	100	95	89	38	SC-SM
SNL MWL 062409-15	6/24/2009	Native Soil Stockpile[1]	100	100	99	95	89	35	SC-SM
SNL MWL 062409-16	6/24/2009	Native Soil Stockpile[1]	100	100	99	93	86	33	SM
SNL MWL 062409-17	6/24/2009	Native Soil Stockpile[1]	100	100	100	95	88	33	SM
SNL MWL 062409-18	6/24/2009	Native Soil Stockpile[1]	100	100	100	93	86	33	SM
SNL MWL 062909-19	6/29/2009	Native Soil Stockpile[1]	99	98	97	93	86	33	SC-SM
SNL MWL 062909-20	6/29/2009	Native Soil Stockpile[1]	100	100	100	96	90	36	SC-SM
SNL MWL 062909-21	6/29/2009	Native Soil Stockpile[1]	100	99	98	93	86	**41**	SC-SM
SNL MWL 062909-22	6/29/2009	Native Soil Stockpile[1]	100	100	100	96	90	36	SM
SNL MWL 062909-23	6/29/2009	Native Soil Stockpile[1]	100	99	99	93	88	36	SM
SNL MWL 062909-24	6/29/2009	Native Soil Stockpile[1]	100	100	99	94	88	34	SC-SM
SNL MWL 063009-25	6/30/2009	Native Soil Stockpile[1]	99	98	98	92	86	34	SC-SM
SNL MWL 063009-26	6/30/2009	Native Soil Stockpile[1]	99	98	97	93	87	36	SC-SM
SNL MWL 063009-27	6/30/2009	Native Soil Stockpile[1]	98	97	96	91	85	32	SM
SNL MWL 063009-28	6/30/2009	Native Soil Stockpile[1]	100	100	99	95	88	33	SM
SNL MWL 063009-29	6/30/2009	Native Soil Stockpile[1]	100	99	99	94	88	33	SM
SNL MWL 063009-30	6/30/2009	Native Soil Stockpile[1]	100	100	99	96	91	39	SC-SM
SNL MWL Berm-1[2]	6/30/2009	Native Soil Excavated[3]	100	99	99	96	92	30	SM
SNL MWL Berm-2[2]	6/30/2009	Native Soil Excavated[3]	99	98	97	92	86	27	SM

Table 6 (cont'd.)
Mixed Waste Landfill 2009 ET Cover Construction Phase CQC
Native Soil Layer Gradation and Classification Laboratory Results

Test Number	Date Sampled	Material Description	% Passing Sieve Size						Soil Classification
			3/4 inch	1/2 inch	3/8 inch	#10	#40	#200	
SNL MWL Berm-3[2]	6/30/2009	Native Soil Excavated[3]	99	97	96	91	86	26	SM
SNL MWL Berm-4	7/10/2009	Native Soil Excavated	100	100	100	97	90	28	SC-SM
SNL MWL Berm-5	7/10/2009	Native Soil Excavated[3]	100	98	97	91	85	24	SM
SNL MWL Berm-6	7/14/2009	Native Soil Excavated[3]	100	100	100	95	88	32	SM
SNL MWL Berm-7	7/14/2009	Native Soil Excavated[3]	100	99	99	94	88	32	SC-SM
SNL MWL Berm-8	7/14/2009	Native Soil Excavated[3]	100	100	99	95	89	36	SC-SM
SNL MWL Berm-9	7/16/2009	Native Soil Excavated[3]	100	99	99	97	92	38	SC-SM
SNL MWL Berm-10	7/16/2009	Native Soil Excavated[3]	100	100	99	95	90	30	SM
SNL MWL Berm-11	7/16/2009	Native Soil Excavated[3]	100	100	100	96	91	36	SC-SM
SNL MWL Berm-12	7/16/2009	Native Soil Excavated[3]	100	99	98	94	89	32	SC-SM
SNL MWL Berm-13	7/16/2009	Native Soil Excavated[3]	100	100	99	94	89	37	SC
SNL MWL Berm-14	7/16/2009	Native Soil Excavated[3]	100	99	99	97	92	34	SM
SNL MWL Berm-15	7/16/2009	Native Soil Excavated[3]	100	100	100	97	92	37	SC-SM
SNL MWL Berm-16	7/16/2009	Native Soil Excavated[3]	100	100	99	96	90	34	SC-SM
SNL MWL Berm-17	7/23/2009	Native Soil Excavated[3]	100	98	98	93	87	34	SM
SNL MWL Berm-18	7/23/2009	Native Soil Excavated[3]	97	95	94	91	86	26	SM
SNL MWL Berm-19	7/23/2009	Native Soil Excavated[3]	100	100	100	97	92	34	SM

[1] Native soil excavated, screened to 2-inch minus, and stockpiled in 2006.
[2] Sample identification number on laboratory data sheet incorrectly spells 'berm' as 'burm' for these samples.
[3] Native soil excavated, screened to 2-inch minus, and stockpiled during 2009 ET Cover construction.

Table 7
Mixed Waste Landfill 2009 ET Cover Construction
Topsoil Gradation and Classification CQC Laboratory Results

Test Number	Date Sampled	Material Description[1]	% Passing Sieve Size						Soil Classification	Gradation/Classification Meet Specification
			3/4 inch	1/2 inch	3/8 inch	#10	#40	#200		
SNL MWL -060209-1	6/2/2009	Topsoil excavated and screened in 2006	100	100	100	98	92	32	SM	YES
SNL MWL -060209-2	6/2/2009	Topsoil excavated and screened in 2006	100	100	100	94	86	29	SM	YES
SNL MWL -060209-3	6/2/2009	Topsoil excavated and screened in 2006	100	100	100	98	93	33	SM	YES
SNL MWL -060209-4	6/2/2009	Topsoil excavated and screened in 2006	100	100	100	98	91	30	SM	YES
SNL MWL -060209-5	6/2/2009	Topsoil excavated and screened in 2006	100	100	100	97	90	30	SM	YES
SNL MWL -060209-6	6/2/2009	Topsoil excavated and screened in 2006	100	100	99	96	90	31	SM	YES
SNL MWL -071009-7	7/10/2009	Topsoil excavated and screened in 2009 from west side of borrow area	100	100	100	97	92	27	SM	YES
SNL MWL 071009-8	7/10/2009	Topsoil excavated and screened in 2009 from west site of borrow area	100	99	99	95	89	21	SM	YES
SNL MWL 071009-9	7/10/2009	Topsoil excavated and screened in 2009 from west side of borrow area	100	100	99	96	90	26	SM	YES
SNL MWL 071409-10	7/14/2009	Topsoil excavated and screened in 2009 from west side of borrow area	100	99	99	95	89	31	SM	YES
SNL MWL 071609-11	7/16/2009	Topsoil excavated and screened in 2009 from west side of borrow area	100	100	100	98	94	36	SC-SM	YES
SNL MWL 071609-12	7/23/2009	Topsoil excavated and screened in 2009 from south side of borrow area	100	100	100	96	90	29	SM	YES

[1] All samples of topsoil fill were collected prior to mixing with 3/8 inch crushed gravel.

Table 8
Mixed Waste Landfill 2009 ET Cover Construction
Saturated Hydraulic Conductivity CQC Laboratory Results

Sample Description	Location	Date Sampled	Compaction	Average Saturated Hydraulic Conductivity[1] (K_{sat}) in cm/s[2]
Native Soil Wedge Lift 1	Grid Block 8	6/19/2009	90.0%	**4.02E-04**
Native Soil Wedge Lift 2	Grid Block 11	6/22/2009	89.0%	**3.58E-05**
Native Soil Lift 3-1	Collected Prior to Placement	6/17/2009	90.2%	**1.59E-06**
Native Soil Lift 3-2	Collected Prior to Placement	6/17/2009	89.7%	**1.81E-06**
Native Soil Lift 3-3	Collected Prior to Placement	6/17/2009	91.0%	**1.98E-06**
Native Soil Lift 4	Grid Block 2	6/30/2009	84.6%	**2.52E-04**
Native Soil Lift 4	Grid Block 6	6/30/2009	81.2%	**1.87E-04**
Native Soil Lift 4	Grid Block 9	6/30/2009	89.8%	**2.14E-04**
Native Soil Lift 5	Grid Block 1	7/9/2009	90.0%	**2.66E-04**
Native Soil Lift 5	Grid Block 4 Retest	7/8/2009	95.3%	**1.43E-04**
Native Soil Lift 5	Grid Block 8 Retest	7/8/2009	94.6%	**1.63E-04**
Native Soil Lift 6-1	Grid Block 3	7/16/2009	90.2%	**3.05E-04**
Native Soil Lift 6-2	Grid Block 6	7/16/2009	90.3%	**3.51E-04**
Native Soil Lift 6-3	Grid Block 12	7/16/2009	89.5%	**2.55E-04**
Native Soil Lift 7	Grid Block 1 Retest	7/20/2009	94.8%	**2.18E-04**
Native Soil Lift 7	Grid Block 5 Retest	7/20/2009	94.8%	**1.87E-04**
Native Soil Lift 7	Grid Block 13	7/22/2009	89.5%	**2.50E-04**
Native Soil Lift 8	Grid Block 2	7/27/2009	90.4%	**1.22E-06**
Native Soil Lift 8	Grid Block 7	7/27/2009	90.0%	**1.23E-06**
Native Soil Lift 8	Grid Block 9	7/27/2009	90.0%	**1.36E-06**
Average			**90.2%**	**1.62E-04**
Geometric Mean			**90.2%**	**4.72E-05**
Median			**90.0%**	**1.87E-04**

[1] Minimum Value is 4.6E-04.
[2] Tests were performed using ASTM D5856 Rigid Wall Method.
CQC = Construction Quality Control
ET = Evapotranspirative

Table 9
Mixed Waste Landfill 2006 Subgrade Construction
In-Place Density and Moisture Content CQC Field Results

Test Number	Date of Field Test	Description	Location	Standard Proctor Maximum Density (lb/ft^3)[1]	Standard Proctor Optimum Moisture Content (%)	Percent of Maximum Density Required	Percent Compaction Achieved	Moisture Content Achieved	Meets Density Specification	Meets Moisture Specification	Testing Laboratory[3]
MWL-ES1-001	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA[2]	90.1	13.8	NA[2]	NA[2]	AMEC
MWL-ES1-002	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	96.8	7.5	NA	NA	AMEC
MWL-ES1-003	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	95.4	7.8	NA	NA	AMEC
MWL-ES1-004	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	91.8	10.2	NA	NA	AMEC
MWL-ES1-005	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	92.5	7.1	NA	NA	AMEC
MWL-ES1-006	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	93.3	7.4	NA	NA	AMEC
MWL-ES1-007	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	96.1	9.5	NA	NA	AMEC
MWL-ES1-008	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	93.7	10.6	NA	NA	AMEC
MWL-ES1-009	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	94.1	8.0	NA	NA	AMEC
MWL-ES1-010	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	89.6	11.9	NA	NA	AMEC
MWL-ES1-011	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	93.2	8.4	NA	NA	AMEC
MWL-ES1-012	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	>100	8.1	NA	NA	AMEC
MWL-ES1-013	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	98.9	8.8	NA	NA	AMEC
MWL-ES1-014	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	95.4	8.8	NA	NA	AMEC
MWL-ES1-015	10/27/2006	Existing Soil Surface	Figure 5	115.5	13.4	NA	95.1	11.9	NA	NA	AMEC
MWL-SG1-001	10/31/2006	Subgrade Lift 1	Figure 6	113.2	10.9	90	100.0	9.1	YES	YES	AMEC
MWL-SG1-002	10/31/2006	Subgrade Lift 1	Figure 6	113.2	10.9	90	99.6	9.8	YES	YES	AMEC
MWL-SG2-001	10/31/2006	Subgrade Lift 2	Figure 7	113.2	10.9	90	97.7	11.1	YES	YES	AMEC
MWL-SG2-002	10/31/2006	Subgrade Lift 2	Figure 7	113.2	10.9	90	99.8	10.6	YES	YES	AMEC
MWL-SG3-001	10/31/2006	Subgrade Lift 3	Figure 8	113.2	10.9	90	94.3	10.0	YES	YES	AMEC
MWL-SG3-002	10/31/2006	Subgrade Lift 3	Figure 8	113.2	10.9	90	93.0	10.6	YES	YES	AMEC
MWL-SG3-003	10/31/2006	Subgrade Lift 3	Figure 8	113.2	10.9	90	99.8	10.0	YES	YES	AMEC
MWL-SG3-004	10/31/2006	Subgrade Lift 3	Figure 8	113.2	10.9	90	96.8	10.7	YES	YES	AMEC
MWL-SG3-005	10/31/2006	Subgrade Lift 3	Figure 8	113.2	10.9	90	100.0	9.0	YES	YES	AMEC
MWL-SG4-001	10/31/2006	Subgrade Lift 4	Figure 9	113.2	10.9	90	93.8	10.7	YES	YES	AMEC

Table 9 (cont'd.)
Mixed Waste Landfill 2006 Subgrade Construction
In-Place Density and Moisture Content CQC Field Results

Test Number	Date of Field Test	Description	Location	Standard Proctor Maximum Density (lb/ft^3)[1]	Standard Proctor Optimum Moisture Content (%)	Percent of Maximum Density Required	Percent Compaction Achieved	Moisture Content Achieved	Meets Density Specification	Meets Moisture Specification	Testing Laboratory[3]
MWL-SG4-002	10/31/2006	Subgrade Lift 4	Figure 9	113.2	10.9	90	94.3	10.5	YES	YES	AMEC
MWL-SG4-003	11/1/2006	Subgrade Lift 4	Figure 9	113.2	10.9	90	91.0	11.1	YES	YES	AMEC
MWL-SG4-004	11/1/2006	Subgrade Lift 4	Figure 9	113.2	10.9	90	98.2	9.6	YES	YES	AMEC
MWL-SG4-005	11/2/2006	Subgrade Lift 4	Figure 9	113.2	10.9	90	90.4	8.9	YES	YES	AMEC
MWL-SG5-001	11/1/2006	Subgrade Lift 5	Figure 10	113.2	10.9	90	96.1	10.2	YES	YES	AMEC
MWL-SG6-001	11/2/2006	Subgrade Lift 6	Figure 11	113.2	10.9	90	100.0	9.2	YES	YES	AMEC
MWL-SG6-002	11/2/2006	Subgrade Lift 6	Figure 11	113.2	10.9	90	97.6	11.0	YES	YES	AMEC
MWL-SG6-003	11/2/2006	Subgrade Lift 6	Figure 11	113.2	10.9	90	95.0	12.1	YES	YES	AMEC
MWL-SG7-001	11/6/2006	Subgrade Lift 7	Figure 12	113.3	13.2	90	96.9	11.2	YES	YES	AMEC
MWL-SG8-001	11/7/2006	Subgrade Lift 8	Figure 13	113.3	13.2	90	98.4	11.5	YES	YES	AMEC
MWL-SG8-002	11/7/2006	Subgrade Lift 8	Figure 13	113.3	13.2	90	94.8	11.5	YES	YES	AMEC
MWL-SG8-003	11/7/2006	Subgrade Lift 8	Figure 13	113.3	13.2	90	92.1	12.5	YES	YES	AMEC
MWL-SG9-001	11/7/2006	Subgrade Lift 9	Figure 14	117.4	12.9	90	91.6	14.2	YES	YES	AMEC
MWL-SG9-002	11/7/2006	Subgrade Lift 9	Figure 14	117.4	12.9	90	96.9	11.0	YES	YES	AMEC
MWL-SG9-003	11/7/2006	Subgrade Lift 9	Figure 14	117.4	12.9	90	93.8	11.0	YES	YES	AMEC
MWL-SG9-004	11/8/2006	Subgrade Lift 9	Figure 14	117.4	12.9	90	92.3	12.7	YES	YES	AMEC
MWL-SG9-005	11/9/2006	Subgrade Lift 9	Figure 14	118.3	12.7	90	95.7	11.7	YES	YES	AMEC
MWL-SG10-001	11/9/2006	Subgrade Lift 10	Figure 15	118.3	12.7	90	94.0	13.8	YES	YES	AMEC
MWL-SG10-002	11/9/2006	Subgrade Lift 10	Figure 15	118.7	12.4	90	93.3	11.3	YES	YES	AMEC
MWL-SG10-003	11/9/2006	Subgrade Lift 10	Figure 15	118.7	12.4	90	91.2	11.7	YES	YES	AMEC
MWL-SG10-004	11/14/2006	Subgrade Lift 10	Figure 15	119.6	11.2	90	94.4	9.6	YES	YES	AMEC
MWL-SG10-005	11/14/2006	Subgrade Lift 10	Figure 15	119.6	11.2	90	98.2	9.6	YES	YES	AMEC
MWL-SG10-006	11/14/2006	Subgrade Lift 10	Figure 15	119.6	11.2	90	94.4	12.5	YES	YES	AMEC
MWL-SG10-007	11/14/2006	Subgrade Lift 10	Figure 15	119.6	11.2	90	95.8	9.4	YES	YES	AMEC
MWL-SG10-008	11/14/2006	Subgrade Lift 10	Figure 15	119.6	11.2	90	98.7	10.9	YES	YES	AMEC
MWL-SG10-009	11/14/2006	Subgrade Lift 10	Figure 15	115.4	12.9	90	92.3	13.9	YES	YES	AMEC
MWL-SG10-010	11/14/2006	Subgrade Lift 10	Figure 15	115.4	12.9	90	99.1	12.4	YES	YES	AMEC
MWL-SG11-001	11/15/2006	Subgrade Lift 11	Figure 16	115.4	12.9	90	99.3	11.8	YES	YES	AMEC
MWL-SG11-002	11/15/2006	Subgrade Lift 11	Figure 16	115.4	12.9	90	97.8	14.2	YES	YES	AMEC
MWL-SG11-003	11/16/2006	Subgrade Lift 11	Figure 16	116.5	13.0	90	93.5	14.1	YES	YES	AMEC
MWL-SG11-004	11/16/2006	Subgrade Lift 11	Figure 16	116.5	13.0	90	98.4	11.5	YES	YES	AMEC
MWL-SG11-005	11/16/2006	Subgrade Lift 11	Figure 16	116.5	13.0	90	98.2	12.7	YES	YES	AMEC

Table 9 (cont'd.)
Mixed Waste Landfill 2006 Subgrade Construction
In-Place Density and Moisture Content CQC Field Results

Test Number	Date of Field Test	Description	Location	Standard Proctor Maximum Density (lb/ft³)[1]	Standard Proctor Optimum Moisture Content (%)	Percent of Maximum Density Required	Percent Compaction Achieved	Moisture Content Achieved	Meets Density Specification	Meets Moisture Specification	Testing Laboratory[3]
MWL-SG11-006	11/16/2006	Subgrade Lift 11	Figure 16	113.5	13.0	90	93.9	11.8	YES	YES	AMEC
MWL-SG11-007	11/16/2006	Subgrade Lift 11	Figure 16	113.5	13.0	90	99.6	14.1	YES	YES	AMEC
MWL-SG11-008	11/16/2006	Subgrade Lift 11	Figure 16	113.5	13.0	90	100.0	12.6	YES	YES	AMEC
MWL-SG11-009	11/20/2006	Subgrade Lift 11	Figure 16	113.5	13.0	90	100.0	14.1	YES	YES	AMEC
MWL-SG11-010	11/20/2006	Subgrade Lift 11	Figure 16	113.5	13.0	90	96.3	12.0	YES	YES	AMEC
MWL-SG11-011	11/21/2006	Subgrade Lift 11	Figure 16	113.6	12.6	90	96.8	14.3	YES	YES	AMEC
MWL-SG11-012	11/21/2006	Subgrade Lift 11	Figure 16	113.6	12.6	90	100.0	11.8	YES	YES	AMEC
MWL-SG11-013	11/21/2006	Subgrade Lift 11	Figure 16	113.6	12.6	90	92.9	13.7	YES	YES	AMEC
MWL-SG11-014	11/21/2006	Subgrade Lift 11	Figure 16	113.6	12.6	90	93.7	12.3	YES	YES	AMEC
MWL-SG11-015	11/21/2006	Subgrade Lift 11	Figure 16	116.0	12.3	90	97.8	10.7	YES	YES	AMEC
MWL-SG11-016	11/21/2006	Subgrade Lift 11	Figure 16	116.0	12.3	90	98.4	11.6	YES	YES	AMEC
MWL-SG11-017	11/21/2006	Subgrade Lift 11	Figure 16	116.0	12.3	90	97.2	13.9	YES	YES	AMEC
MWL-SG11-018	11/22/2006	Subgrade Lift 11	Figure 16	116.0	12.3	90	100.0	13.2	YES	YES	AMEC
MWL-SG12-001	11/30/2006	Subgrade Lift 12	Figure 17	117.9	13.0	90	93.2	12.2	YES	YES	AMEC
MWL-SG12-002	11/30/2006	Subgrade Lift 12	Figure 17	117.9	13.0	90	96.9	11.7	YES	YES	AMEC
MWL-SG12-003	11/30/2006	Subgrade Lift 12	Figure 17	118.1	13.3	90	99.7	11.8	YES	YES	AMEC
MWL-SG12-004	11/30/2006	Subgrade Lift 12	Figure 17	118.1	13.3	90	99.1	12.2	YES	YES	AMEC
MWL-SG12-005	12/5/2006	Subgrade Lift 12	Figure 17	118.4	12.7	90	100.0	12.3	YES	YES	AMEC
MWL-SG12-006	12/5/2006	Subgrade Lift 12	Figure 17	118.4	12.7	90	94.6	12.4	YES	YES	AMEC
MWL-SG12-007	12/7/2006	Subgrade Lift 12	Figure 17	112.4	13.6	90	100.0	13.1	YES	YES	AMEC
MWL-SG12-008	12/7/2006	Subgrade Lift 12	Figure 17	112.4	13.6	90	100.0	14.1	YES	YES	AMEC
MWL-SG12-009	12/7/2006	Subgrade Lift 12	Figure 17	119.0	12.0	90	94.4	13.6	YES	YES	AMEC
MWL-SG12-010	12/7/2006	Subgrade Lift 12	Figure 17	119.0	12.0	90	92.8	11.9	YES	YES	AMEC
MWL-SG12-011	12/13/2006	Subgrade Lift 12	Figure 17	115.9	12.2	90	99.1	10.8	YES	YES	AMEC
MWL-SG12-012	12/13/2006	Subgrade Lift 12	Figure 17	115.9	12.2	90	97.6	12.1	YES	YES	AMEC
MWL-SG12-013	12/15/2006	Subgrade Lift 12	Figure 17	115.9	12.2	90	96.9	12.3	YES	YES	AMEC
MWL-SG12-014	12/15/2006	Subgrade Lift 12	Figure 17	117.9	12.1	90	96.0	13.7	YES	YES	AMEC
MWL-SG12-015	12/18/2006	Subgrade Lift 12	Figure 17	117.9	12.1	90	92.2	14.0	YES	YES	AMEC
MWL-SG12-016	12/18/2006	Subgrade Lift 12	Figure 17	117.9	12.1	90	94.2	13.1	YES	YES	AMEC

[1] lb/ft³ = Pounds per cubic foot.
[2] NA = Not applicable; there were no Maximum Density and Moisture Content specifications for the existing surface.
[3] AMEC = AMEC Earth & Environmental, Albuquerque, New Mexico.

Table 10
Mixed Waste Landfill 2009 ET Cover Construction
In-Place Density and Moisture Content CQC Field Results

Test Number	Date of Field Test	Description	Location[1]	Standard Proctor Maximum Density (lb/ft^3)[2]	Standard Proctor Optimum Moisture Content (%)	Percent of Maximum Density Required	Percent Compaction Achieved	Moisture Content Achieved	Meets Density Spec?	Meets Moisture Spec?	Testing Laboratory[3]
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 1[4]	120.1	11.6	90%	97	11.4	YES	YES	AMEC
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 2[4]	120.1	11.6	90%	99	9.8	YES	YES	AMEC
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 3[4]	120.1	11.6	90%	100	9.8	YES	YES	AMEC
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 4[4]	120.1	11.6	90%	100	9.9	YES	YES	AMEC
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 5[4]	120.1	11.6	90%	98	11.6	YES	YES	AMEC
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 6[4]	120.1	11.6	90%	98	10.5	YES	YES	AMEC
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 7[4]	120.1	11.6	90%	100	10.2	YES	YES	AMEC
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 8[4]	120.1	11.6	90%	98	11.5	YES	YES	AMEC
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 9[4]	120.1	11.6	90%	98	9.7	YES	YES	AMEC
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 10[4]	120.1	11.6	90%	96	11.6	YES	YES	AMEC
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 11[4]	120.1	11.6	90%	99	9.8	YES	YES	AMEC
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 12[4]	120.1	11.6	90%	97	10.2	YES	YES	AMEC
EDi Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 13[4]	120.1	11.6	90%	98	10.2	YES	YES	AMEC
EDi North Slope Lift 1	6/17/2009	North Slope, Lift 1	North Side Slope[5]	120.1	11.6	90%	97	11.2	YES	YES	AMEC
EDi North Slope Lift 2	6/17/2009	North Slope, Lift 2	North Side Slope[5]	120.1	11.6	90%	99	10.8	YES	YES	AMEC
EDi North Slope Lift 3	6/17/2009	North Slope, Lift 3	North Side Slope[5]	120.1	11.6	90%	97	11.8	YES	YES	AMEC
EDi North Slope Lift 4	6/17/2009	North Slope, Lift 4	North Side Slope[5]	120.1	11.6	90%	95	12.7	YES	YES	AMEC
EDi North Slope Lift 5	6/18/2009	North Slope, Lift 5	North Side Slope[5]	120.1	11.6	90%	97	11.8	YES	YES	AMEC
EDi North Slope Lift 6	6/18/2009	North Slope, Lift 6	North Side Slope[5]	120.1	11.6	90%	99	11.1	YES	YES	AMEC
EDi North Slope Lift 7	6/19/2009	North Slope, Lift 7	North Side Slope[5]	115.8	12.3	90%	93	14.3	YES	YES	AMEC
EDi North Slope Lift 8	6/19/2009	North Slope, Lift 8	North Side Slope[5]	115.8	12.3	90%	93	14.2	YES	YES	AMEC
EDi East Slope Lift 1	6/17/2009	East Slope, Lift 1	East Side Slope[5]	120.1	11.6	90%	97	11.0	YES	YES	AMEC
EDi East Slope Lift 2	6/17/2009	East Slope, Lift 2	East Side Slope[5]	120.1	11.6	90%	97	11.2	YES	YES	AMEC
EDi East Slope Lift 3	6/17/2009	East Slope, Lift 3	East Side Slope[5]	120.1	11.6	90%	97	12.2	YES	YES	AMEC
EDi East Slope Lift 4	6/17/2009	East Slope, Lift 4	East Side Slope[5]	120.1	11.6	90%	98	11.3	YES	YES	AMEC
EDi East Slope Lift 5	6/18/2009	East Slope, Lift 5	East Side Slope[5]	120.1	11.6	90%	96	11.3	YES	YES	AMEC
EDi East Slope Lift 6	6/18/2009	East Slope, Lift 6	East Side Slope[5]	120.1	11.6	90%	99	11.7	YES	YES	AMEC
EDi West Slope Lift 1	6/17/2009	West Slope, Lift 1	West Side Slope[5]	120.1	11.6	90%	96	11.7	YES	YES	AMEC
EDi West Slope Lift 2	6/17/2009	West Slope, Lift 2	West Side Slope[5]	120.1	11.6	90%	98	11.8	YES	YES	AMEC
EDi West Slope Lift 3	6/17/2009	West Slope, Lift 3	West Side Slope[5]	120.1	11.6	90%	96	11.1	YES	YES	AMEC
EDi West Slope Lift 4	6/17/2009	West Slope, Lift 4	West Side Slope[5]	120.1	11.6	90%	97	11.1	YES	YES	AMEC
EDi West Slope Lift 5	6/18/2009	West Slope, Lift 5	West Side Slope[5]	120.1	11.6	90%	97	11.3	YES	YES	AMEC

Table 10 (cont'd.)
Mixed Waste Landfill 2009 ET Cover Construction
In-Place Density and Moisture Content CQC Field Results

Test Number	Date of Field Test	Description	Location[1]	Standard Proctor Maximum Density (lb/ft^3)[2]	Standard Proctor Optimum Moisture Content (%)	Percent of Maximum Density Required	Percent Compaction Achieved	Moisture Content Achieved	Meets Density Spec?	Meets Moisture Spec?	Testing Laboratory[3]
EDi West Slope Lift 6	6/18/2009	West Slope, Lift 6	West Side Slope[5]	120.1	11.6	90%	98	11.9	YES	YES	AMEC
EDi Dog Leg Lift 1	6/18/2009	Lift 1 on Dog Leg	Dog Leg Side Slope[5]	120.1	11.6	90%	97	11.9	YES	YES	AMEC
EDi Dog Leg Lift 2	6/18/2009	Lift 2 on Dog Leg	Dog Leg Side Slope[5]	120.1	11.6	90%	97	11.1	YES	YES	AMEC
EDi Wedge Lift 1	6/19/2009	Native Soil Lift 1	Grid Block 7	115.8	12.3	90%	96	11.1	YES	YES	AMEC
EDi Wedge Lift 1	6/19/2009	Native Soil Lift 1	Grid Block 8	115.8	12.3	90%	97	12.4	YES	YES	AMEC
EDi Wedge Lift 1	6/19/2009	Native Soil Lift 1	Grid Block 11	115.8	12.3	90%	94	12.2	YES	YES	AMEC
EDi Wedge Lift 2	6/19/2009	Native Soil Lift 2	Grid Block 7	115.8	12.3	90%	97	11.7	YES	YES	AMEC
EDi Wedge Lift 2	6/19/2009	Native Soil Lift 2	Grid Block 8	115.8	12.3	90%	96	10.6	YES	YES	AMEC
EDi Wedge Lift 2	6/19/2009	Native Soil Lift 2	Grid Block 11	115.8	12.3	90%	96	11.5	YES	YES	AMEC
EDi NS Lift 3	6/23/2009	Native Soil Lift 3	Grid Block 1	115.8	12.3	90%	100	10.7	YES	YES	AMEC
EDi NS Lift 3	6/23/2009	Native Soil Lift 3	Grid Block 2	115.8	12.3	90%	100	10.3	YES	YES	AMEC
EDi NS Lift 3	6/24/2009	Native Soil Lift 3	Grid Block 6	117.0	12.0	90%	97	11.6	YES	YES	AMEC
EDi NS Lift 3	6/24/2009	Native Soil Lift 3	Grid Block 8	117.0	12.0	90%	95	10.9	YES	YES	AMEC
EDi NS Lift 3	6/26/2009	Native Soil Lift 3	Grid Block 11 SE	117.0	12.0	90%	99	11.4	YES	YES	AMEC
EDi NS Lift 3	6/26/2009	Native Soil Lift 3	Grid Block 11 NE	117.0	12.0	90%	91	12.4	YES	YES	AMEC
EDi NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 1	117.0	12.0	90%	100	13.8	YES	YES	AMEC
EDi NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 2	117.0	12.0	90%	98	11.6	YES	YES	AMEC
EDi NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 3	117.0	12.0	90%	94	13.8	YES	YES	AMEC
EDi NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 4	117.0	12.0	90%	97	12.4	YES	YES	AMEC
EDi NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 5	117.0	12.0	90%	97	12.9	YES	YES	AMEC
EDi NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 6	117.0	12.0	90%	100	13.5	YES	YES	AMEC
EDi NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 7	117.0	12.0	90%	99	11.6	YES	YES	AMEC
EDi NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 8	117.0	12.0	90%	100	12.7	YES	YES	AMEC
EDi NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 9	117.0	12.0	90%	100	12.0	YES	YES	AMEC
EDi NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 10	117.0	12.0	90%	97	12.0	YES	YES	AMEC
EDi NS Lift 4	6/29/2009	Native Soil Lift 4	Grid Block 11	117.0	12.0	90%	98	10.1	YES	YES	AMEC
EDi NS Lift 4	6/29/2009	Native Soil Lift 4	Grid Block 12	117.0	12.0	90%	96	13.1	YES	YES	AMEC
EDi NS Lift 4	6/29/2009	Native Soil Lift 4	Grid Block 13	117.0	12.0	90%	97	10.9	YES	YES	AMEC
EDi NS Lift 5	7/7/2009	Native Soil Lift 5	Grid Block 1	117.0	12.0	90%	94	12.3	YES	YES	AMEC
EDi NS Lift 5 Retest[6]	7/9/2009	Native Soil Lift 5	Grid Block 1	117.0	12.0	90%	95	10.9	YES	YES	AMEC
EDi NS Lift 5	7/7/2009	Native Soil Lift 5	Grid Block 2	117.0	12.0	90%	91	6.8	YES	**NO**	AMEC
EDi NS Lift 5 Retest[6]	7/9/2009	Native Soil Lift 5	Grid Block 2	117.0	12.0	90%	100	10.5	YES	YES	AMEC

Table 10 (cont'd.)
Mixed Waste Landfill 2009 ET Cover Construction
In-Place Density and Moisture Content CQC Field Results

Test Number	Date of Field Test	Description	Location[1]	Standard Proctor Maximum Density (lb/ft^3)[2]	Standard Proctor Optimum Moisture Content (%)	Percent of Maximum Density Required	Percent Compaction Achieved	Moisture Content Achieved	Meets Density Spec?	Meets Moisture Spec?	Testing Laboratory[3]
EDi NS Lift 5	7/7/2009	Native Soil Lift 5	Grid Block 3	117.0	12.0	90%	89	12.2	**NO**	YES	AMEC
EDi NS Lift 5 Retest[6]	7/9/2009	Native Soil Lift 5	Grid Block 3	117.0	12.0	90%	99	12.2	YES	YES	AMEC
EDi NS Lift 5	7/7/2009	Native Soil Lift 5	Grid Block 4	117.0	12.0	90%	95	11.9	YES	YES	AMEC
EDi NS Lift 5 Retest[6]	7/9/2009	Native Soil Lift 5	Grid Block 4	117.0	12.0	90%	100	12.1	YES	YES	AMEC
EDi NS Lift 5	7/7/2009	Native Soil Lift 5	Grid Block 5	117.0	12.0	90%	89	6.9	**NO**	**NO**	AMEC
EDi NS Lift 5 Retest[6]	7/9/2009	Native Soil Lift 5	Grid Block 5	117.0	12.0	90%	99	13.5	YES	YES	AMEC
EDi NS Lift 5	7/2/2009	Native Soil Lift 5	Grid Block 6	117.0	12.0	90%	100	13.4	YES	YES	AMEC
EDi NS Lift 5	7/1/2009	Native Soil Lift 5	Grid Block 7 East Edge[7]	117.0	12.0	90%	89	7.1	**NO**	**NO**	AMEC
EDi NS Lift 5 Retest[6]	7/1/2009	Native Soil Lift 5	Grid Block 7 East Edge[7]	117.0	12.0	90%	96	10.3	YES	YES	AMEC
EDi NS Lift 5	7/2/2009	Native Soil Lift 5	Grid Block 7	117.0	12.0	90%	96	13.6	YES	YES	AMEC
EDi NS Lift 5	7/2/2009	Native Soil Lift 5	Grid Block 8	117.0	12.0	90%	97	10.8	YES	YES	AMEC
EDi NS Lift 5	7/2/2009	Native Soil Lift 5	Grid Block 9	117.0	12.0	90%	98	11.9	YES	YES	AMEC
EDi NS Lift 5	7/2/2009	Native Soil Lift 5	Grid Block 10	117.0	12.0	90%	94	11.1	YES	YES	AMEC
EDi NS Lift 5	7/1/2009	Native Soil Lift 5	Grid Block 11	117.0	12.0	90%	91	10.2	YES	YES	AMEC
EDi NS Lift 5	7/1/2009	Native Soil Lift 5	Grid Block 12	117.0	12.0	90%	96	11.5	YES	YES	AMEC
EDi NS Lift 5	7/1/2009	Native Soil Lift 5	Grid Block 13	117.0	12.0	90%	95	12.1	YES	YES	AMEC
EDi NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 1	117.0	12.0	90%	97	14.0	YES	YES	AMEC
EDi NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 2	117.0	12.0	90%	96	14.0	YES	YES	AMEC
EDi NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 3	117.0	12.0	90%	99	10.2	YES	YES	AMEC
EDi NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 4	117.0	12.0	90%	94	10.1	YES	YES	AMEC
EDi NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 5	117.0	12.0	90%	99	12.5	YES	YES	AMEC
EDi NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 6	117.0	12.0	90%	94	10.7	YES	YES	AMEC
EDi NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 7	117.0	12.0	90%	91	10.0	YES	YES	AMEC
EDi NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 8	117.0	12.0	90%	100	11.6	YES	YES	AMEC
EDi NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 9	117.0	12.0	90%	100	12.4	YES	YES	AMEC
EDi NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 10	117.0	12.0	90%	100	10.5	YES	YES	AMEC
EDi NS Lift 6	7/14/2009	Native Soil Lift 6	Grid Block 11	117.0	12.0	90%	99	10.9	YES	YES	AMEC
EDi NS Lift 6	7/14/2009	Native Soil Lift 6	Grid Block 12	117.0	12.0	90%	99	12.7	YES	YES	AMEC
EDi NS Lift 6	7/14/2009	Native Soil Lift 6	Grid Block 13	117.0	12.0	90%	99	13.2	YES	YES	AMEC
EDi NS Lift 6	7/17/2009	Native Soil Lift 6	MW-4	117.0	12.0	90%	94	9.6	YES	**NO**	AMEC
EDi NS Lift 6 Retest[6]	7/21/2009	Native Soil Lift 6	MW-4	117.0	12.0	90%	91	10.3	YES	YES	AMEC
EDi NS Lift 7	7/22/2009	Native Soil Lift 7	Grid Block 1	117.0	12.0	90%	94	13.7	YES	YES	AMEC

Table 10 (cont'd.)
Mixed Waste Landfill 2009 ET Cover Construction
In-Place Density and Moisture Content CQC Field Results

Test Number	Date of Field Test	Description	Location[1]	Standard Proctor Maximum Density (lb/ft^3)[2]	Standard Proctor Optimum Moisture Content (%)	Percent of Maximum Density Required	Percent Compaction Achieved	Moisture Content Achieved	Meets Density Spec?	Meets Moisture Spec?	Testing Laboratory[3]
EDi NS Lift 7	7/22/2009	Native Soil Lift 7	Grid Block 2	117.0	12.0	90%	96	13.6	YES	YES	AMEC
EDi NS Lift 7	7/22/2009	Native Soil Lift 7	Grid Block 3	117.0	12.0	90%	94	11.4	YES	YES	AMEC
EDi NS Lift 7	7/22/2009	Native Soil Lift 7	Grid Block 4	117.0	12.0	90%	94	13.0	YES	YES	AMEC
EDi NS Lift 7	7/22/2009	Native Soil Lift 7	Grid Block 5	117.0	12.0	90%	95	11.8	YES	YES	AMEC
EDi NS Lift 7	7/21/2009	Native Soil Lift 7	Grid Block 6	117.0	12.0	90%	100	10.6	YES	YES	AMEC
EDi NS Lift 7	7/21/2009	Native Soil Lift 7	Grid Block 7	117.0	12.0	90%	100	12.2	YES	YES	AMEC
EDi NS Lift 7	7/21/2009	Native Soil Lift 7	Grid Block 8	117.0	12.0	90%	96.0	11.0	YES	YES	AMEC
EDi NS Lift 7	7/21/2009	Native Soil Lift 7	Grid Block 9	117.0	12.0	90%	100	12.4	YES	YES	AMEC
EDi NS Lift 7	7/21/2009	Native Soil Lift 7	Grid Block 10	117.0	12.0	90%	100	12.6	YES	YES	AMEC
EDi NS Lift 7	7/21/2009	Native Soil Lift 7	Grid Block 11	117.0	12.0	90%	99	11.9	YES	YES	AMEC
EDi NS Lift 7	7/21/2009	Native Soil Lift 7	Grid Block 12	117.0	12.0	90%	95	13.8	YES	YES	AMEC
EDi NS Lift 7	7/21/2009	Native Soil Lift 7	Grid Block 13	117.0	12.0	90%	99	11.2	YES	YES	AMEC
EDi NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 1	117.0	12.0	90%	100	10.7	YES	YES	AMEC
EDi NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 2	117.0	12.0	90%	99	11.4	YES	YES	AMEC
EDi NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 3	117.0	12.0	90%	99	12.5	YES	YES	AMEC
EDi NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 4	117.0	12.0	90%	99	11.4	YES	YES	AMEC
EDi NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 5	117.0	12.0	90%	97	13.4	YES	YES	AMEC
EDi NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 6	117.0	12.0	90%	100	10.0	YES	YES	AMEC
EDi NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 7	117.0	12.0	90%	100	10.0	YES	YES	AMEC
EDi NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 8	117.0	12.0	90%	98	8.6	YES	**NO**	AMEC
EDi NS Lift 8 Retest[6]	7/28/2009	Native Soil Lift 8	Grid Block 8	117.0	12.0	90%	100	10.3	YES	YES	AMEC
EDi NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 9	117.0	12.0	90%	100	10.1	YES	YES	AMEC
EDi NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 10	117.0	12.0	90%	98	7.6	YES	**NO**	AMEC
EDi NS Lift 8 Retest[6]	7/28/2009	Native Soil Lift 8	Grid Block 10	117.0	12.0	90%	100	11.2	YES	YES	AMEC
EDi NS Lift 8	7/24/2009	Native Soil Lift 8	Grid Block 11	117.0	12.0	90%	100	10.5	YES	YES	AMEC
EDi NS Lift 8	7/24/2009	Native Soil Lift 8	Grid Block 12	117.0	12.0	90%	100	11.9	YES	YES	AMEC
EDi NS Lift 8	7/24/2009	Native Soil Lift 8	Grid Block 13	117.0	12.0	90%	100	10.9	YES	YES	AMEC
EDi NS Lift 8	7/28/2009	Native Soil Lift 8	MW-4	117.0	12.0	90%	98	8.8	YES	**NO**	AMEC
EDi NS Lift 8 Retest[6]	7/28/2009	Native Soil Lift 8	MW-4	117.0	12.0	90%	97	10.3	YES	YES	AMEC
EDi NS Top Soil[8]	9/03/2009	Topsoil	Grid Block 12 4" depth	118.9	9.6	NA[9]	89	4.7	NA[9]	NA[9]	AMEC
EDi NS Top Soil[8]	9/03/2009	Topsoil	Grid Block 12 10" depth	118.9	9.6	NA[9]	94	4.9	NA[9]	NA[9]	AMEC

Table 10 (cont'd.)
Mixed Waste Landfill 2009 ET Cover Construction
In-Place Density and Moisture Content CQC Field Results

Test Number	Date of Field Test	Description	Location[1]	Standard Proctor Maximum Density (lb/ft^3)[2]	Standard Proctor Optimum Moisture Content (%)	Percent of Maximum Density Required	Percent Compaction Achieved	Moisture Content Achieved	Meets Density Spec?	Meets Moisture Spec?	Testing Laboratory[3]
EDi NS Top Soil[8]	9/03/2009	Topsoil	Grid Block 8 4" depth	118.9	9.6	NA[9]	75	3.9	NA[9]	NA[9]	AMEC
EDi NS Top Soil[8]	9/03/2009	Topsoil	Grid Block 8 6" depth	118.9	9.6	NA[9]	82	3.9	NA[9]	NA[9]	AMEC
EDi NS Top Soil[8]	9/03/2009	Topsoil	Grid Block 2 4" depth	118.9	9.6	NA[9]	89	3.8	NA[9]	NA[9]	AMEC
EDi NS Top Soil[8]	9/03/2009	Topsoil	Grid Block 2 8" depth	118.9	9.6	NA[9]	96	3.7	NA[9]	NA[9]	AMEC
EDi NS Top Soil[8]	9/03/2009	Topsoil	Grid Block 5 4" depth	118.9	9.6	NA[9]	88	5.4	NA[9]	NA[9]	AMEC
EDi NS Top Soil[8]	9/03/2009	Topsoil	Grid Block 5 8" depth	118.9	9.6	NA[9]	94	3.8	NA[9]	NA[9]	AMEC

[1] Locations shown for all CQC field tests, except Topsoil Layer tests, in Figures 21 through 29.
[2] lb/ft^3 = Pounds per cubic foot.
[3] AMEC = AMEC Earth and Environmental, Albuquerque, New Mexico.
[4] Location incorrectly referred to as 'Grid Line' instead of Grid Block on laboratory data sheet.
[5] All side slope work to establish the required 6 to 1 slope angle was performed as the first part of Native Soil Layer construction around the northern half of the MWL boundary (North, West, East, and Dog Leg boundary areas). Locations of all CQC side slope tests are shown in Figure 22.
[6] All retests were performed at the same location as the original test.
[7] This location is labeled "EDi-NS-L5-GB7A" in Figure 26 and is located on the northeastern boundary of Grid Block 6.
[8] Topsoil Layer density and moisture testing were performed but not required. These test locations were not surveyed.
[9] NA = Not applicable; Maximum Density and Moisture Content specifications and tests do not apply to the topsoil layer.

Table 11
Mixed Waste Landfill 2009 ET Cover Construction
In-Place Density and Moisture Content CQA Field Results

Test Number	Date of Field Test	Description	Location[1]	Standard Proctor Maximum Density (lb/ft^3)[2]	Standard Proctor Optimum Moisture Content (%)	Percent of Maximum Density Required	Percent Compaction Achieved	Moisture Content Achieved	Meets Density Spec?	Meets Moisture Spec?	Testing Laboratory[3]
URS Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 5	120.1	11.6	90%	98	10.6	YES	YES	AMEC
URS Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 12	120.1	11.6	90%	97	11.0	YES	YES	AMEC
URS Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 8	120.1	11.6	90%	99	10.0	YES	YES	AMEC
URS Sub-Grade	5/22/2009	Subgrade Surface	Grid Block 1	120.1	11.6	90%	98	10.0	YES	YES	AMEC
URS North Slope Lift 7	6/19/2009	North Slope Lift 7	North Slope[4]	115.8	12.3	90%	92	14	YES	YES	AMEC
URS North Slope Lift 8	6/19/2009	North Slope Lift 8	North Slope[4]	115.8	12.3	90%	89	15.2	**NO**	**NO**	AMEC
URS North Slope Lift 8 Retest[5]	6/22/2009	North Slope Lift 8	Grid Block 5[4]	115.8	12.3	90%	92	11.0	YES	YES	AMEC
URS North Slope Lift 8 Retest[5]	6/22/2009	North Slope Lift 8	Grid Block 10[4]	115.8	12.3	90%	92	10.5	YES	YES	AMEC
URS North Slope Lift 8 Retest[5]	6/22/2009	North Slope Lift 8	Grid Block 13[4]	115.8	12.3	90%	91	10.9	YES	YES	AMEC
URS East Slope Lift 5	6/19/2009	East Slope Lift 5	East Slope[4]	120.1	11.6	90%	94	10.3	YES	YES	AMEC
URS East Slope Lift 6	6/19/2009	East Slope Lift 6	East Slope[4]	120.1	11.6	90%	98	10.1	YES	YES	AMEC
URS West Slope Lift 5	6/19/2009	West Slope Lift 5	West Slope[4]	120.1	11.6	90%	96	10.6	YES	YES	AMEC
URS West Slope Lift 6	6/19/2009	West Slope Lift 6	West Slope[4]	120.1	11.6	90%	98	11.1	YES	YES	AMEC
URS Wedge Lift 1	6/19/2009	Native Soil Lift 1	Grid Block 8	115.8	12.3	90%	91	10.7	YES	YES	AMEC
URS Wedge Lift 1	6/19/2009	Native Soil Lift 1	Grid Block 11	115.8	12.3	90%	92	11.0	YES	YES	AMEC
URS Wedge Lift 2	6/19/2009	Native Soil Lift 2	Grid Block 11	115.8	12.3	90%	94	11.0	YES	YES	AMEC
URS NS Lift 3	6/23/2009	Native Soil Lift 3	Grid Block 2	115.8	12.3	90%	97	10.8	YES	YES	AMEC
URS NS Lift 3	6/24/2009	Native Soil Lift 3	Grid Block 8	117.0	12.0	90%	94	10.0	YES	YES	AMEC
URS NS Lift 3	6/26/2009	Native Soil Lift 3	Grid Block 11	117.0	12.0	90%	98	13.7	YES	YES	AMEC
URS NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 1	117.0	12.0	90%	100	14.0	YES	YES	AMEC
URS NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 3	117.0	12.0	90%	95	13.5	YES	YES	AMEC
URS NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 5	117.0	12.0	90%	95	12.8	YES	YES	AMEC
URS NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 9	117.0	12.0	90%	98	11.5	YES	YES	AMEC
URS NS Lift 4	6/26/2009	Native Soil Lift 4	Grid Block 7	117.0	12.0	90%	96	11.6	YES	YES	AMEC
URS NS Lift 4	6/29/2009	Native Soil Lift 4	Grid Block 13	117.0	12.0	90%	98	11.6	YES	YES	AMEC
URS NS Lift 4	6/29/2009	Native Soil Lift 4	Grid Block 11	117.0	12.0	90%	97	10.1	YES	YES	AMEC
URS NS Lift 5	7/1/2009	Native Soil Lift 5	Grid Block 12	117.0	12.0	90%	92	10.0	YES	YES	AMEC
URS NS Lift 5	7/2/2009	Native Soil Lift 5	Grid Block 10	117.0	12.0	90%	94	12.3	YES	YES	AMEC
URS NS Lift 5	7/2/2009	Native Soil Lift 5	Grid Block 8	117.0	12.0	90%	93	12.8	YES	YES	AMEC
URS NS Lift 5	7/2/2009	Native Soil Lift 5	Grid Block 6	117.0	12.0	90%	97	13.5	YES	YES	AMEC
URS NS Lift 5	7/9/2009	Native Soil Lift 5	Grid Block 4	117.0	12.0	90%	100	10.0	YES	YES	AMEC

Table 11 (cont'd.)
Mixed Waste Landfill 2009 ET Cover Construction
In-Place Density and Moisture Content CQA Field Results

Test Number	Date of Field Test	Description	Location[1]	Standard Proctor Maximum Density (lb/ft^3)[2]	Standard Proctor Optimum Moisture Content (%)	Percent of Maximum Density Required	Percent Compaction Achieved	Moisture Content Achieved	Meets Density Spec?	Meets Moisture Spec?	Testing Laboratory[3]
URS NS Lift 5	7/9/2009	Native Soil Lift 5	Grid Block 2	117.0	12.0	90%	97	10.2	YES	YES	AMEC
URS NS Lift 6	7/14/2009	Native Soil Lift 6	Grid Block 11	117.0	12.0	90%	99	10.4	YES	YES	AMEC
URS NS Lift 6	7/14/2009	Native Soil Lift 6	Grid Block 13	117.0	12.0	90%	100	12.2	YES	YES	AMEC
URS NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 8	117.0	12.0	90%	100	12.8	YES	YES	AMEC
URS NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 6	117.0	12.0	90%	93	10.3	YES	YES	AMEC
URS NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 2	117.0	12.0	90%	95	14.0	YES	YES	AMEC
URS NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 4	117.0	12.0	90%	97	10.9	YES	YES	AMEC
URS NS Lift 6	7/17/2009	Native Soil Lift 6	Grid Block 9	117.0	12.0	90%	100	11.4	YES	YES	AMEC
URS NS Lift 7	7/21/2009	Native Soil Lift 7	Grid Block 11	117.0	12.0	90%	96	12.0	YES	YES	AMEC
URS NS Lift 7	7/21/2009	Native Soil Lift 7	Grid Block 13	117.0	12.0	90%	98	12.8	YES	YES	AMEC
URS NS Lift 7	7/21/2009	Native Soil Lift 7	Grid Block 9	117.0	12.0	90%	99	11.9	YES	YES	AMEC
URS NS Lift 7	7/21/2009	Native Soil Lift 7	Grid Block 7	117.0	12.0	90%	100	12.4	YES	YES	AMEC
URS NS Lift 7	7/22/2009	Native Soil Lift 7	Grid Block 1	117.0	12.0	90%	93	14.0	YES	YES	AMEC
URS NS Lift 7	7/22/2009	Native Soil Lift 7	Grid Block 3	117.0	12.0	90%	92	10.5	YES	YES	AMEC
URS NS Lift 7	7/22/2009	Native Soil Lift 7	Grid Block 5	117.0	12.0	90%	95	12.2	YES	YES	AMEC
URS NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 12	117.0	12.0	90%	100	10.0	YES	YES	AMEC
URS NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 6	117.0	12.0	90%	99	10.0	YES	YES	AMEC
URS NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 2	117.0	12.0	90%	99	10.8	YES	YES	AMEC
URS NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 4	117.0	12.0	90%	97	12.1	YES	YES	AMEC
URS NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 8	117.0	12.0	90%	100	10.3	YES	YES	AMEC
URS NS Lift 8	7/28/2009	Native Soil Lift 8	Grid Block 10	117.0	12.0	90%	99	11.0	YES	YES	AMEC

[1] Locations shown for all CQA field tests in Figures 21 through 29.
[2] lb/ft^3 = Pounds per cubic foot.
[3] AMEC = AMEC Earth and Environmental, Albuquerque, New Mexico.
[4] All side slope work to establish the required 6 to 1 slope angle was performed as the first part of Native Soil Layer construction around the northern half of the MWL boundary (North, West, and East boundary areas). Locations of all CQC side slope tests are shown in Figure 22.
[5] Three retests were performed for the one North Slope Lift 8 test that failed (6-19-09 test). The three retests were performed on 6-22-09 across the northern slope area within Grid Blocks 5, 10, and 13 to make sure density and moisture specifications were consistently met across the entire northern boundary for Lift 8. The original failed test location and three retest locations are shown in Figure 22.

Table 12
Mixed Waste Landfill 2009 ET Cover Construction CQC
Land Survey Elevation Data

Grid No.	Subgrade		Biointrusion Rock Layer			Thin Soil Layer above Biointrusion Layer			Native Soil Layer			Topsoil Layer		
	Pt. No.	Elev.	Pt. No.	Elev.	Depth (ft)	Pt. No.	Elev.	Depth (ft)	Pt. No.	Elev.	Depth (ft)	Pt. No.	Elev.	Depth (ft)
A1	1043	5379.49	1747	5380.75	1.26	1905	5380.94	0.19	5311	5383.51	2.76	5256	5384.52	1.01
A2	1071	5380.15	1755	5381.28	1.13	1904	5381.54	0.26	5310	5384.04	2.76	5262	5385.03	0.99
A3	1080	5380.94	1758	5382.26	1.32	1903	5382.43	0.17	5307	5384.93	2.67	5264	5385.99	1.06
A4	1095	5381.97	1761	5383.18	1.21	1923	5383.46	0.28	5306	5385.99	2.81	5267	5387.02	1.03
A5	1106	5383.08	1770	5384.54	1.46	1929	5384.78	0.24	5290	5387.28	2.74	5274	5388.33	1.05
A6	1127	5383.83	1806	5385.11	1.28	1940	5385.40	0.29	5289	5387.93	2.82	5279	5388.89	0.96
A7	1139	5384.83	1820	5386.03	1.20	1955	5386.35	0.32	5347	5388.54	2.51	5281	5389.58	1.04
B1	1044	5380.16	1777	5381.49	1.33	1900	5381.74	0.25	5312	5384.36	2.87	5276	5385.40	1.04
B2	1070	5380.88	1754	5382.13	1.25	1921	5382.39	0.26	5309	5384.87	2.74	5261	5385.90	1.03
B3	1081	5382.03	1759	5383.32	1.29	1901	5383.51	0.19	5300	5385.98	2.66	5265	5387.00	1.02
B4	1094	5382.97	1760	5384.17	1.20	1902	5384.47	0.30	5305	5386.99	2.82	5266	5388.01	1.02
B5	1112	5384.18	1769	5385.46	1.28	1928	5385.61	0.15	5291	5388.09	2.63	5273	5389.08	0.99
B6	1126	5385.06	1805	5386.18	1.12	1939	5386.39	0.21	5292	5388.92	2.74	5278	5389.87	0.95
B7	1140	5386.02	1821	5387.19	1.17	1950	5387.26	0.07	5346	5389.37	2.18	5282	5390.50	1.13
C1	1048	5380.74	1778	5382.24	1.50	1898	5382.38	0.14	5313	5384.87	2.63	5277	5385.88	1.01
C2	1069	5381.65	1746	5382.86	1.21	1920	5383.15	0.29	5340	5385.59	2.73	5255	5386.56	0.97
C3	1082	5382.47	1711	5383.75	1.28	1897	5384.05	0.30	5315	5386.61	2.86	5247	5387.60	0.99
C4	1093	5383.43	1712	5384.70	1.27	1896	5384.94	0.24	5304	5387.52	2.82	5248	5388.55	1.03
C5	1113	5384.80	1713	5385.88	1.08	1895	5386.01	0.13	5294	5388.59	2.71	5249	5389.59	1.00
C6	1125	5385.76	1835	5386.97	1.21	1938	5387.26	0.29	5345	5389.57	2.60	5284	5390.65	1.08
C7	1141	5386.37	1834	5387.66	1.29	1949	5387.96	0.30	5293	5390.48	2.82	5283	5391.59	1.11

Table 12 (cont'd.)
Mixed Waste Landfill 2009 ET Cover Construction CQC
Land Survey Elevation Data

Grid No.	Subgrade		Biointrusion Rock Layer			Thin Soil Layer above Biointrusion			Native Soil Layer			Topsoil Layer		
	Pt. No.	Elev.	Pt. No.	Elev.	Depth (ft)	Pt. No.	Elev.	Depth (ft)	Pt. No.	Elev.	Depth (ft)	Pt. No.	Elev.	Depth (ft)
D1	1049	5381.12	1719	5382.38	1.26	1889	5382.59	0.21	5314	5385.09	2.71	5254	5386.07	0.98
D2	1068	5381.85	1710	5383.13	1.28	1892	5383.35	0.22	5341	5385.77	2.64	5246	5386.78	1.01
D3	1083	5382.71	1709	5383.83	1.12	1891	5384.07	0.24	5316	5386.80	2.97	5245	5387.78	0.98
D4	1092	5383.55	1708	5384.80	1.25	1893	5385.08	0.28	5303	5387.77	2.97	5244	5388.78	1.01
D5	1114	5384.75	1707	5385.78	1.03	1894	5386.01	0.23	5295	5388.73	2.95	5243	5389.77	1.04
D6	1124	5385.90	1847	5387.17	1.27	1931	5387.35	0.18	5296	5389.74	2.57	5288	5390.78	1.04
D7	1142	5386.36	1837	5387.64	1.28	1953	5387.94	0.30	5297	5390.77	3.13	5285	5391.79	1.02
E1	1054	5381.20	1717	5382.43	1.23	1882	5382.71	0.28	5319	5385.22	2.79	5253	5386.21	0.99
E2	1067	5381.76	1702	5383.05	1.29	1886	5383.20	0.15	5318	5385.86	2.81	5238	5386.84	0.98
E3	1084	5382.77	1703	5383.98	1.21	1883	5384.24	0.26	5317	5386.84	2.86	5239	5387.84	1.00
E4	1091	5383.58	1704	5384.69	1.11	1884	5384.97	0.28	5302	5387.85	3.16	5240	5388.83	0.98
E5	1115	5384.28	1705	5385.45	1.17	1885	5385.75	0.30	5301	5388.85	3.40	5241	5389.82	0.97
E5.1	1116	5384.56	1706	5385.79	1.23	1933	5386.09	0.30	5300	5389.12	3.33	5242	5390.06	0.94
E6	1123	5384.76	1846	5386.17	1.41	1932	5386.49	0.32	5299	5389.83	3.66	5287	5390.83	1.00
E7	1143	5385.07	1845	5386.91	1.84	1948	5387.24	0.33	5298	5390.89	3.98	5286	5391.91	1.02
F1	1055	5380.98	1716	5382.09	1.11	1887	5382.34	0.25	5320	5384.87	2.78	5252	5385.88	1.01
F2	1066	5381.78	1701	5382.85	1.07	1880	5383.11	0.26	5321	5385.49	2.64	5237	5386.52	1.03
F3	1085	5382.73	1700	5383.80	1.07	1879	5384.09	0.29	5322	5386.57	2.77	5236	5387.61	1.04
F4	1090	5383.53	1699	5384.81	1.28	1878	5384.89	0.08	5323	5387.48	2.67	5235	5388.63	1.15
F5	1117	5384.19	1698	5385.41	1.22	1877	5385.67	0.26	5324	5388.46	3.05	5234	5389.49	1.03

Table 12 (cont'd.)
Mixed Waste Landfill 2009 ET Cover Construction CQC
Land Survey Elevation Data

Grid No.	Subgrade		Biointrusion Rock Layer			Thin Soil Layer above Biointrusion			Native Soil Layer			Topsoil Layer		
	Pt. No.	Elev.	Pt. No.	Elev.	Depth (ft)	Pt. No.	Elev.	Depth (ft)	Pt. No.	Elev.	Depth (ft)	Pt. No.	Elev.	Depth (ft)
G1	1058	5380.64	1715	5381.97	1.33	1868	5382.25	0.28	5329	5384.75	2.78	5251	5385.77	1.02
G2	1065	5381.27	1692	5382.51	1.24	1871	5382.75	0.24	5328	5385.34	2.83	5232	5386.42	1.08
G3	1086	5382.40	1749	5383.72	1.32	1872	5383.92	0.20	5327	5386.42	2.70	5258	5387.49	1.07
G4	1089	5383.14	1748	5384.40	1.26	1873	5384.99	0.59	5326	5387.44	3.04	5257	5388.45	1.01
G5	1118	5383.98	1695	5385.21	1.23	1874	5385.54	0.33	5325	5388.41	3.20	5233	5389.39	0.98
H1	1063	5380.35	1714	5381.73	1.38	1866	5382.02	0.29	5330	5384.43	2.70	5250	5385.52	1.09
H2	1064	5381.28	1691	5382.33	1.05	1869	5382.62	0.29	5331	5385.17	2.84	5231	5386.19	1.02
H3	1087	5382.00	1768	5383.44	1.44	1864	5383.74	0.30	5332	5386.19	2.75	5272	5387.24	1.05
H4	1088	5382.97	1766	5384.42	1.45	1865	5384.68	0.26	5333	5387.20	2.78	5270	5388.27	1.07
H5	1119	5383.87	1688	5384.94	1.07	1863	5385.28	0.34	5334	5388.19	3.25	5230	5389.27	1.08
I1	1189	5379.82	1750	5381.09	1.27	1853	5381.34	0.25	5339	5383.82	2.73	5259	5384.83	1.01
I2	1184	5380.56	1751	5381.87	1.31	1855	5382.07	0.20	5338	5384.53	2.66	5260	5385.55	1.02
I3	1180	5381.40	1683	5382.73	1.33	1857	5382.99	0.26	5337	5385.70	2.97	5228	5386.64	0.94
I4	1177	5382.56	1767	5383.89	1.33	1861	5384.14	0.25	5336	5386.59	2.70	5271	5387.66	1.07
I5	1172	5383.51	1685	5384.58	1.07	1859	5384.78	0.20	5335	5387.60	3.02	5229	5388.60	1.00
			Average Depth =		**1.25**	**Average Depth =**		**0.25**	**Average Depth =**		**2.85**	**Average Depth =**		**1.02**

Note: The location of verification survey grid points is shown in Figure 18.

Table 13

Mixed Waste Landfill 2009 ET Cover Construction Equipment Summary

Vehicle	Make/Model	Gross Weight (lbs)	Tire Size	Tire Pressure (if applicable)	Specific Application	Other Pertinent Information
Motor Grader	JD 670 D	37,790	14.00-24 12PR	55	Place, process and grade native soil and topsoil	
Dozer	JD 650 J	18,598	NA		Spread and grade biointrusion layer rock and soil	Shoe size 18 in., track length (on ground surface) 7.25 ft
Vibratory Roller	IR SD100	22,490 Total Drum 13,320	23.1 x 26-8PR	35	Proof roll subgrade, compaction of native soil lifts	Drum: 84"W × 59"Dia., 52,520 lbs max centrifugal force
Wheel Loader	JD 644 J	40,620	23.5 R25	40	Placement of biointrusion rock, material loading	
Wheel Loader	JD 544 J	28,534	20.5 R25	40	Material loading, grading on landfill cover	
Skid Steer Loader	CAT 242B	6,914	12-16.5	50	T-post removal, site grading, transport jumping jack compactor	
Secondary Vehicles						
Water Truck	4000 Gallon	46,000	11R-22.5	110	Material processing, dust suppression	
Water Truck	2000 Gallon	29,000	11R-22.5	110	Material processing, dust suppression	
Dump Truck, Tandem (3)	12 Cu. Yd.	46,000			Haul biointrusion rock	
Bottom Dump Truck (4)	20 Cu. Yd.	80,000	11R-22.5	110	Haul and place native soil and topsoil	Dumps with 8-ft axle spread Max 86,000 G.V.W.
Ag Tractor	KUBOTA M7040	4,608	Front 9.5-24 Rear 16.9-30	Front 45 Rear 25	Tilling , drill seeding and crimping straw mulch	
Dump Truck Single Axle	GMC Top Kick	26,000	19.5 R-20	100	Haul straw bales, tow straw blower	

Table 13 (cont'd.)
Mixed Waste Landfill 2009 ET Cover Construction Equipment Summary

Vehicle	Make/Model	Gross Weight (lbs)	Tire Size	Tire Pressure (if applicable)	Specific Application	Other Pertinent Information
Borrow Pit Operations						
Excavator	JD 200 CLC	44,750	NA		Excavate native and topsoil, feed screen plant	Shoe size 32 in., track length (on ground surface) 12 ft
Excavator	JD 240 CLC	54,654	NA		Load trucks, excavate native and topsoil, feed screen plant	Shoe size 32 in., track length (on ground surface) 12.5 ft
Wheel Loader	JD 644 J	40,620	23.5 R25	40	Load trucks, support screening plant operations	
Wheel Loader	JD 544 J	28,534	20.5 R25	40	Load trucks, support screening plant operations	
Wheel Loader	CAT 966 E	44,551	26.5-25 14PR	40	Feed pug mill during topsoil blending	
Wheel Loader	CAT 966 F	45,162	26.5-25 14PR	40	Wheel material away from pug mill, build stockpile	
Motor Grader	JD 670 D	37,790	14.00-24 12PR	55	Site grading, road maintenance at borrow area	

ET = Evapotranspirative
NA = Not applicable

Table 14
Mixed Waste Landfill Subgrade and ET Cover Design Change Summary

CMIP Specification	Description	No Adverse Quality Impact Summary
2006 Subgrade Preparation		
Appendix A, Earthwork, 02200, Section 3.3.3	Existing surface was to be compacted with 10 passes of a roller with ballasted weight of 25 tons and a minimum tire pressure of 90 psi – a smaller roller and fewer passes used and compaction specifications were met. Optimum moisture content could not be attained for the existing ground surface, but was not a requirement.	Field tests were not required but used to verify soil density specifications were met with the equipment used.
Appendix A, Earthwork, 02200, Section 3.4.2 and Table 3.1	First Standard Proctor sample used to characterize ~1,384 cy (versus 500 cy) because the next two sample results were not available after the initial 500 cy was installed (due to laboratory turnaround times).	Fill soil properties are consistent.
2009 ET Cover Construction		
Design drawings	The Subgrade top east-to-west surface slope was less than the 2% design slope in the east-central portion of the Subgrade surface (~1.8%)	2% design slope established with Native and Topsoil Layers.
Design drawings	The Subgrade side slopes were steeper than 6:1	6:1 side slopes established with Native and Topsoil Layers.
Design drawings	The Biointrusion Layer side slopes were steeper than 6:1, consistent with the Subgrade side slopes.	6:1 side slopes established with Native and Topsoil Layers.
Design drawings	The Biointrusion surface slope was less than the 2% design slope in specific areas, consistent with the Subgrade surface (~1.8%).	2% design slope established with Native and Topsoil Layers.
Appendix A, Earthwork, 02200, Section 3.3.5	The procedure for filling void spaces in the Biointrusion Layer was not addressed in the CMIP.	Soil added to void spaces created a more structurally sound cover less prone to subsidence.
Appendix A, Earthwork, 02200, Section 3.3.5	Establishing a smooth surface on the Biointrusion Layer upon which the Native Soil Layer could be constructed was not addressed in the CMIP.	Thin soil layer added created a more regular surface on which the Native Soil Layer was constructed, resulting in a more structurally sound Native Soil Layer.
Appendix B, Section 5.0 and Grades, Lines, and Levels, Section 1.4.2	The Native Soil Layer average thickness exceeded the maximum thickness of 2.75 feet by 0.10 feet.	Slight thickness exceedence resulted in a more protective Native Soil Layer.
Appendix A, Earthwork, 02200, Section 2.1.2	The 3/8-inch crushed gravel used in the Topsoil Layer did not meet specifications for the percent passing the #4 sieve (the "no more than 5%" requirement was exceeded). No locally available 3/8-inch gravel met the specification.	Approved aggregate had the lowest percent passing of available material.
Appendix A, Reclamation Seeding and Mulching, Section 2.2.1	Topsoil Layer seeding rate was increased from 20 to 80 pounds per acre. Some of the additional seed quantity was applied by hand (hand broadcasting) to ensure a relatively even distribution across the cover surface, side slopes, and disturbed areas.	Higher seeding rate and application process increased the probability of successful revegetation.

Table 14 (cont'd.)
Mixed Waste Landfill Subgrade and ET Cover Design Change Summary

CMIP Specification	Description	No Adverse Quality Impact Summary
2009 ET Cover Construction (cont'd.)		
Appendix A, Reclamation Seeding and Mulching, Section 2.2.2	A starter fertilizer was not used because the seeding was performed late in the growing season. When fertilizer is used late in the growing season, growth is artificially stimulated and seedlings are more susceptible to frost damage.	Use of fertilizer late in the growing season can be harmful to long-term plant growth.
Appendix A, Reclamation Seeding and Mulching	Use of supplemental watering (i.e., as temporary irrigation system) was not addressed in the CMIP, but was approved by the NMED in the conditional approval of the CMIP (Bearzi, December 2008).	Use of supplemental watering increases the probability of successful revegetation.
Appendix A, Earthwork, 02200	Soil drainage diversions at monitoring well locations along the west slope of the cover were not addressed in the CMIP. They are necessary to divert runoff around monitoring well locations due to the larger footprint of the cover.	Drainage features will protect the existing monitoring wells from side-slope drainage.
Section 6.0 of CMIP main text and Design Drawings	Soil and rock volumes used to construct the ET Cover are larger then the estimated volumes in the CMIP.	Larger volumes used resulted in a more protective final cover.
Design Drawings	Final footprint of the cover is larger then the CMIP design.	Larger footprint is structurally sound and more protective of the disposal areas.
Appendix A, Monitoring Well MW-4 Extension, 02670, Section 3.1	The existing concrete pad of MWL-MW-4 was not broken up and removed when the well and protective casing were extended. It was left around the protective steel casing and incorporated into the Subgrade.	Incorporating the concrete pad into the Subgrade created a structurally sound "anchor" for the extended casing.
Appendix A, Monitoring Well MW-4 Extension, 02670, Section 3.1	The final height of the MWL-MW-4 well casing is less than the minimum specification of 2 feet, 6 inches above the final grade of the constructed cover.	The height of the well casing (16 inches) does not adversely impact access to the well or well performance.
Not Included in the CMIP	Two soil-vapor monitoring points were installed through the ET Cover per the NMED conditional approval of the CMIP (Bearzi, December 2008) and direction received from NMED.	Required by NMED and installed prior to revegetation of Topsoil Layer to minimize impact to cover.
Section 7.1 of CMIP main text and Design drawings	Three angled boreholes for vadose zone moisture monitoring are addressed in the CMIP and shown on the design drawings but were installed in August 2003. The installation and construction of these boreholes will be documented in the MWL Long-Term Monitoring and Maintenance Plan.	Boreholes located on the edge of the cover side slope.

CMIP = Corrective Measures Implementation Plan
ET = Evapotranspirative
MWL = Mixed Waste Landfill
NMED = New Mexico Environment Department

Table 15

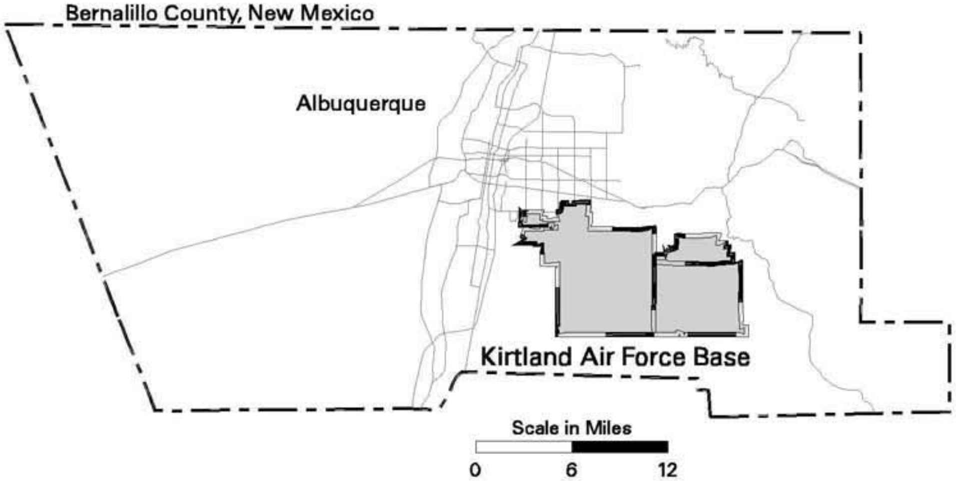
Mixed Waste Landfill Final In-Place Subgrade and ET Cover Layer Soil and Rock Volume Estimates

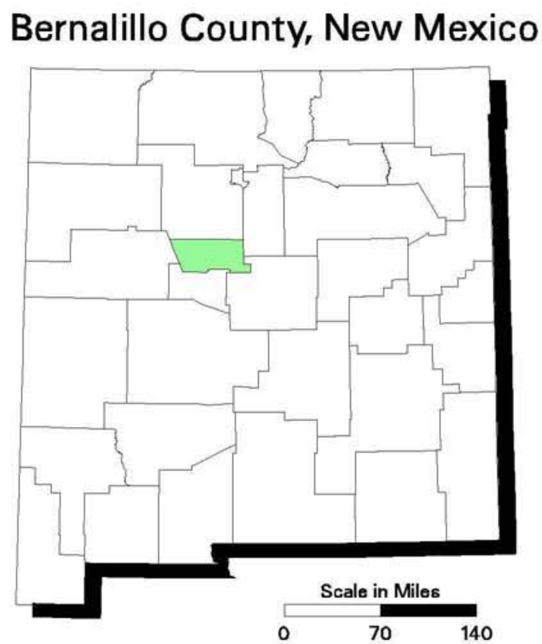
MWL ET Cover Layer	Volume Estimates Reflect Placed, Compacted Cubic Yards (cy)		Explanation
	CMIP Volume	As-Constructed Volume	
Subgrade	6,500	7,700	The MWL existing surface required more elevation increase than anticipated in the CMIP design.
Biointrusion Layer	4,900	6,800	The average thickness of the installed Biointrusion Layer is 0.25 feet greater than the CMIP design. The in-place surveyed volume is approximately 5,800 cy. The 1,000-cy discrepancy is most likely due to the fact that the Subgrade surface elevation was lowered approximately 1 to 2 inches during the scarification process prior to installing the rock material. The surveyed volume estimate does not account for the volume of rock penetrating down into the Subgrade.
Biointrusion Layer – Void filling and overlying 3-inch-thick soil layer	Not Estimated	3,100	Volume estimate is based on truckload tallies and represents a loose, uncompacted estimate. Volume cannot be accurately estimated due to some soil moving down into rock void space. To estimate an approximate total volume of compacted soil for the MWL ET Cover, a compaction factor of 16% was used for this thin soil layer, resulting in an estimated compacted volume of 2,600 cy.
Native Soil	13,200	17,300	The average thickness of the constructed Native Soil Layer is approximately 2.85 feet (versus 2.5 feet minimum in the CMIP) due to wedge lifts required to correct the 2% slope in the Subgrade and Biointrusion Layer.
Topsoil	3,900	5,400	The average thickness of the Topsoil Layer is approximately 0.33 feet greater than the CMIP design.
Total	**28,500**	**36,200**	**7,700 cy difference (27% increase from original estimate).** The 36,200-cy total does not include the 3,100 cy used for the void space filling and thin soil layer above the Biointrusion Layer.

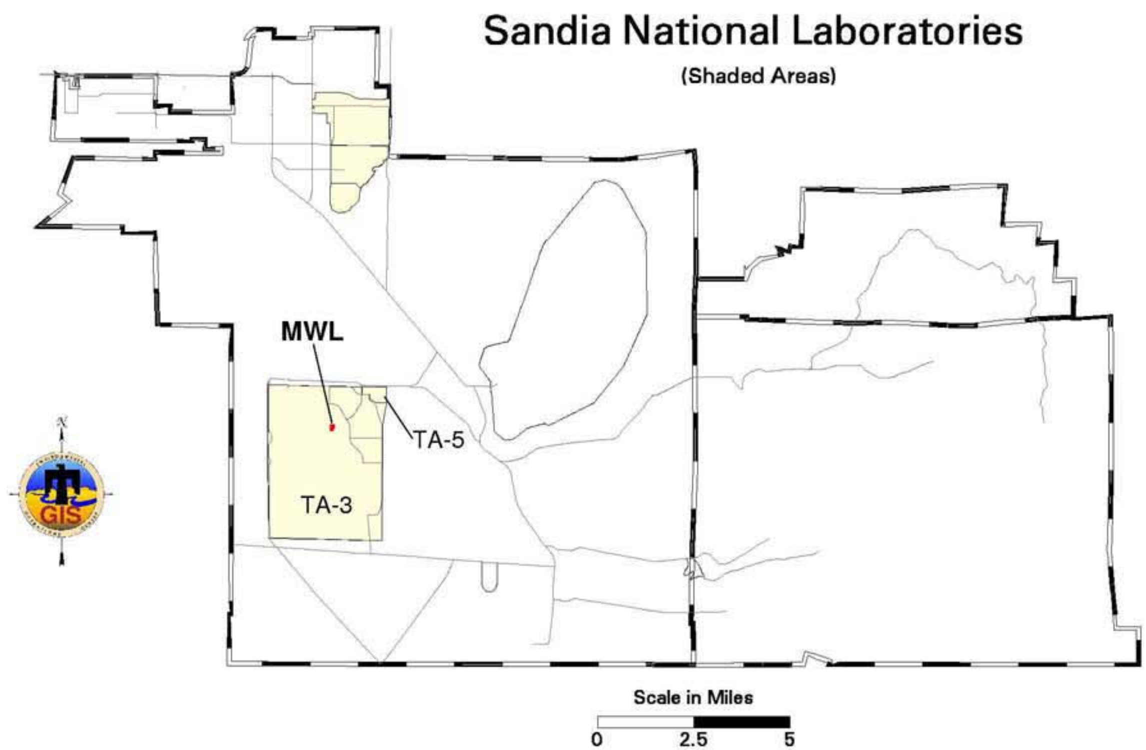
[1] The CMIP estimates were based upon minimum thickness specifications for each cover layer. The greater cover layer thicknesses resulted in a larger cover footprint, increasing the volume of soil material required for the side slopes.
[2] The increase in soil and rock material volumes results in a thicker, larger, more protective ET Cover.
CMIP = Corrective Measures Implementation Plan
ET = Evapotranspirative
MWL = Mixed Waste Landfill

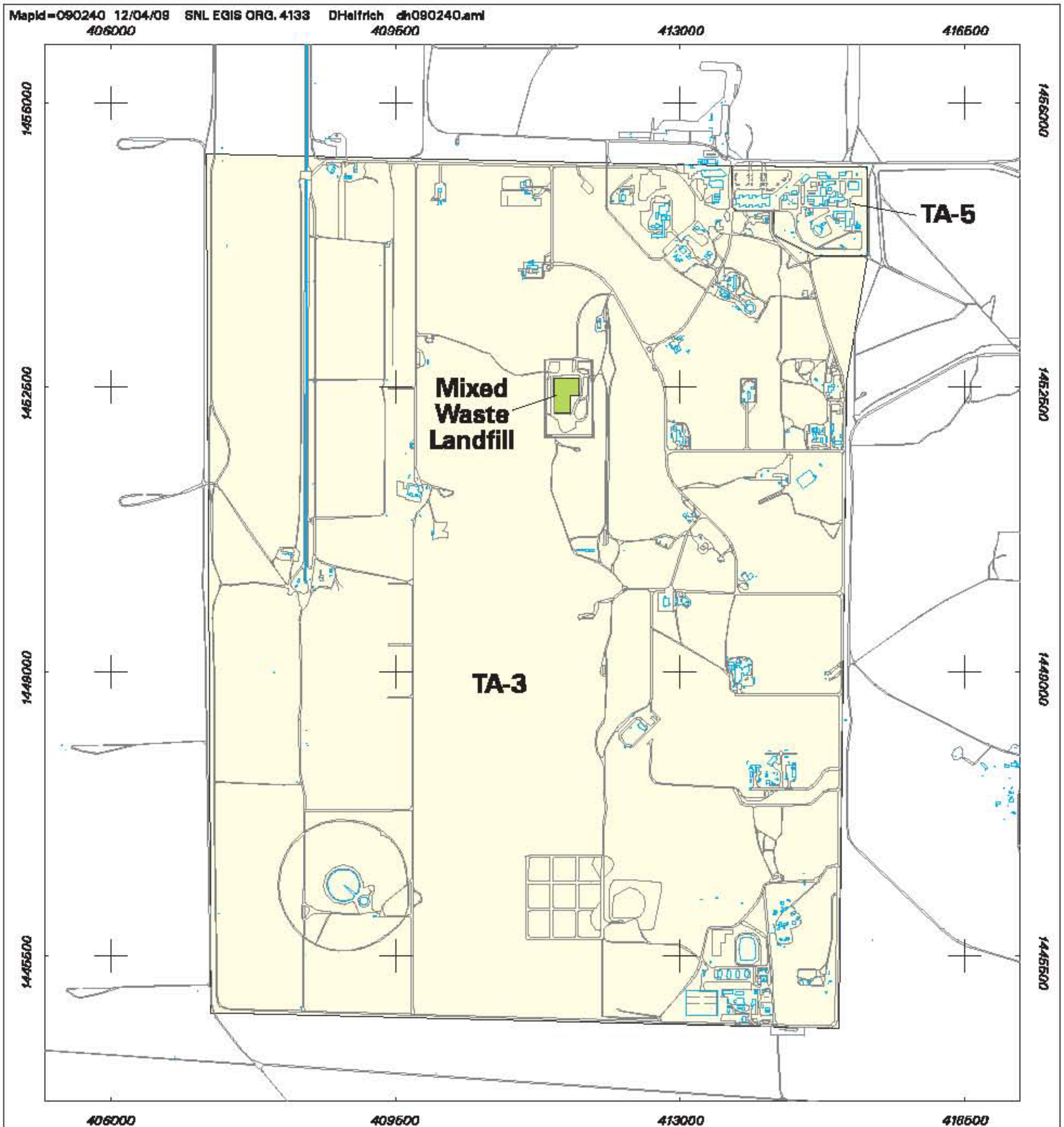
Figures

Figure 1
Location of Kirtland Air Force Base, Sandia National Laboratories, New Mexico and the Mixed Waste Landfill









Legend

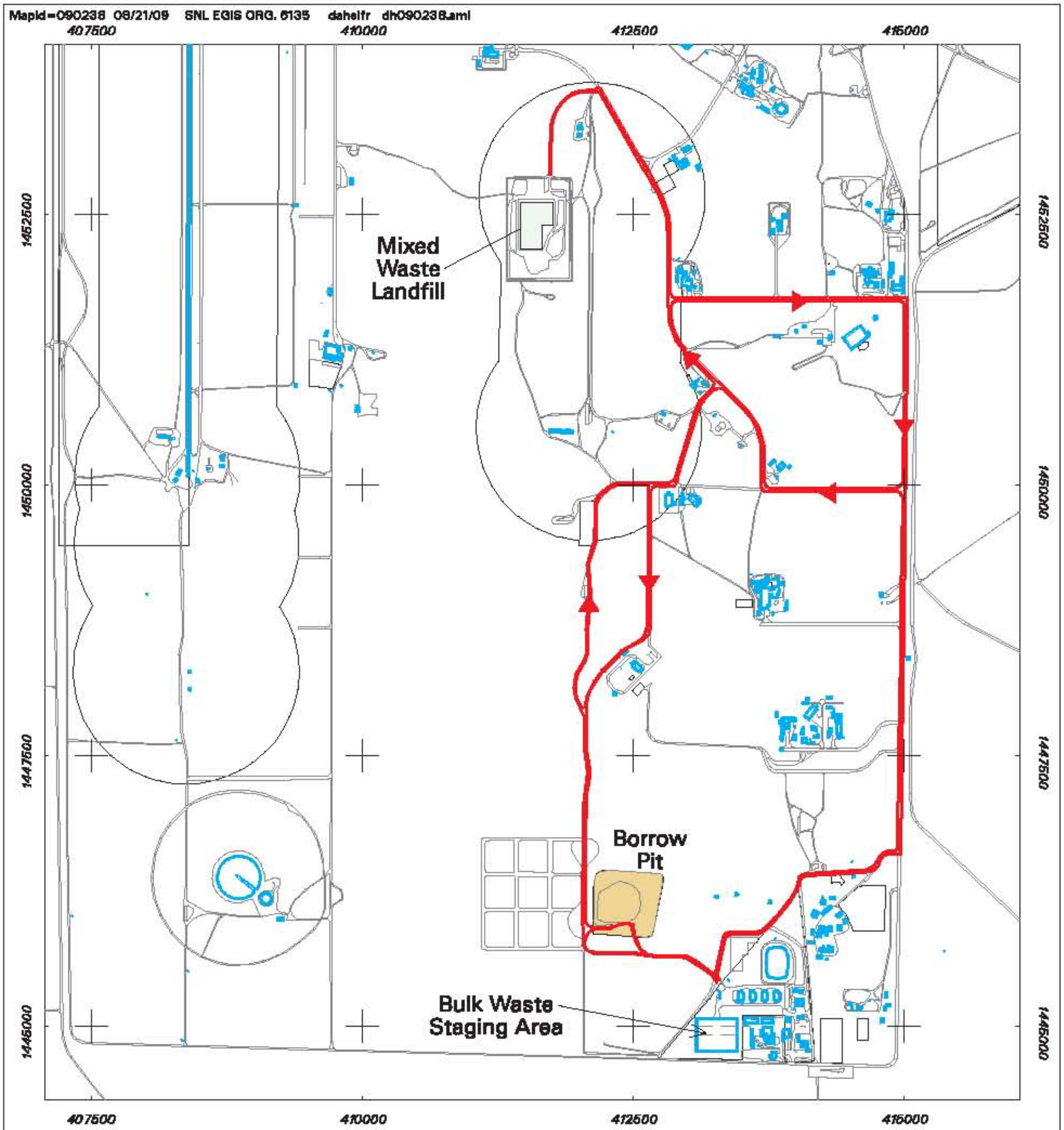
Building / Structure
Paved and Unpaved Road
SNL Technical Area 3 & 5
Mixed Waste Landfill

Figure 2
Location of Technical Areas 3 & 5 and the Mixed Waste Landfill

0 1000 2000 Scale in Feet

0 240 480 Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System



Legend

- Building / Structure
- Paved and Unpaved Road
- Haul Route
- Mixed Waste Landfill
- MWL Borrow Pit

Figure 3
Location of the Mixed Waste Landfill, Borrow Pit, Bulk Waste Staging Area, and Haul Routes

0 750 1500
Scale in Feet

0 180 360
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

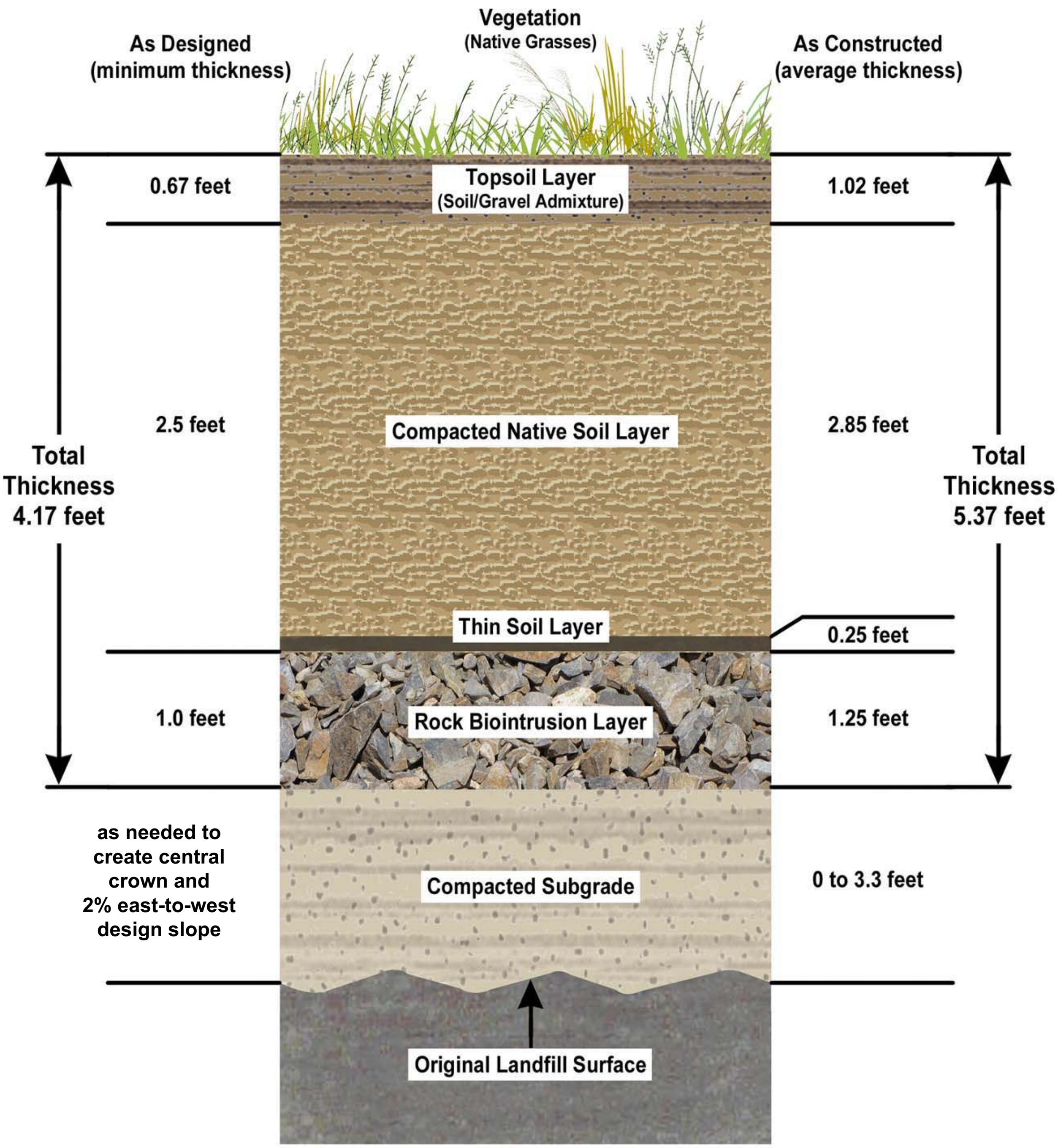


Figure 4
Schematic Diagram of the Mixed Waste Landfill Alternative Evapotranspirative Cover

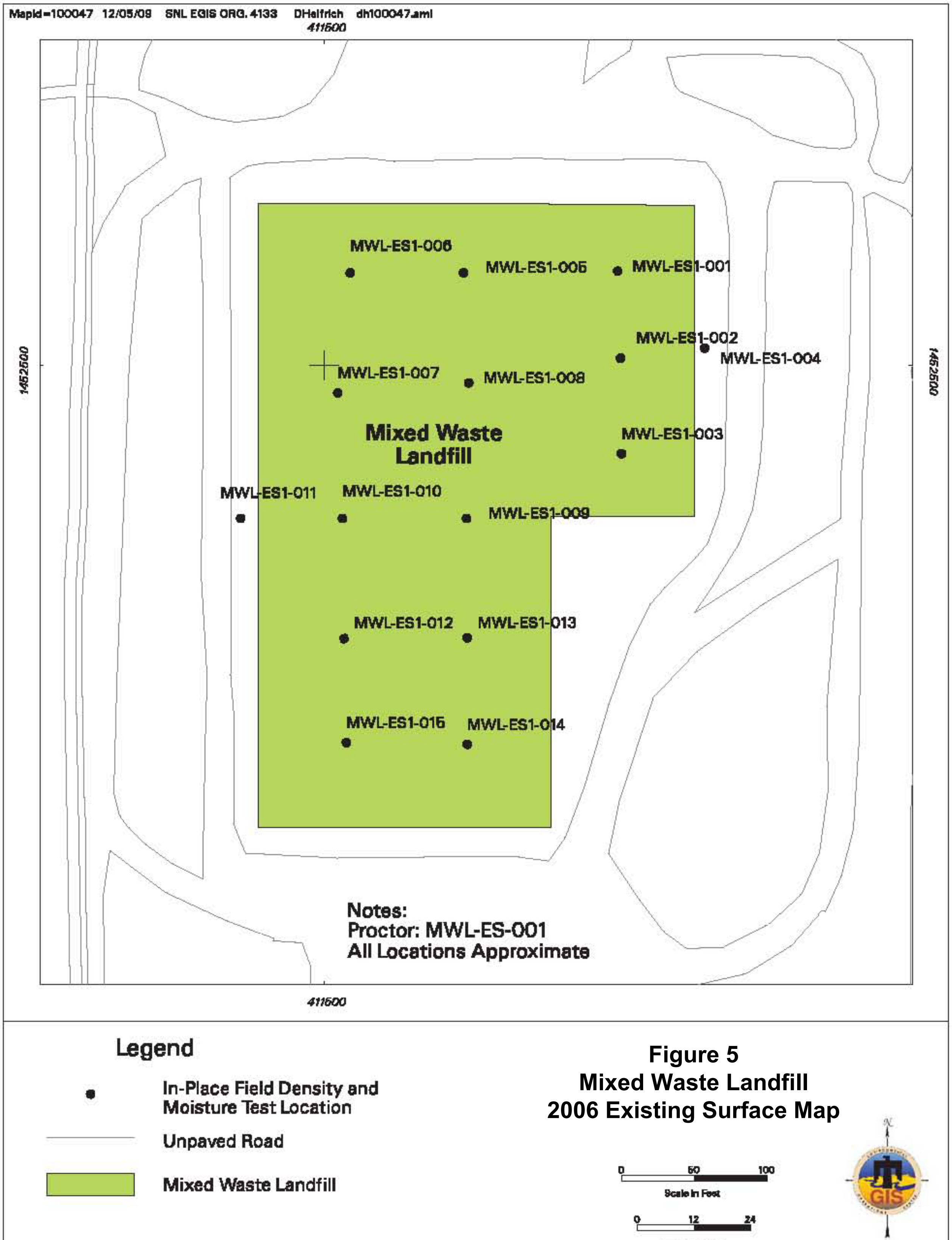
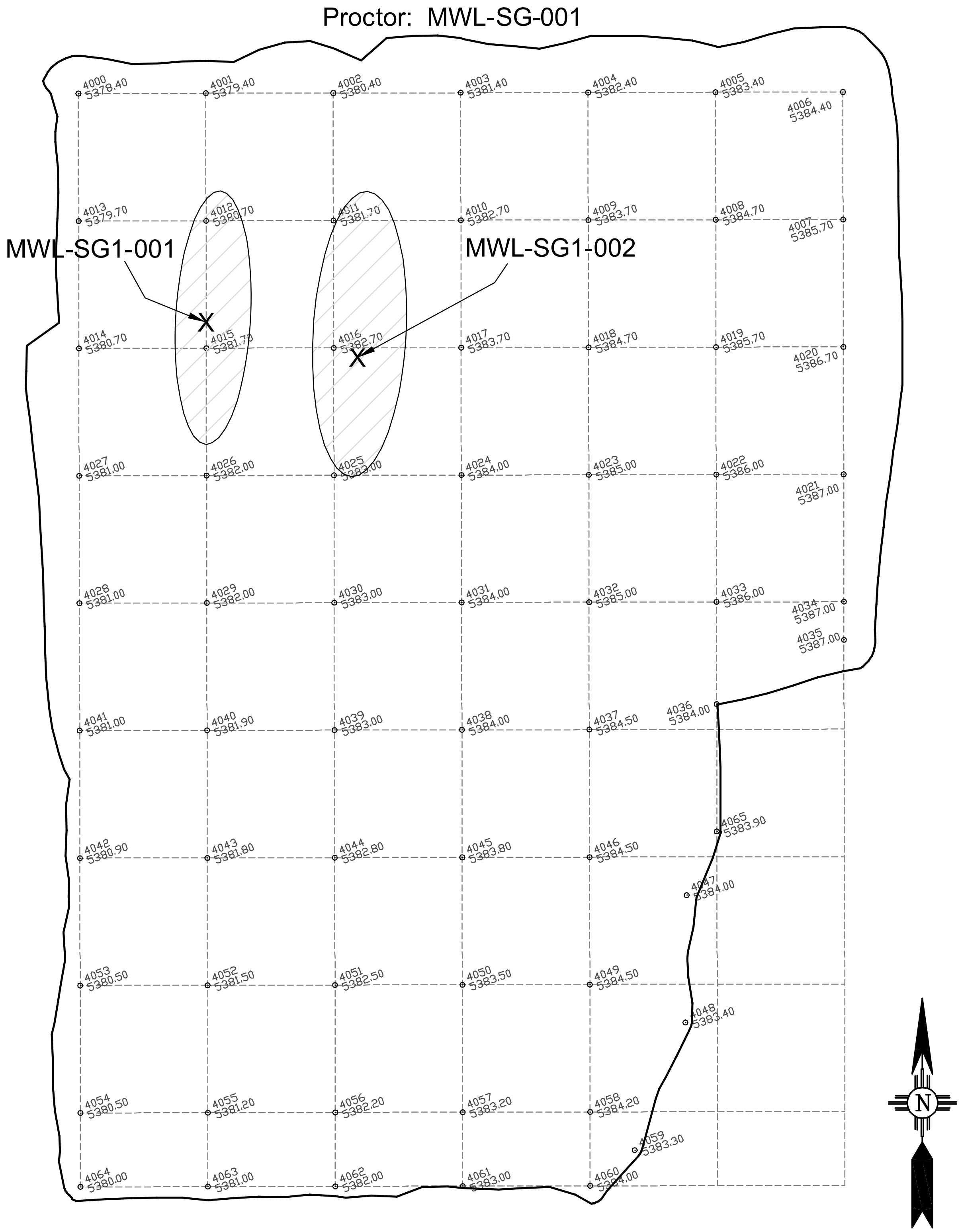


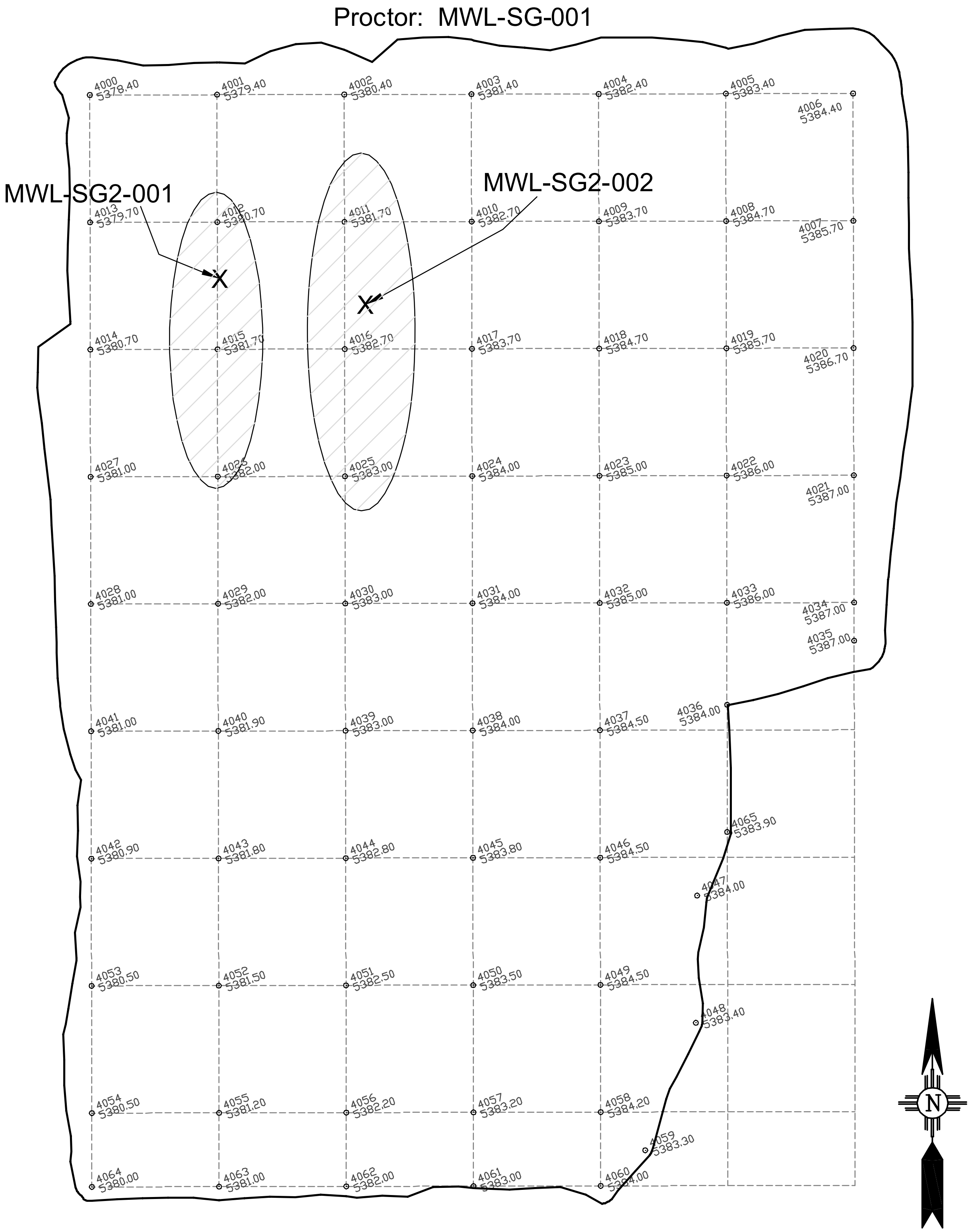
Figure 5
Mixed Waste Landfill
2006 Existing Surface Map

Sandia National Laboratories, New Mexico
Environmental Geographic Information System



X = Compaction Test Site

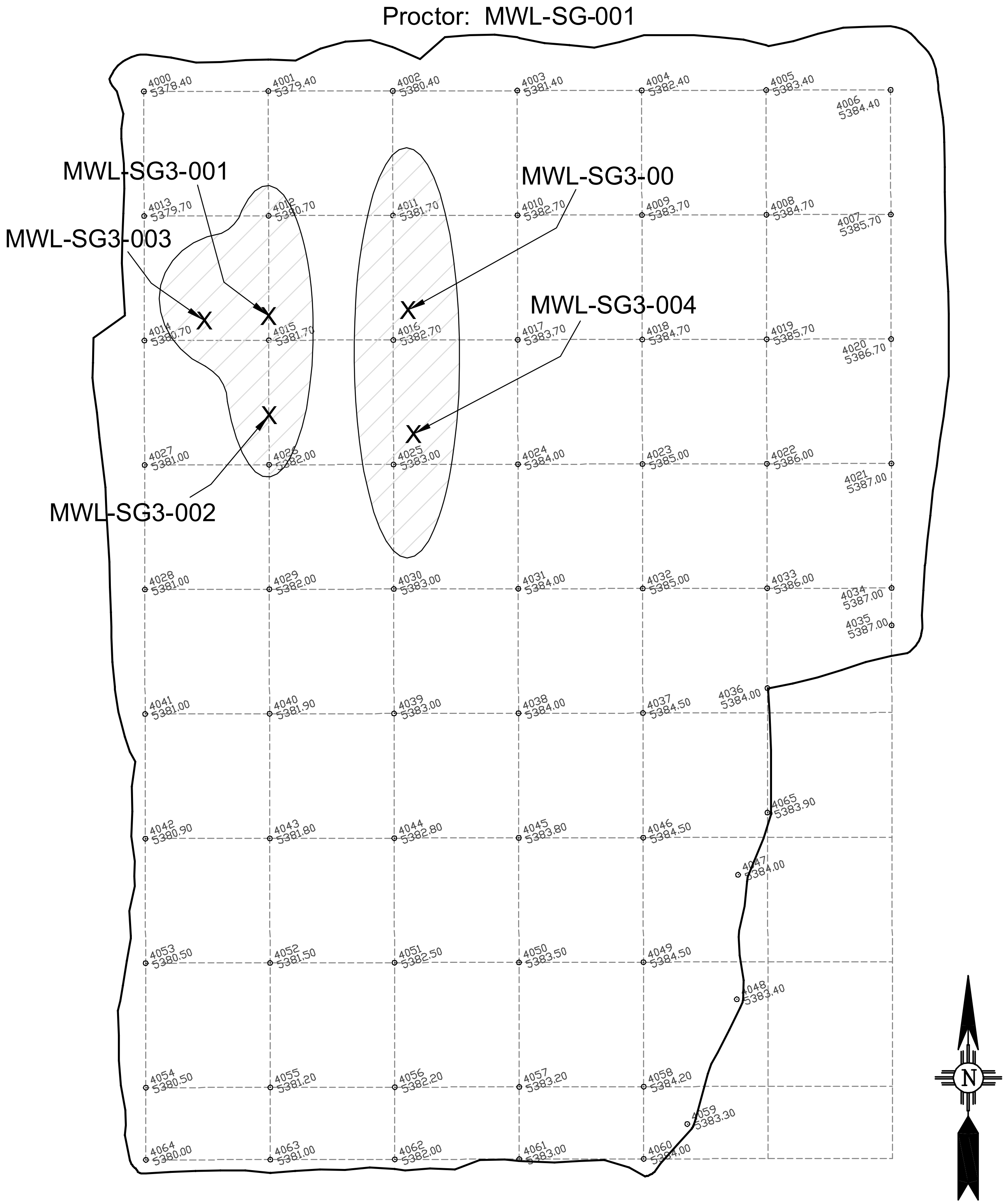
Figure 6
Mixed Waste Landfill
Subgrade Lift 1 Map



X = Compaction Test Site

Figure 7
Mixed Waste Landfill
Subgrade Lift 2 Map

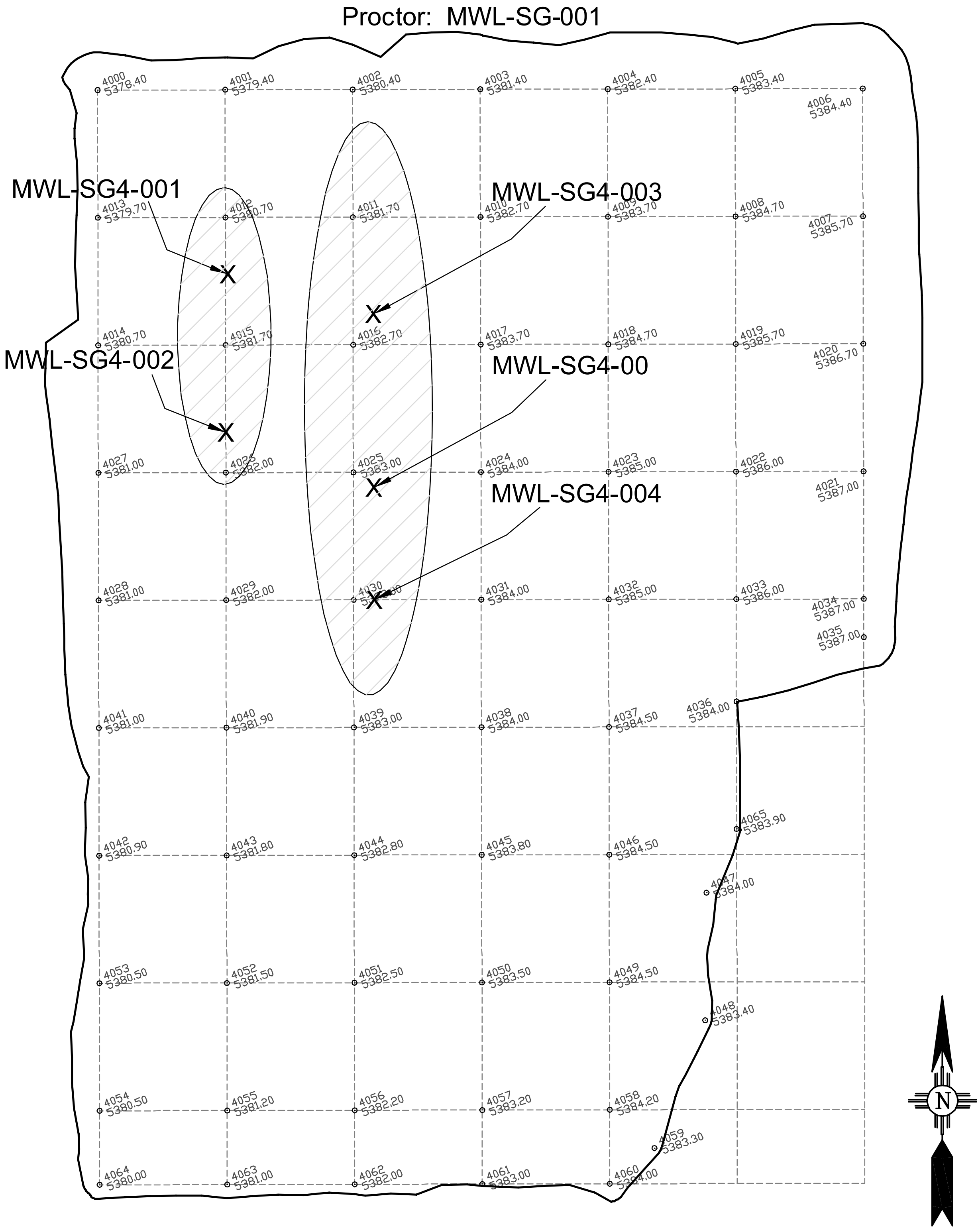
URS



X = Compaction Test Site

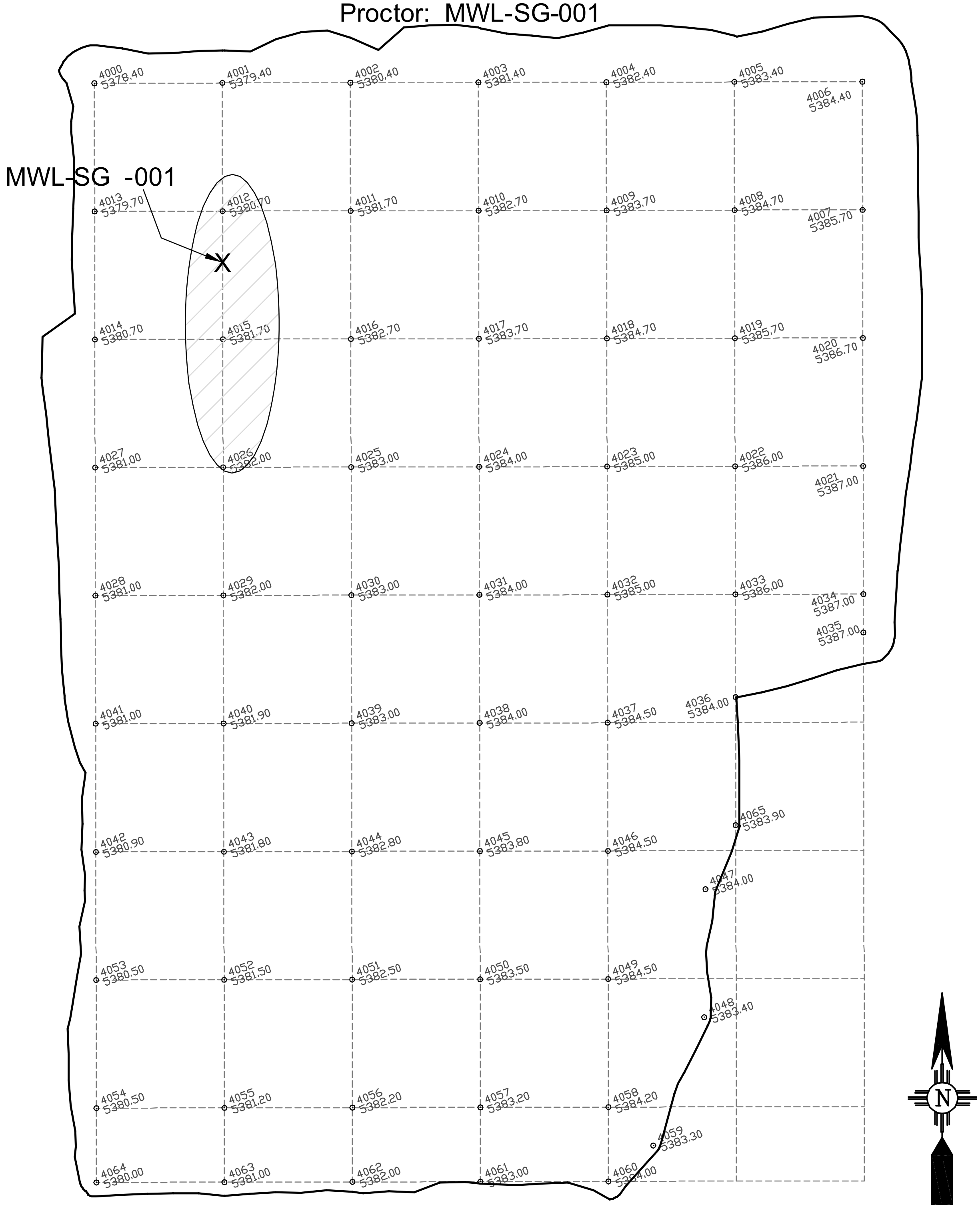
Figure 8
Mixed Waste Landfill
Subgrade Lift 3 Map

URS



X = Compaction Test Site

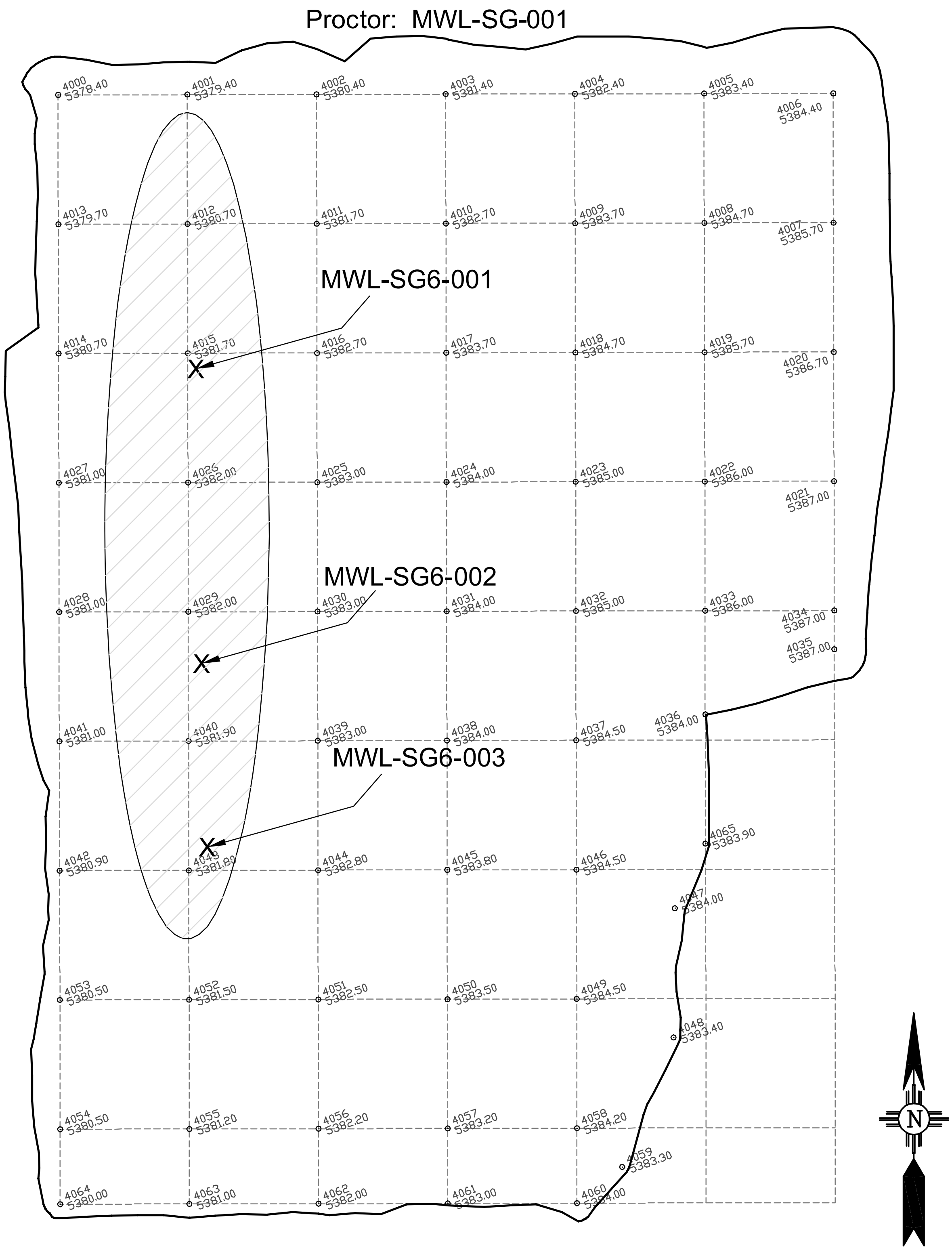
Figure 9
Mixed Waste Landfill
Subgrade Lift 4 Map



X = Compaction Test Site

Figure 10
Mixed Waste Landfill
Subgrade Lift 5 Map

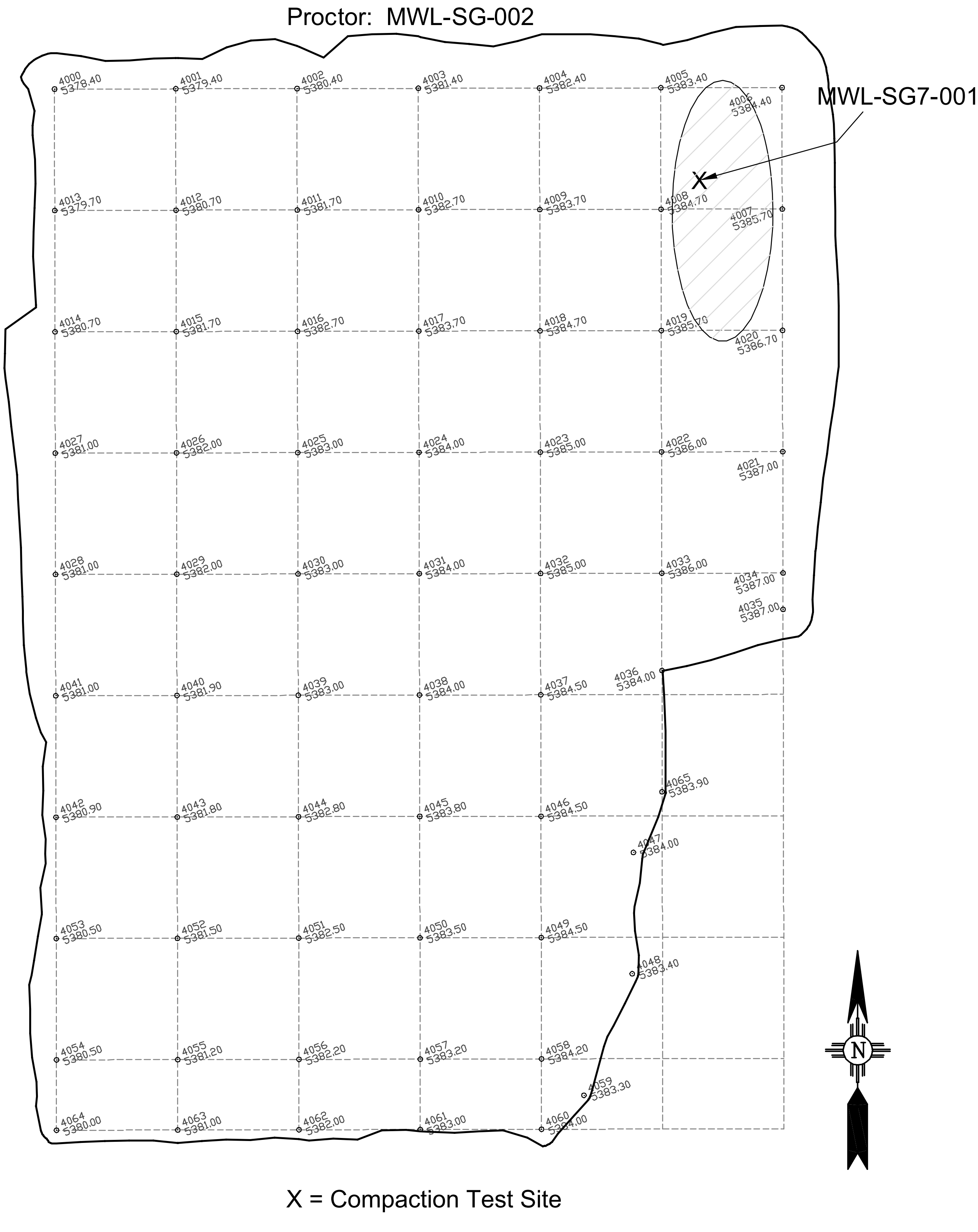
URS



X = Compaction Test Site

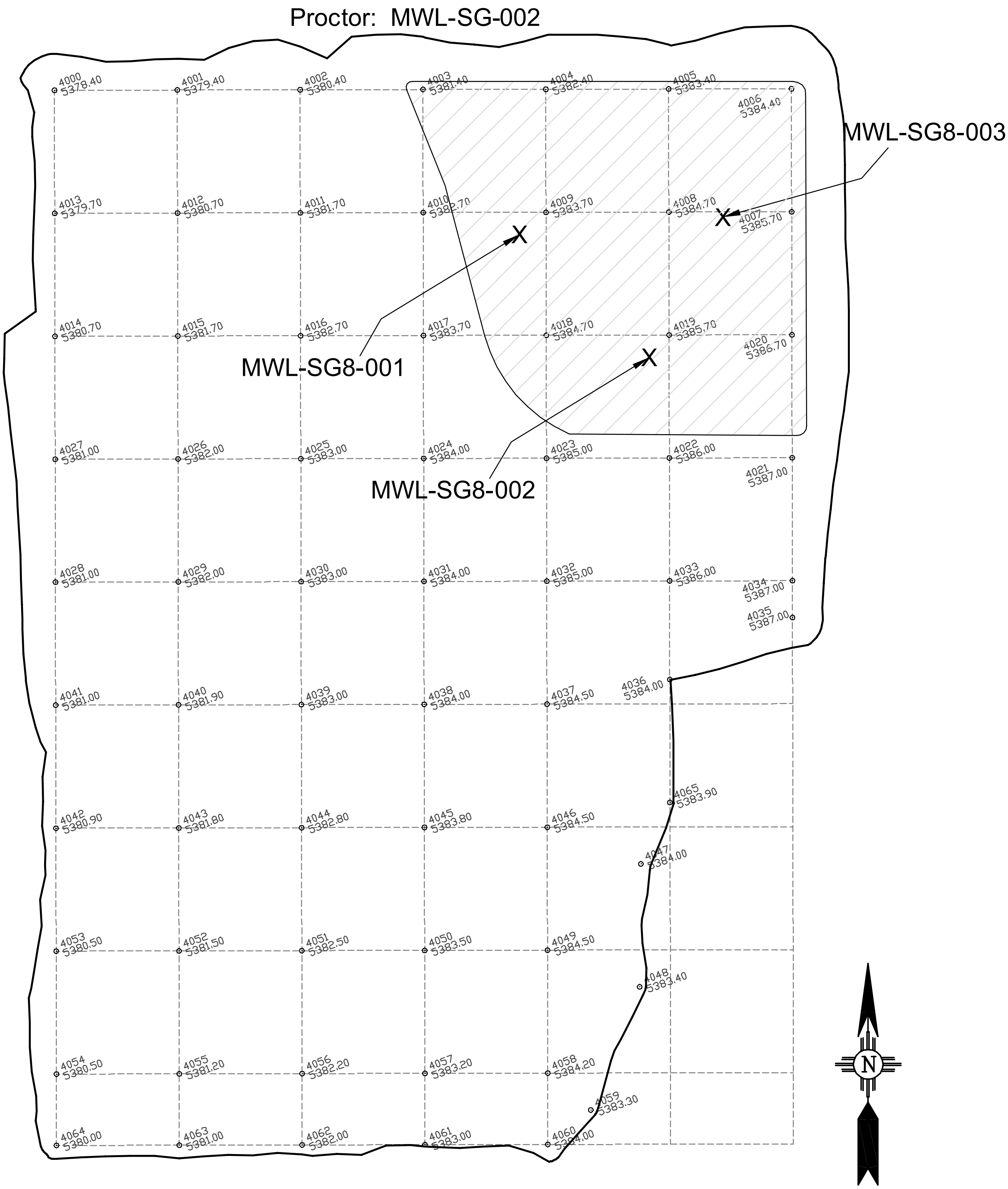
Figure 11
Mixed Waste Landfill
Subgrade Lift 6 Map

URS



X = Compaction Test Site

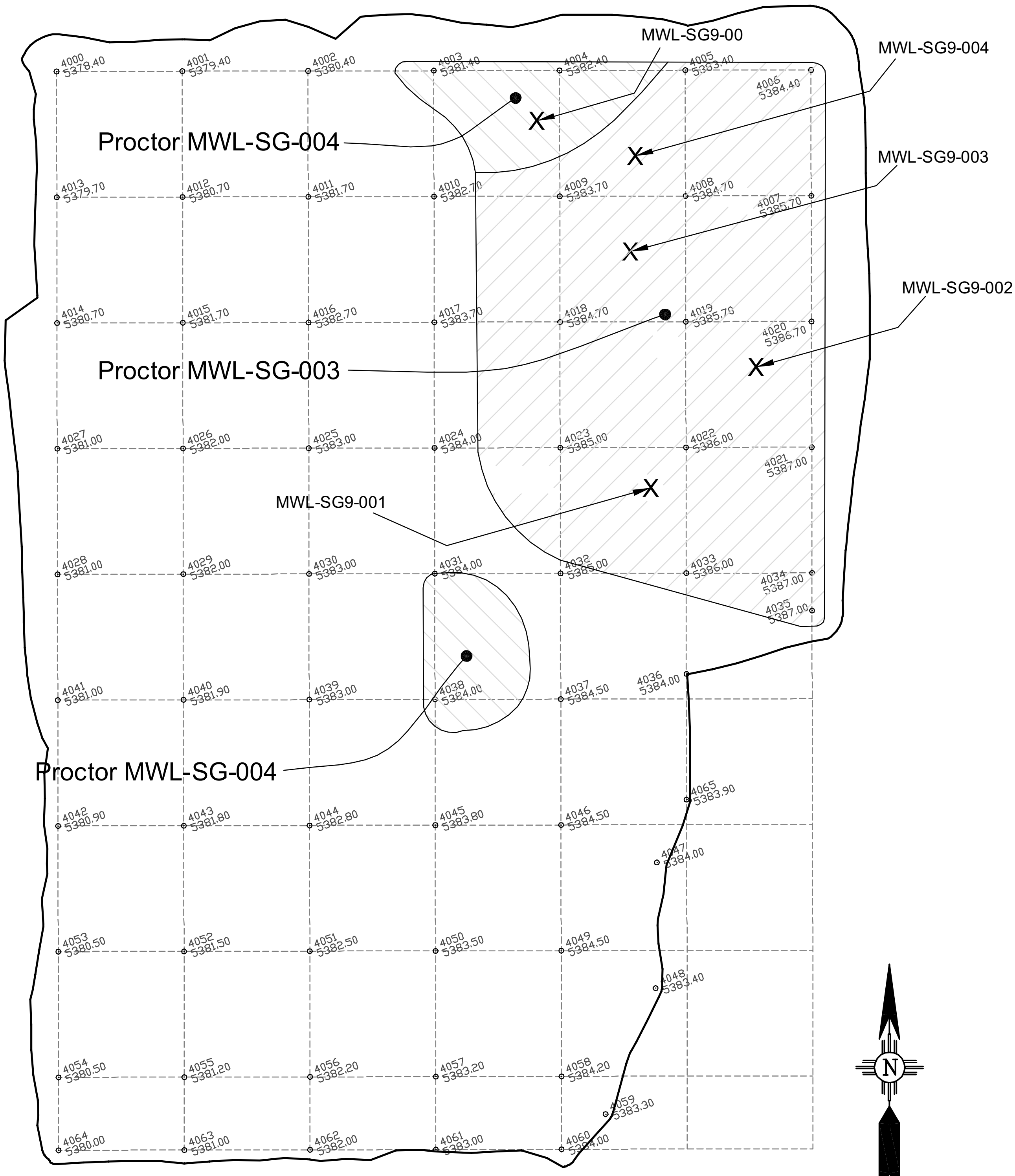
Figure 12
Mixed Waste Landfill
Subgrade Lift 7 Map



X = Compaction Test Site

Figure 13
Mixed Waste Landfill
Subgrade Lift 8 Map

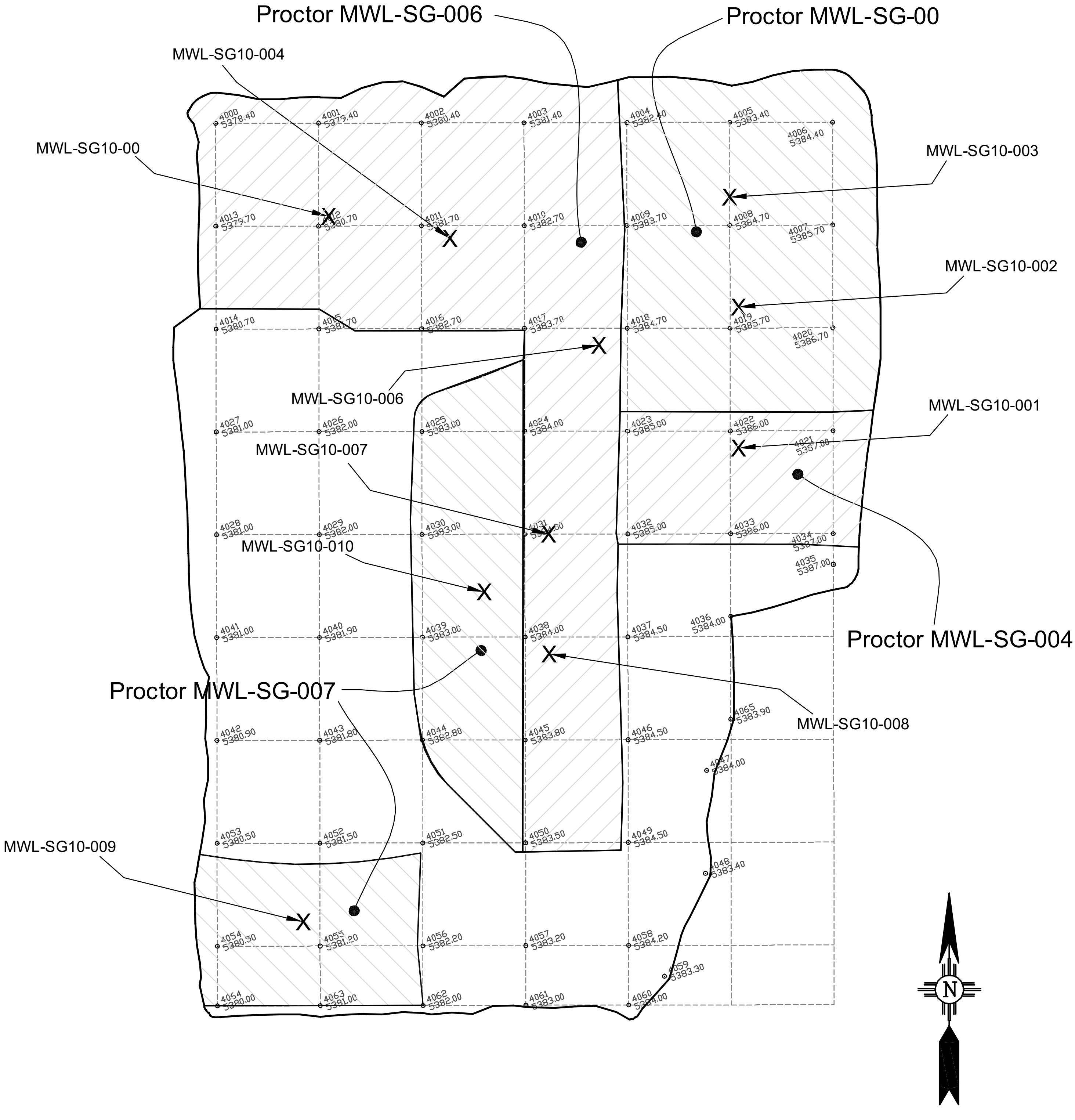
URS



X = Compaction Test Site

Figure 14
Mixed Waste Landfill
Subgrade Lift 9 Map

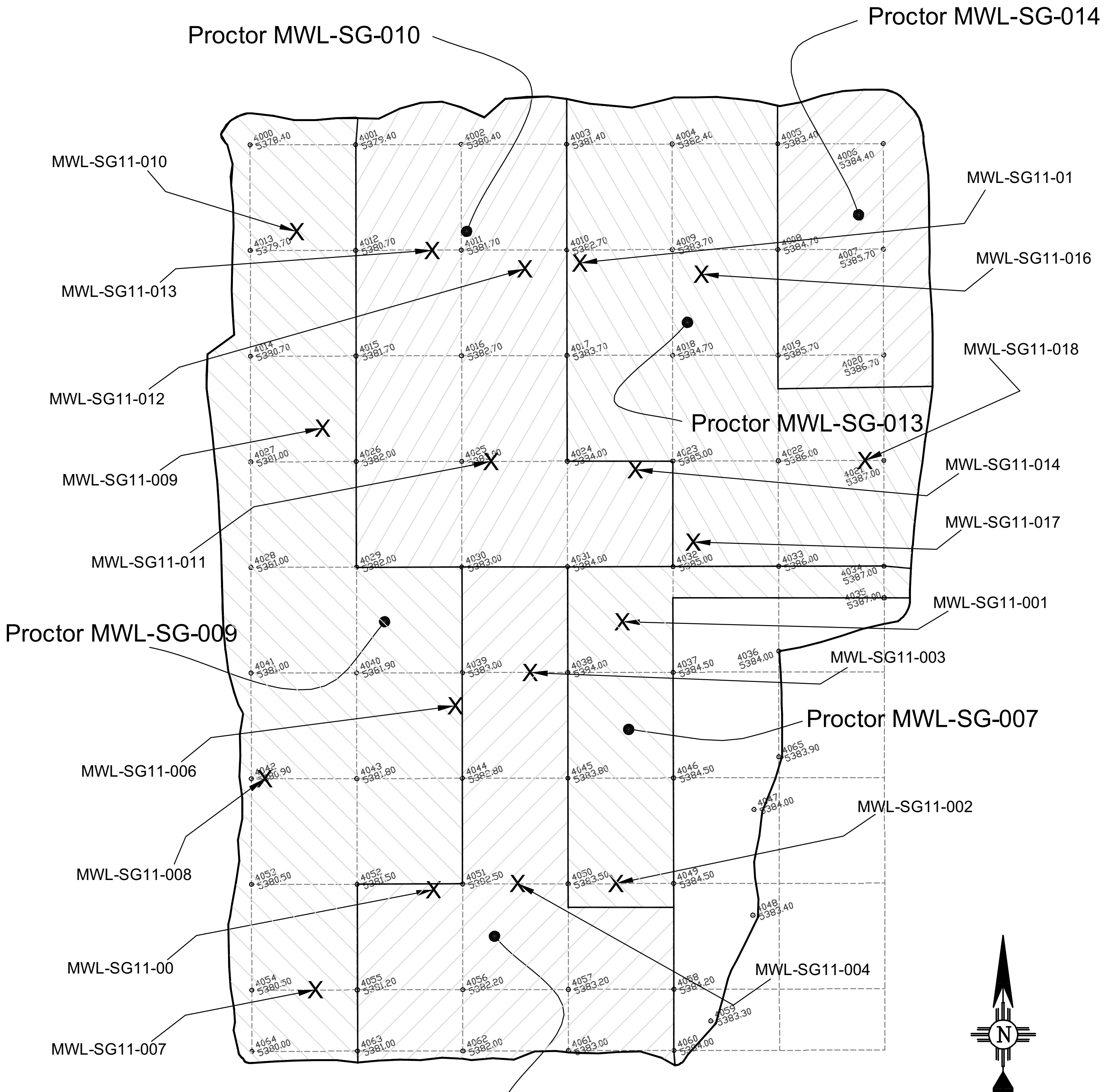
URS



X = Compaction Test Site

Figure 15
Mixed Waste Landfill
Subgrade Lift 10 Map

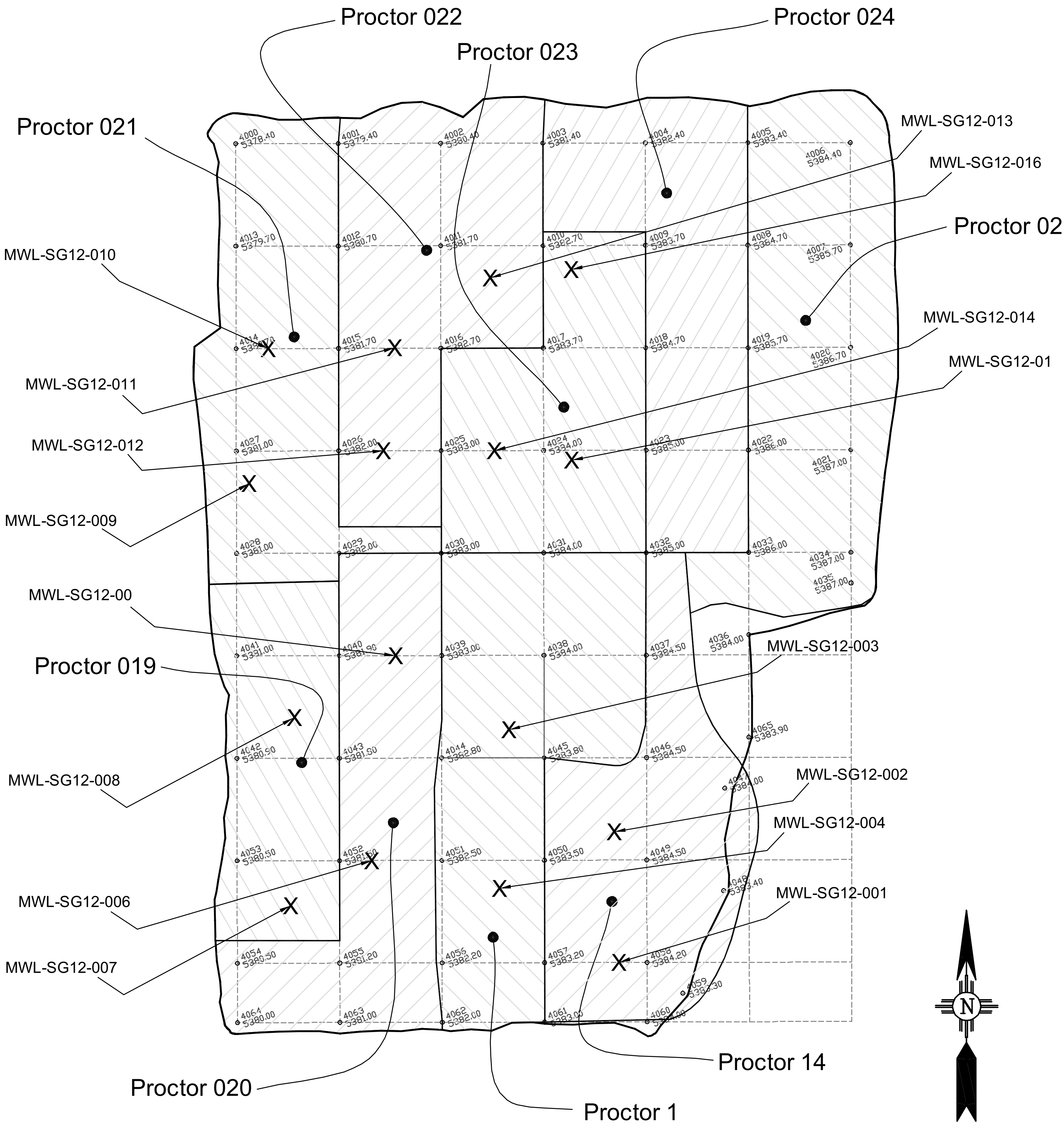
URS



X = Compaction Test Site

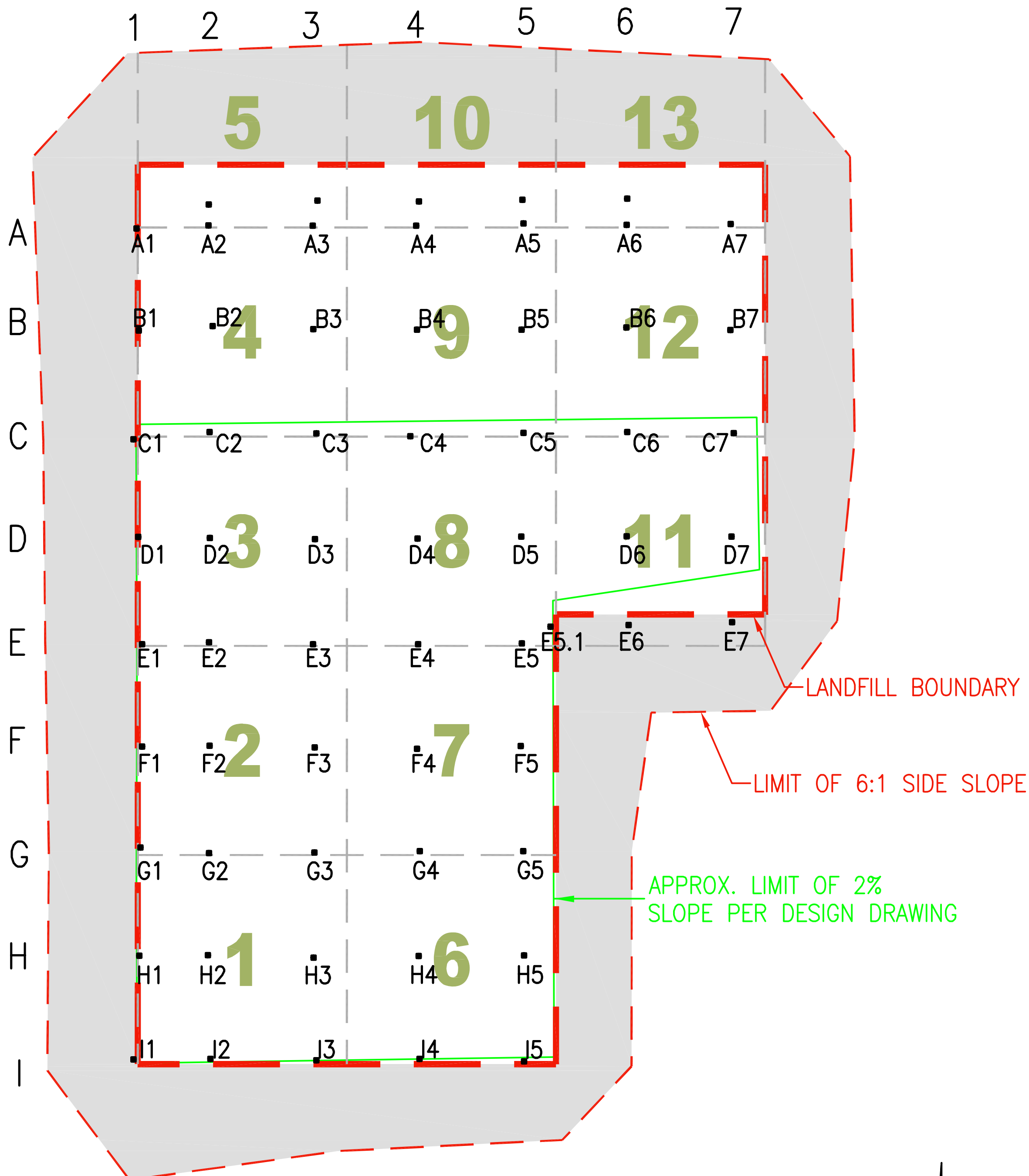
Figure 16
Mixed Waste Landfill
Subgrade Lift 11 Map

URS



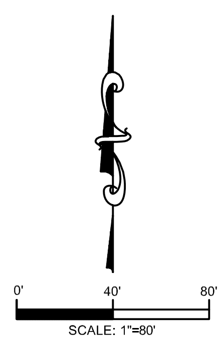
X = Compaction Test Site

Figure 17
Mixed Waste Landfill
Subgrade Lift 12 Map



LEGEND:

6	GRID BLOCK NUMBER
H3	QC SURVEY VERIFICATION GRID POINTS
	GRID BLOCK BOUNDARY
	LANDFILL BOUNDARY
	LIMIT OF SIDESLOPE (APPROX 6:1)
	SLOPE AREAS



AMEC Earth & Environmental
8519 Jefferson, NE
Albuquerque, NM 87113

CLIENT LOGO

CLIENT: **SANDIA NATIONAL LABORATORIES**

TITLE

**MIXED WASTE LANDFILL
SURVEY VERIFICATION GRID POINTS
AND FIELD TESTING GRID BLOCKS**

DWN BY: BDP	DATUM: --	DATE: NOV 2009
CHK'D BY: CW	REV. NO.: A	PROJECT NO: 9-517-00022G
PROJECTION: --	SCALE: AS SHOWN	FIGURE No. 18

G:\CAD\MIXED WASTE LANDFILL\951700022G\FIG 3-4.dwg Dec 07,2009 10:21am

Mapid=100046 12/07/09 SNL EGIS ORG. 4133 DHelfrich dh100046.aml

Legend

- Mobile Office / Shed / Water Tank
- 1-ft. Subgrade Contour Interval
- Edge of unpaved Road
- 100-ft. Sample Grid
- MWL Disposal Area
- Wedge Lift 1
- Wedge Lift 2

Figure 19
Mixed Waste Landfill Cover Grid Blocks and Locations of Native Soil Layer Wedge Lifts 1 & 2

0 80 160
Scale in Feet

0 19.2 38.4
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

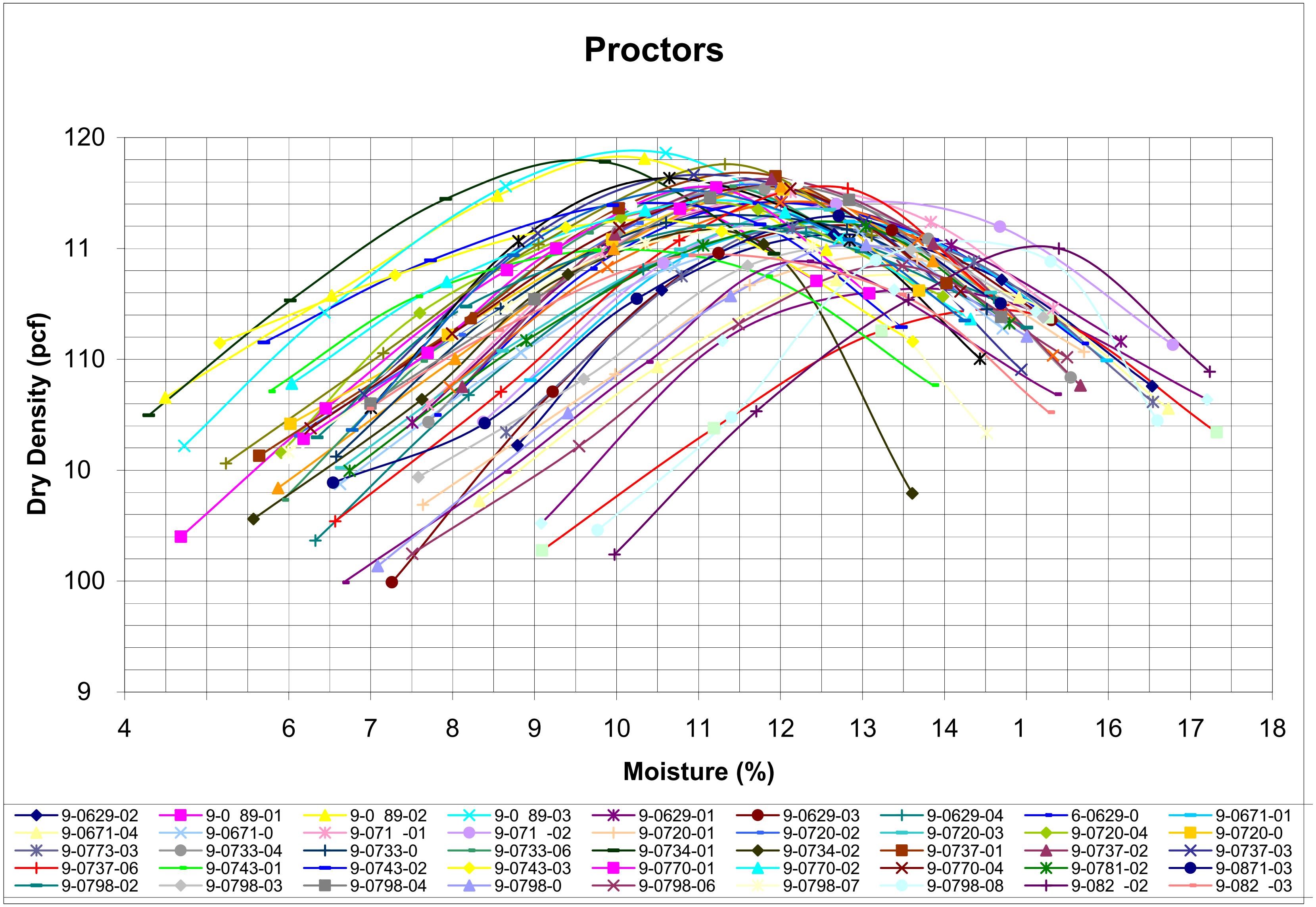
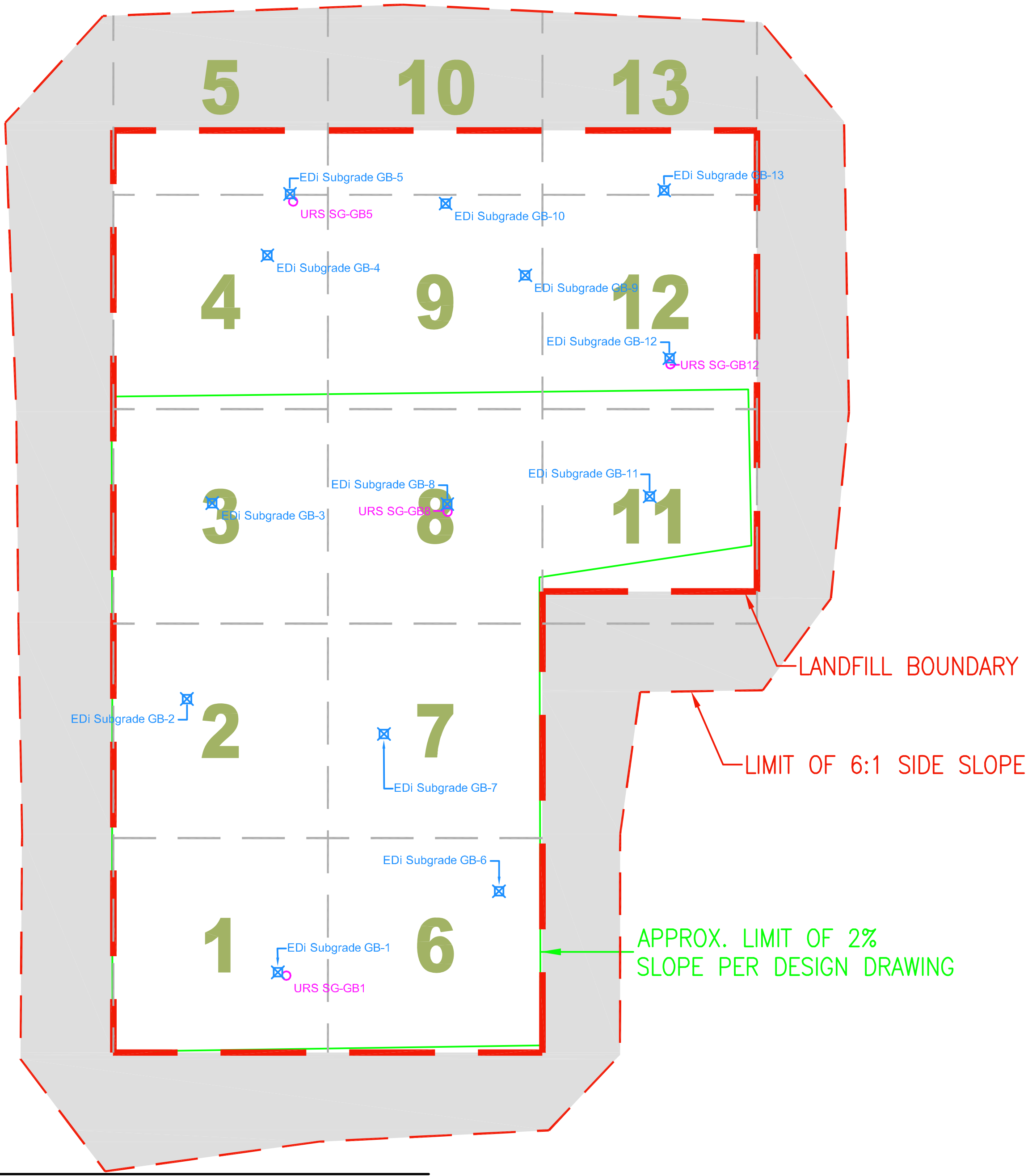
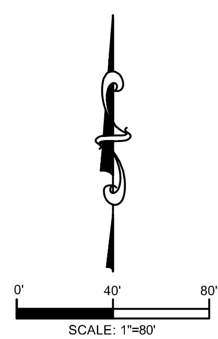


Figure 20. Graphical Representation of all MWL Alternative Cover Standard Proctor Results



LEGEND:

6	GRID BLOCK NUMBER
⊠	QC TEST LOCATIONS
○	QA TEST LOCATIONS
	GRID BLOCK BOUNDARY
	LANDFILL BOUNDARY
	LIMIT OF SIDESLOPE (APPROX 6:1)
	SLOPE AREAS



AMEC Earth & Environmental
8519 Jefferson, NE
Albuquerque, NM 87113

amec

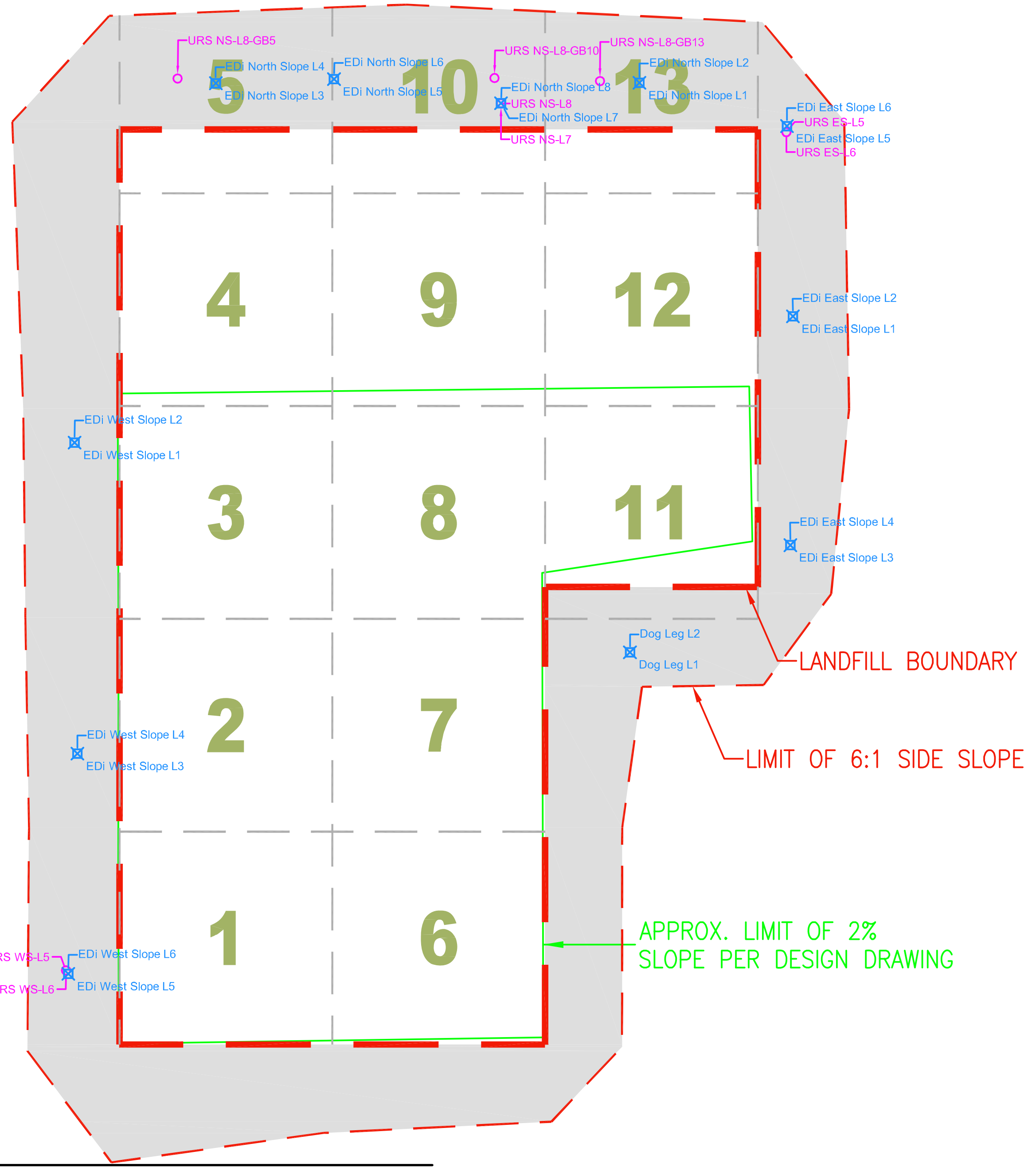
CLIENT LOGO

CLIENT
SANDIA NATIONAL LABORATORIES

TITLE
MIXED WASTE LANDFILL
MOISTURE/DENSITY TEST LOCATIONS
2009 SUBGRADE SURFACE

DWN BY: BDP	DATUM: --	DATE: OCT 2009
CHK'D BY: CW	REV. NO.: A	PROJECT NO: 9-517-00022G
PROJECTION: --	SCALE: AS SHOWN	FIGURE No. 21

G:\CAD\MIXED WASTE LANDFILL\951700022G\FIG 3-5.dwg Nov 06,2009 10:59am



LEGEND:

Symbol	Description
6	GRID BLOCK NUMBER
⊠	QC TEST LOCATIONS
○	QA TEST LOCATIONS
grey dashed line	GRID BLOCK BOUNDARY
thick red dashed line	LANDFILL BOUNDARY
thin red dashed line	LIMIT OF SIDESLOPE (APPROX 6:1)
grey box	SLOPE AREAS

0' 40' 80'

SCALE: 1"=80'

AMEC Earth & Environmental
8519 Jefferson, NE
Albuquerque, NM 87113

amec

CLIENT LOGO

CLIENT

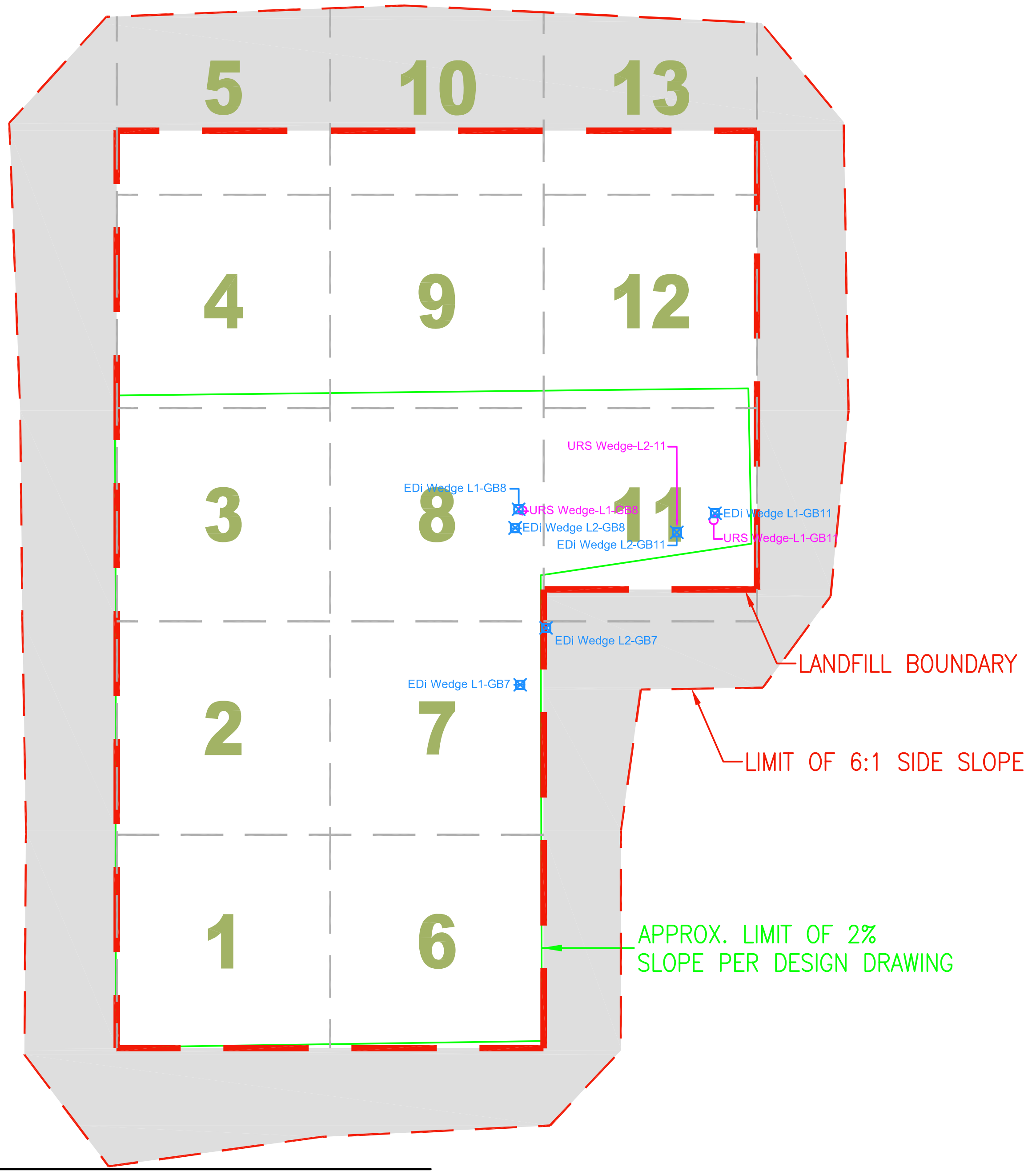
SANDIA NATIONAL LABORATORIES

TITLE

MIXED WASTE LANDFILL
MOISTURE/DENSITY TEST LOCATIONS
SIDE SLOPE LIFTS

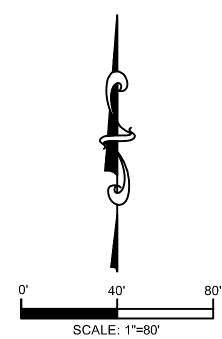
DWN BY: BDP	DATUM: --	DATE: OCT 2009
CHK'D BY: CW	REV. NO.: A	PROJECT NO: 9-517-00022G
PROJECTION: --	SCALE: AS SHOWN	FIGURE No. 22

G:\CAD\MIXED WASTE LANDFILL\951700022G\FIG 3-6.dwg Nov 04,2009 10:02am



LEGEND:

Symbol	Description
6	GRID BLOCK NUMBER
⊠	QC TEST LOCATIONS
o	QA TEST LOCATIONS
gray dashed line	GRID BLOCK BOUNDARY
heavy red dashed line	LANDFILL BOUNDARY
thin red dashed line	LIMIT OF SIDESLOPE (APPROX 6:1)
gray box	SLOPE AREAS



AMEC Earth & Environmental
8519 Jefferson, NE
Albuquerque, NM 87113

amec

CLIENT LOGO

CLIENT

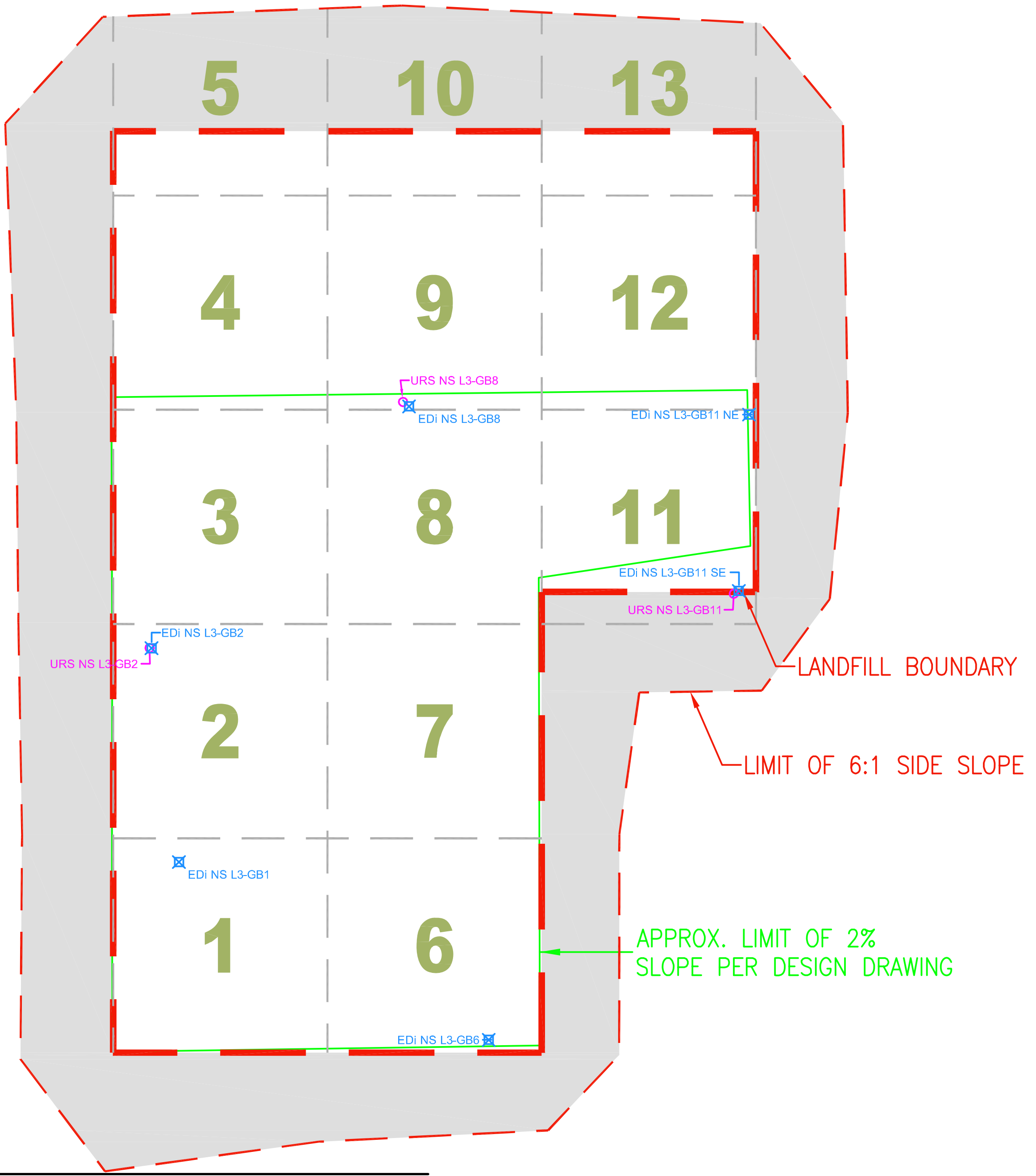
SANDIA NATIONAL LABORATORIES

TITLE

MIXED WASTE LANDFILL
MOISTURE/DENSITY TEST LOCATIONS
NATIVE SOIL LAYER WEDGE LIFTS 1 & 2

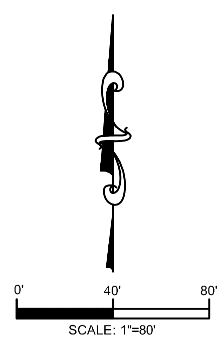
DWN BY: BDP	DATUM: --	DATE: OCT 2009
CHK'D BY: CW	REV. NO.: A	PROJECT NO: 9-517-00022G
PROJECTION: --	SCALE: AS SHOWN	FIGURE No. 23

G:\CAD\MIXED WASTE LANDFILL\951700022G\FIG 3-7.dwg Nov 04,2009 10:02am



LEGEND:

6	GRID BLOCK NUMBER
⊠	QC TEST LOCATIONS
○	QA TEST LOCATIONS
— — — (grey dashed)	GRID BLOCK BOUNDARY
▬ ▬ (thick red dashed)	LANDFILL BOUNDARY
— — — (red dashed)	LIMIT OF SIDESLOPE (APPROX 6:1)
▭	SLOPE AREAS



AMEC Earth & Environmental
8519 Jefferson, NE
Albuquerque, NM 87113

CLIENT LOGO

CLIENT

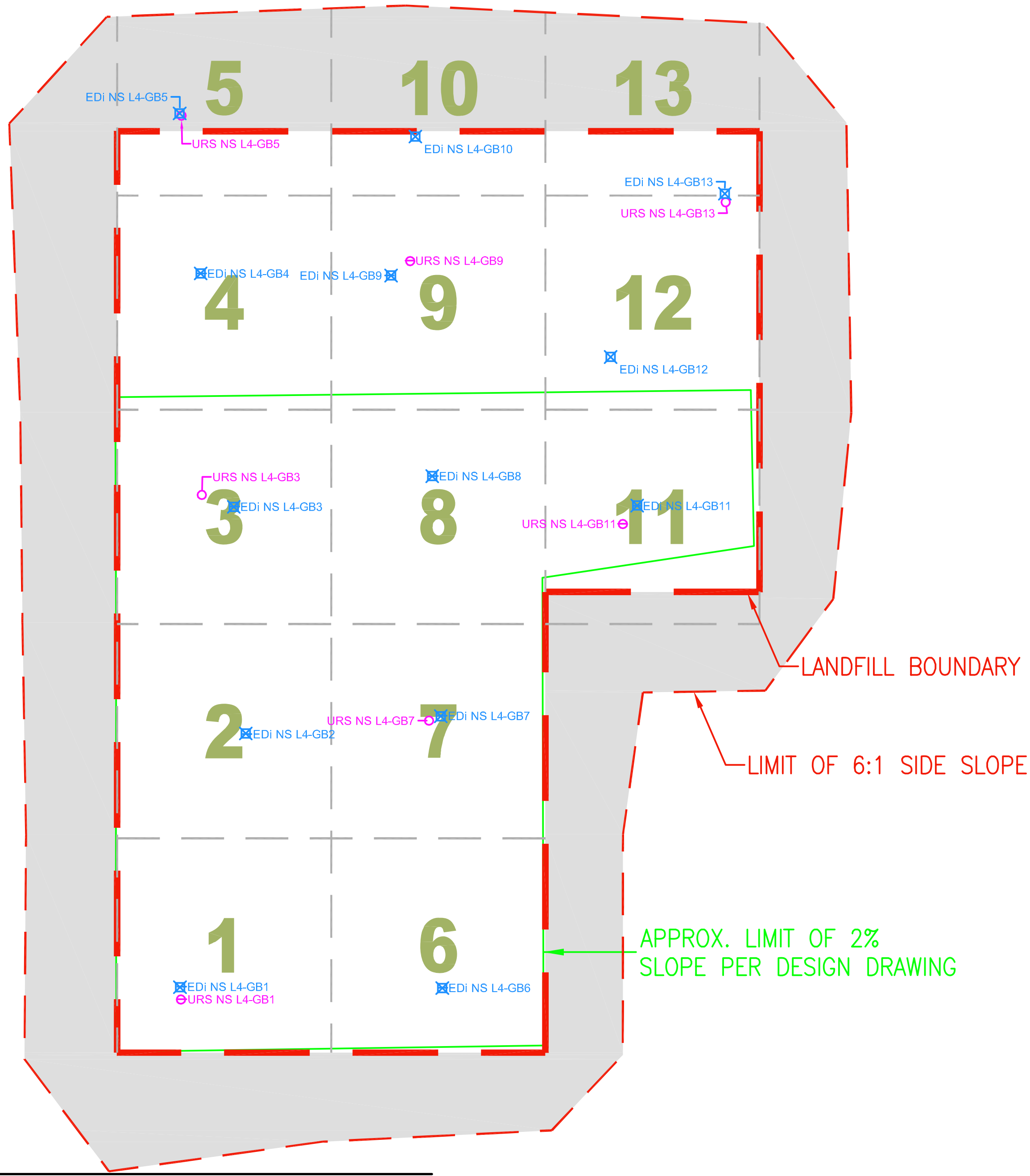
SANDIA NATIONAL LABORATORIES

TITLE

MIXED WASTE LANDFILL
MOISTURE/DENSITY TEST LOCATIONS
NATIVE SOIL LAYER LIFT 3

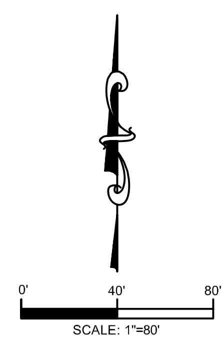
DWN BY: BDP	DATUM: --	DATE: OCT 2009
CHK'D BY: CW	REV. NO.: A	PROJECT NO: 9-517-00022G
PROJECTION: --	SCALE: AS SHOWN	FIGURE No. 24

G:\CAD\MIXED WASTE LANDFILL\951700022G\FIG 3-8.dwg Nov 04,2009 10:01am



LEGEND:

Symbol	Description
6	GRID BLOCK NUMBER
⊠	QC TEST LOCATIONS
○	QA TEST LOCATIONS
— — —	GRID BLOCK BOUNDARY
▬ ▬	LANDFILL BOUNDARY
— — —	LIMIT OF SIDESLOPE (APPROX 6:1)
▭	SLOPE AREAS



AMEC Earth & Environmental
8519 Jefferson, NE
Albuquerque, NM 87113

CLIENT LOGO

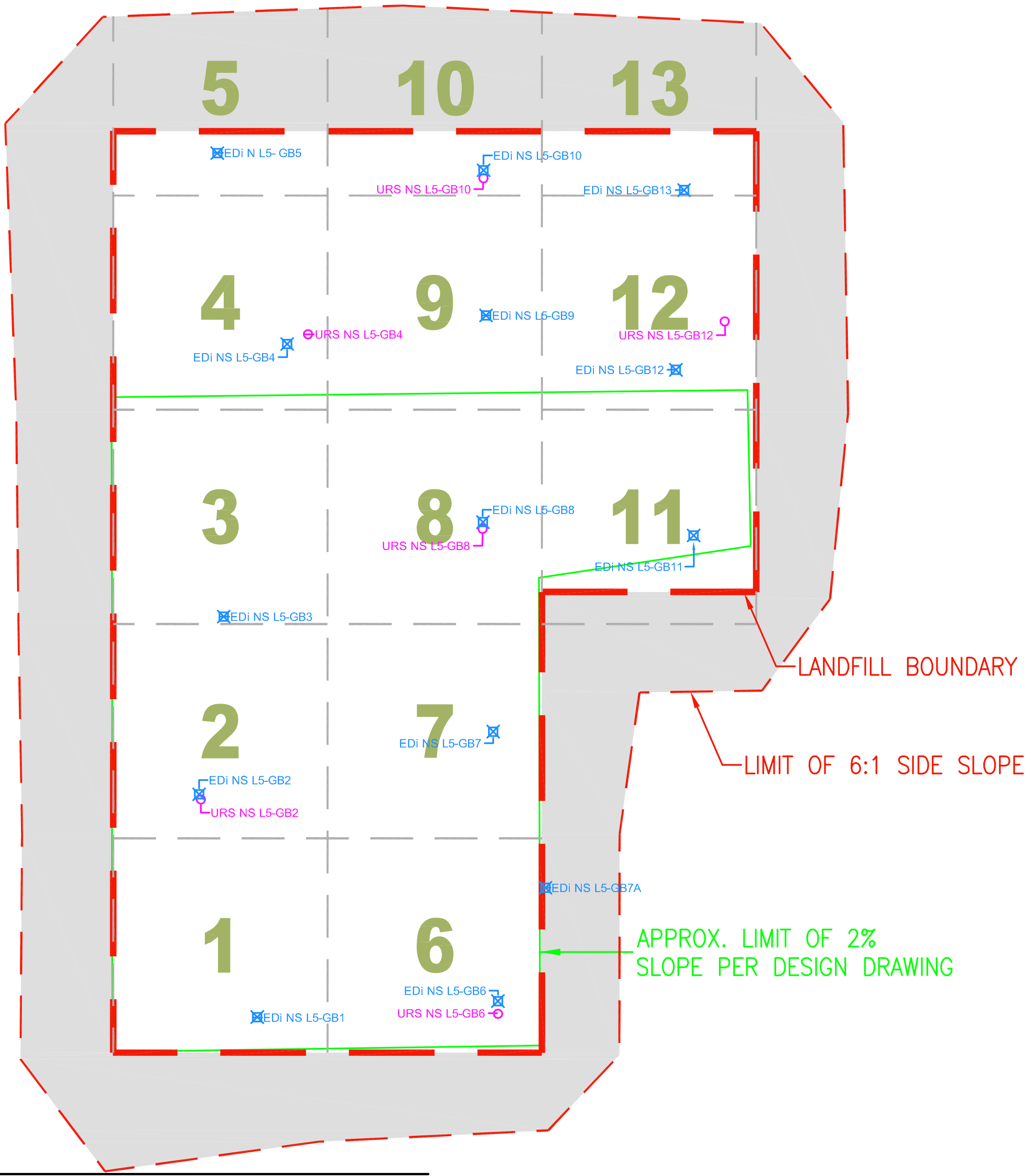
CLIENT: **SANDIA NATIONAL LABORATORIES**

TITLE

MIXED WASTE LANDFILL
MOISTURE/DENSITY TEST LOCATIONS
NATIVE SOIL LAYER LIFT 4

DWN BY: BDP	DATUM: --	DATE: OCT 2009
CHK'D BY: CW	REV. NO.: A	PROJECT NO: 9-517-00022G
PROJECTION: --	SCALE: AS SHOWN	FIGURE No. 25

G:\CAD\MIXED WASTE LANDFILL\951700022G\FIG 3-9.dwg Nov 04,2009 10:01am



LEGEND:

6	GRID BLOCK NUMBER
⊠	QC TEST LOCATIONS
○	QA TEST LOCATIONS
— — —	GRID BLOCK BOUNDARY
▬ ▬	LANDFILL BOUNDARY
— — —	LIMIT OF SIDESLOPE (APPROX 6:1)
▭	SLOPE AREAS

0' 40' 80'

SCALE: 1"=80'

AMEC Earth & Environmental
8519 Jefferson, NE
Albuquerque, NM 87113

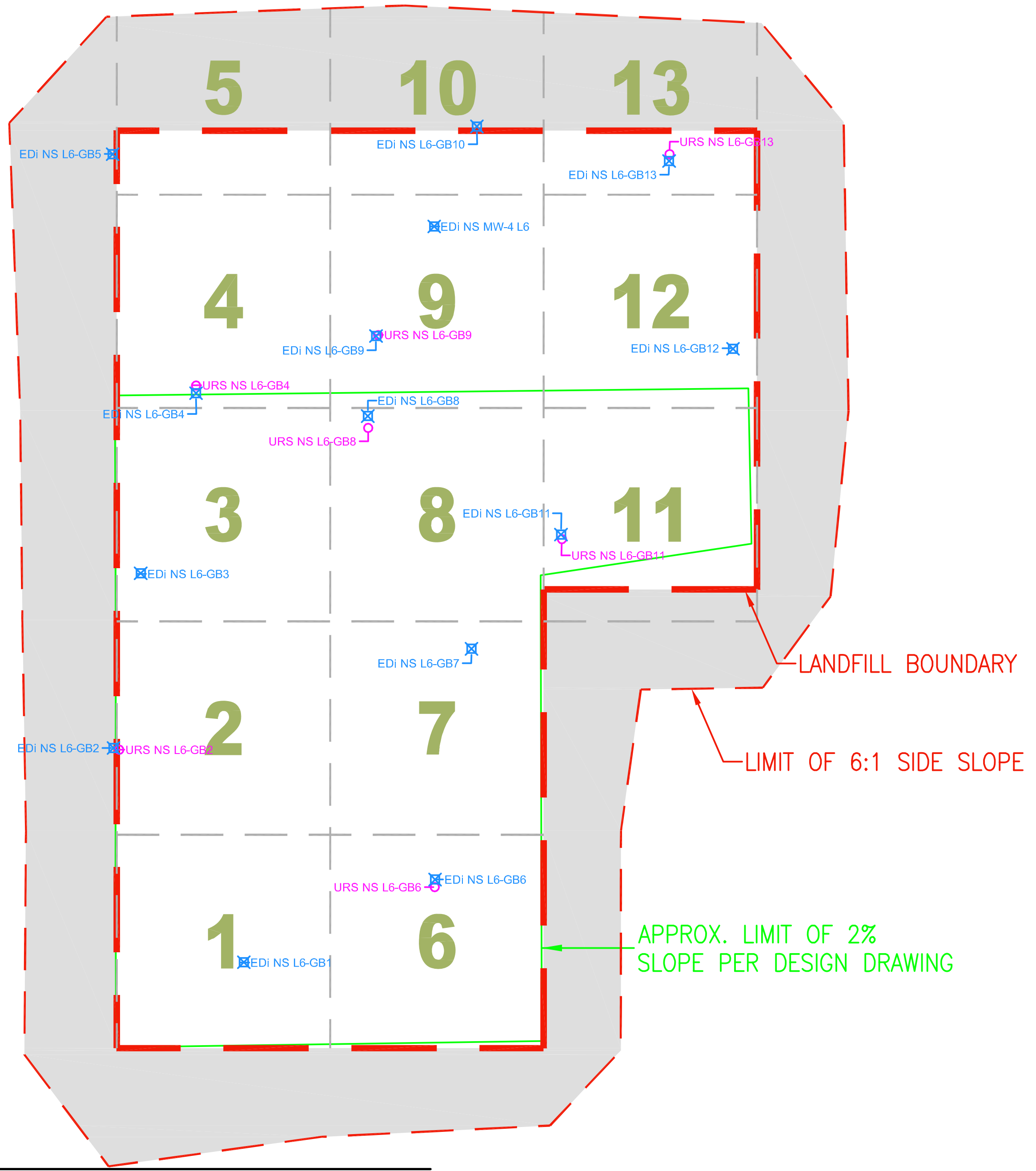
CLIENT LOGO	CLIENT	**SANDIA NATIONAL LABORATORIES**

TITLE

MIXED WASTE LANDFILL
MOISTURE/DENSITY TEST LOCATIONS
NATIVE SOIL LAYER LIFT 5

DWN BY: BDP	DATUM: --	DATE: OCT 2009
CHK'D BY: CW	REV. NO.: A	PROJECT NO: 9-517-00022G
PROJECTION: --	SCALE: AS SHOWN	FIGURE No. **26**

G:\CAD\MIXED WASTE LANDFILL\951700022G\FIG 3-10.dwg Nov 04,2009 10:20am



LEGEND:

6	GRID BLOCK NUMBER
	QC TEST LOCATIONS
	QA TEST LOCATIONS
	GRID BLOCK BOUNDARY
	LANDFILL BOUNDARY
	LIMIT OF SIDESLOPE (APPROX 6:1)
	SLOPE AREAS

0' 40' 80'

SCALE: 1"=80'

AMEC Earth & Environmental
8519 Jefferson, NE
Albuquerque, NM 87113

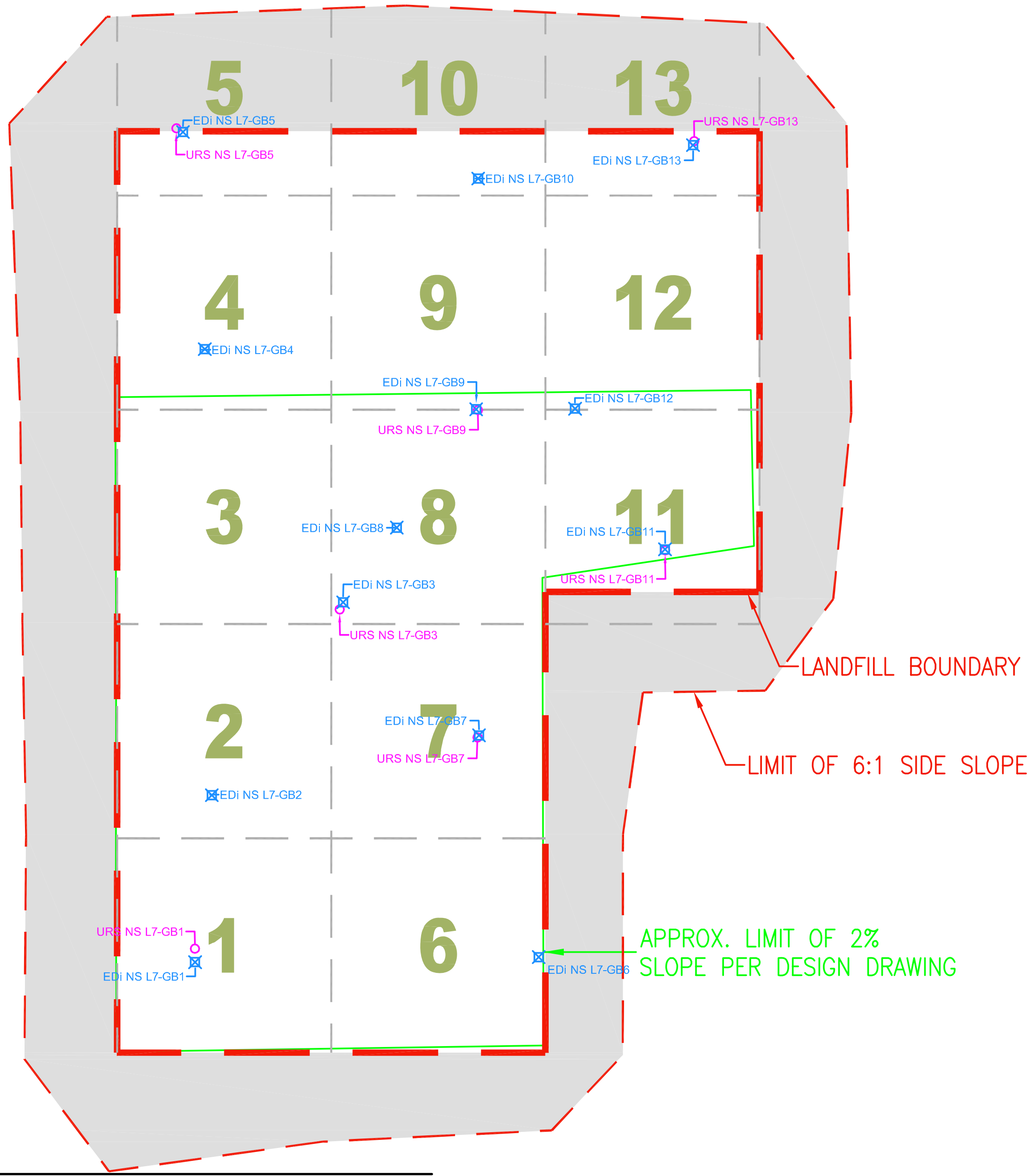
CLIENT LOGO

CLIENT
SANDIA NATIONAL LABORATORIES

TITLE
MIXED WASTE LANDFILL
MOISTURE/DENSITY TEST LOCATIONS
NATIVE SOIL LAYER LIFT 6

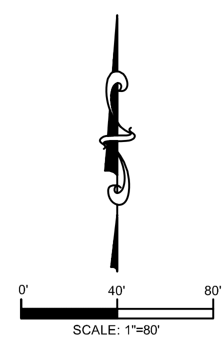
DWN BY: BDP	DATUM: --	DATE: OCT 2009
CHK'D BY: CW	REV. NO.: A	PROJECT NO: 9-517-00022G
PROJECTION: --	SCALE: AS SHOWN	FIGURE No. 27

G:\CAD\MIXED WASTE LANDFILL\951700022G\FIG 3-11.dwg Nov 04,2009 10:01am



LEGEND:

6	GRID BLOCK NUMBER
⊠	QC TEST LOCATIONS
o	QA TEST LOCATIONS
— — — (grey dashed)	GRID BLOCK BOUNDARY
— — (red heavy dashed)	LANDFILL BOUNDARY
— — — (red thin dashed)	LIMIT OF SIDESLOPE (APPROX 6:1)
(grey box)	SLOPE AREAS



AMEC Earth & Environmental
8519 Jefferson, NE
Albuquerque, NM 87113

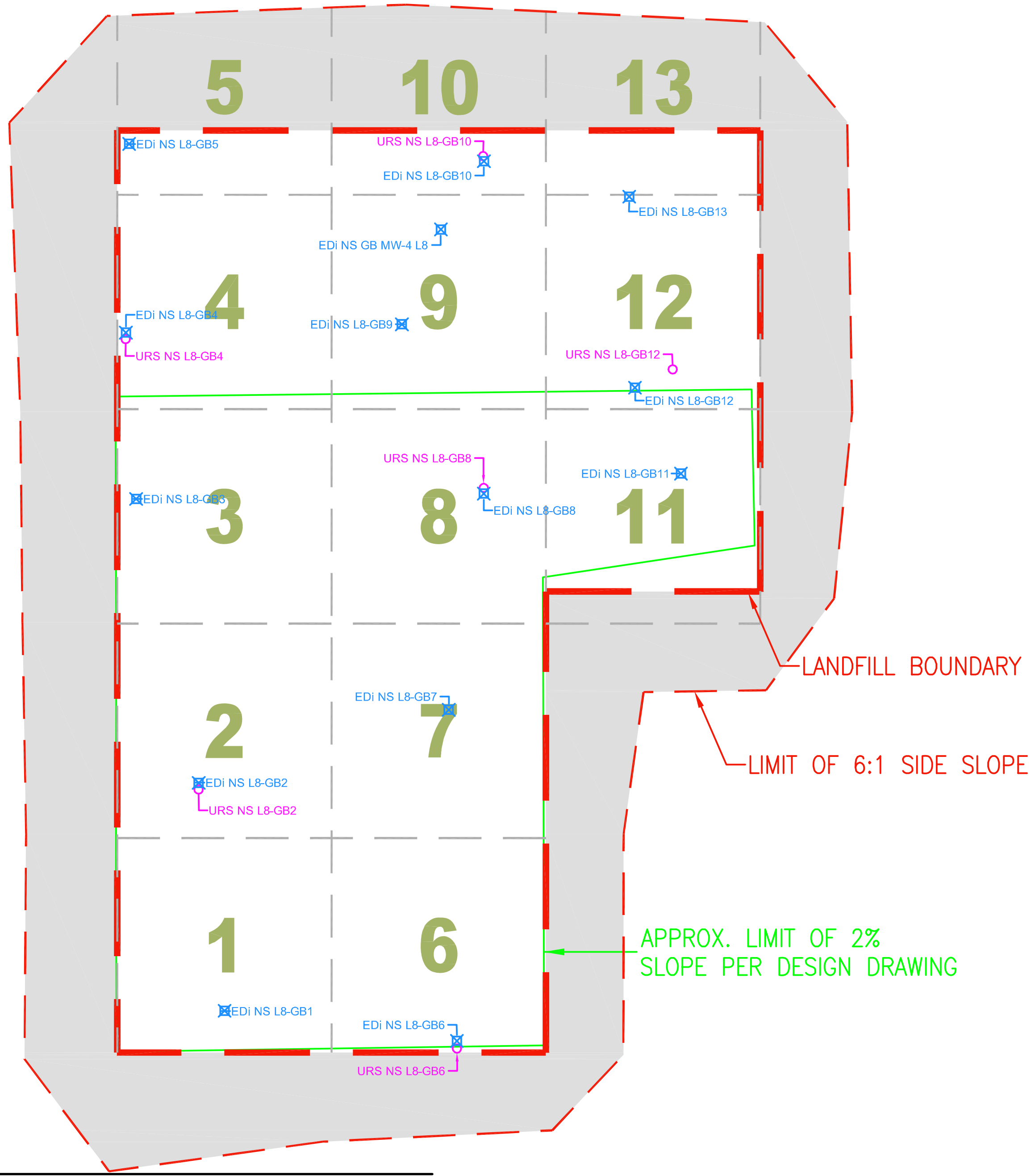
CLIENT LOGO

CLIENT
SANDIA NATIONAL LABORATORIES

TITLE
MIXED WASTE LANDFILL
MOISTURE/DENSITY TEST LOCATIONS
NATIVE SOIL LAYER LIFT 7

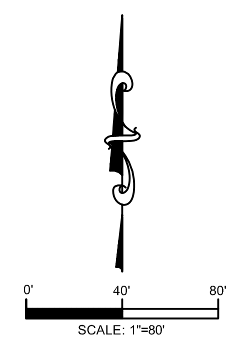
DWN BY: BDP	DATUM: --	DATE: OCT 2009
CHK'D BY: CW	REV. NO.: A	PROJECT NO: 9-517-00022G
PROJECTION: --	SCALE: AS SHOWN	FIGURE No. 28

G:\CAD\MIXED WASTE LANDFILL\951700022G\FIG 3-12.dwg Nov 04,2009 10:00am



LEGEND:

6	GRID BLOCK NUMBER
⊠	QC TEST LOCATIONS
○	QA TEST LOCATIONS
— — — (grey dashed)	GRID BLOCK BOUNDARY
— — (red heavy dashed)	LANDFILL BOUNDARY
— — — (red thin dashed)	LIMIT OF SIDESLOPE (APPROX 6:1)
(grey box)	SLOPE AREAS



AMEC Earth & Environmental 8519 Jefferson, NE Albuquerque, NM 87113	amec	CLIENT LOGO	CLIENT **SANDIA NATIONAL LABORATORIES**

TITLE			
MIXED WASTE LANDFILL MOISTURE/DENSITY TEST LOCATIONS NATIVE SOIL LAYER LIFT 8	DWN BY: BDP	DATUM: --	DATE: OCT 2009
	CHK'D BY: CW	REV. NO.: A	PROJECT NO: 9-517-00022G
	PROJECTION: --	SCALE: AS SHOWN	FIGURE No. **29**

G:\CAD\MIXED WASTE LANDFILL\951700022G\FIG 3-13.dwg Nov 04,2009 10:00am

As-Built Drawings

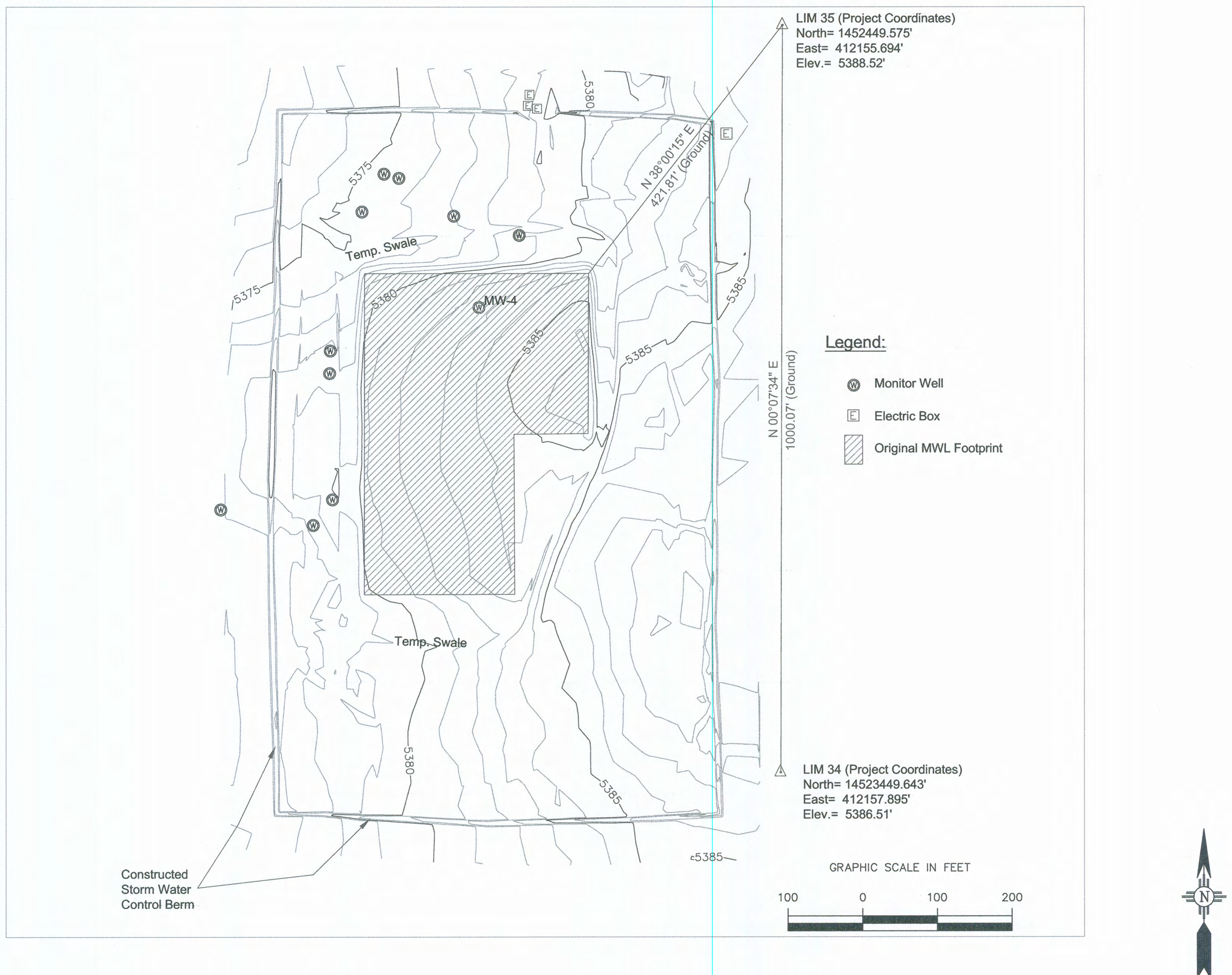
2006 Subgrade As-Built Drawing

MIXED WASTE LANDFILL FINISHED SUBGRADE SURVEY

MWL

TECH AREA III

Sandia National Laboratories
Bernalillo County, New Mexico
August 2007



Survey Notes:

1.) "Finished Subgrade" conditions based on topographic surveys by URS Corporation April 2007.

2.) Elevations for this survey are based on SNL/KAFB Monument "LIM 35" with an NGVD 29 elevation of 5388.52'. Contour interval is one foot.

3.) Survey Control Coordinates are modified state plane (or "Ground"), based on New Mexico State Plane, Central Zone, North American Datum of 1927. A Combined Scale Factor of .999651675 was used to derive project coordinates. State Plane (or "Grid") values of Control Points Used:
LIM 34 (North= 1452943.37, East= 412014.33) and LIM 35 (North= 1451943.65, East= 412012.13)

4.) Only surface appurtenances of underground utilities are shown. Other utilities may exist that are not shown on this survey. SNL ESD files were not incorporated into this survey.

5.) Distances shown are ground.

6.) This is not a boundary survey. No property corners or lines are shown.

7.) This map has been produced according to procedures that have been demonstrated to produce data that meets or exceeds the minimum standards for a topographic map compiled at a scale of 1 inch equals 100 feet with a contour interval of 1 foot.

URS
URS CORPORATION

SURVEYOR'S CERTIFICATION

I, RUSSELL D. ELLIOTT, NEW MEXICO PROFESSIONAL SURVEYOR No. 13838, HEREBY CERTIFY THAT A TOPOGRAPHIC SURVEY, AS SHOWN HEREON, HAS BEEN SURVEYED AND PLATTED IN ACCORDANCE WITH THE STANDARDS FOR TOPOGRAPHIC SURVEYS IN THE STATE OF NEW MEXICO, RULE 500.5, AND IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. I, FURTHER CERTIFY THAT THIS SURVEY AND PLAT DO NOT MEET THE REQUIREMENTS OF ANY (MUNICIPAL, COUNTY AND/OR STATE) SUBDIVISION ORDINANCES AND IS NOT INTENDED TO SUBDIVIDE ANY EXISTING PARCEL. THIS IS NOT A BOUNDARY SURVEY.

RUSSELL D. ELLIOTT NEW MEXICO 13838 LICENSED PROFESSIONAL SURVEYOR RDE 8-30-07

Russell D Elliott — 8-30-2007
RUSSELL D. ELLIOTT N.M.P.S. No. 13838 — DATE

CAD DRAWING
FILE NAME: MWL-FinishedGrade

P.O. OR W.O. / PROJECT NO.	REV	DATE	DESCRIPTION	DWN	CKD	APP

U.S. DEPARTMENT OF ENERGY
KIRTLAND AREA OFFICE — ALBUQUERQUE, NEW MEXICO

SANDIA NATIONAL LABORATORIES
ALBUQUERQUE, NEW MEXICO; LIVERMORE, CALIFORNIA; TONOPAH, NEVADA

SNL/NM MIXED WASTE LANDFILL
2006 Finished Subgrade

P.O. OR W.O.	
PROJECT NO.	
DRAWN BY	DW/JDL
CHECKED BY	HFB
APPROVED BY	RDE
DATE	08/07

SURVEY

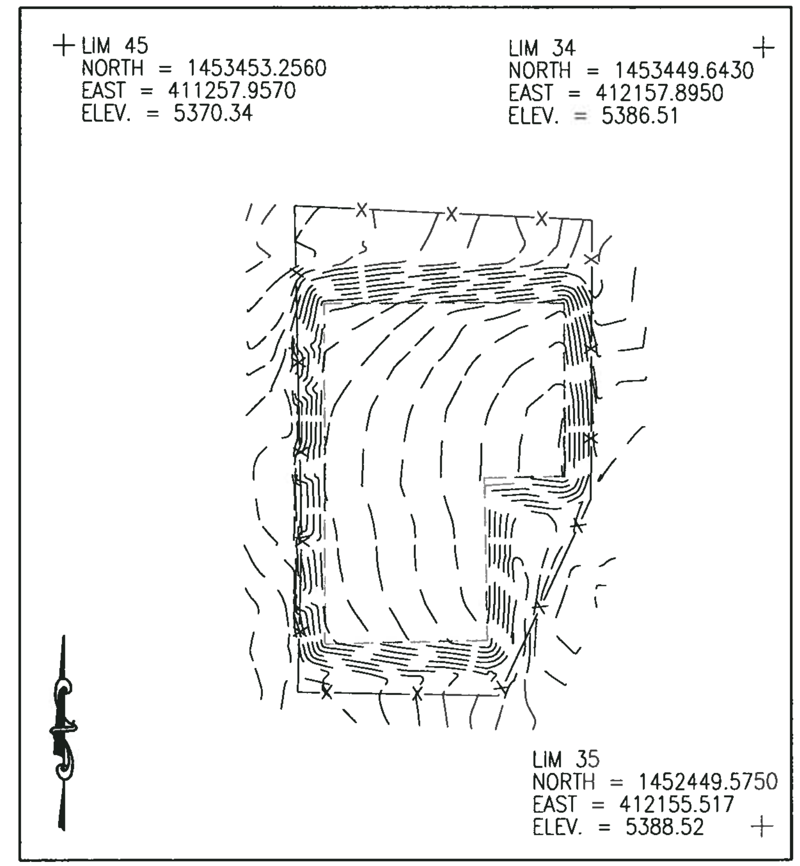
SIZE	DRAWING NO.	SEQ.
	1	1/1

24342640\07 Design\Survey\Finish Surface\dwg\MWL-FinishedGrade.dwg

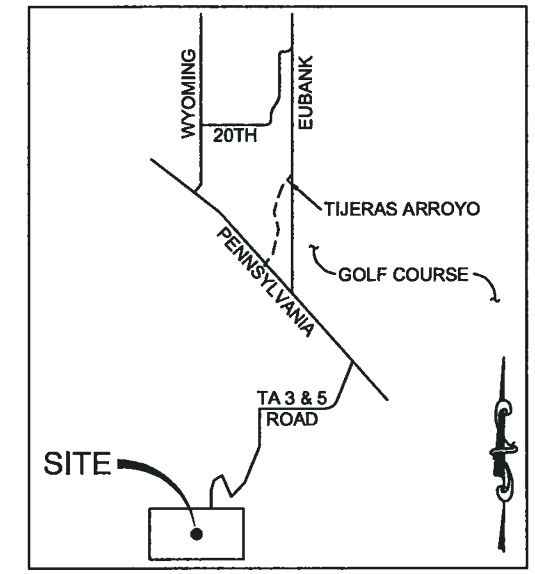
2009 Alternative Cover
As-Built Drawings

AS-BUILT DRAWINGS
MIXED WASTE LANDFILL ALTERNATIVE EVAPOTRANSPIRATIVE COVER
SANDIA NATIONAL LABORATORIES
ALBUQUERQUE, NEW MEXICO
JANUARY 2010

VICINITY MAP
N.T.S.



BENCHMARK MAP

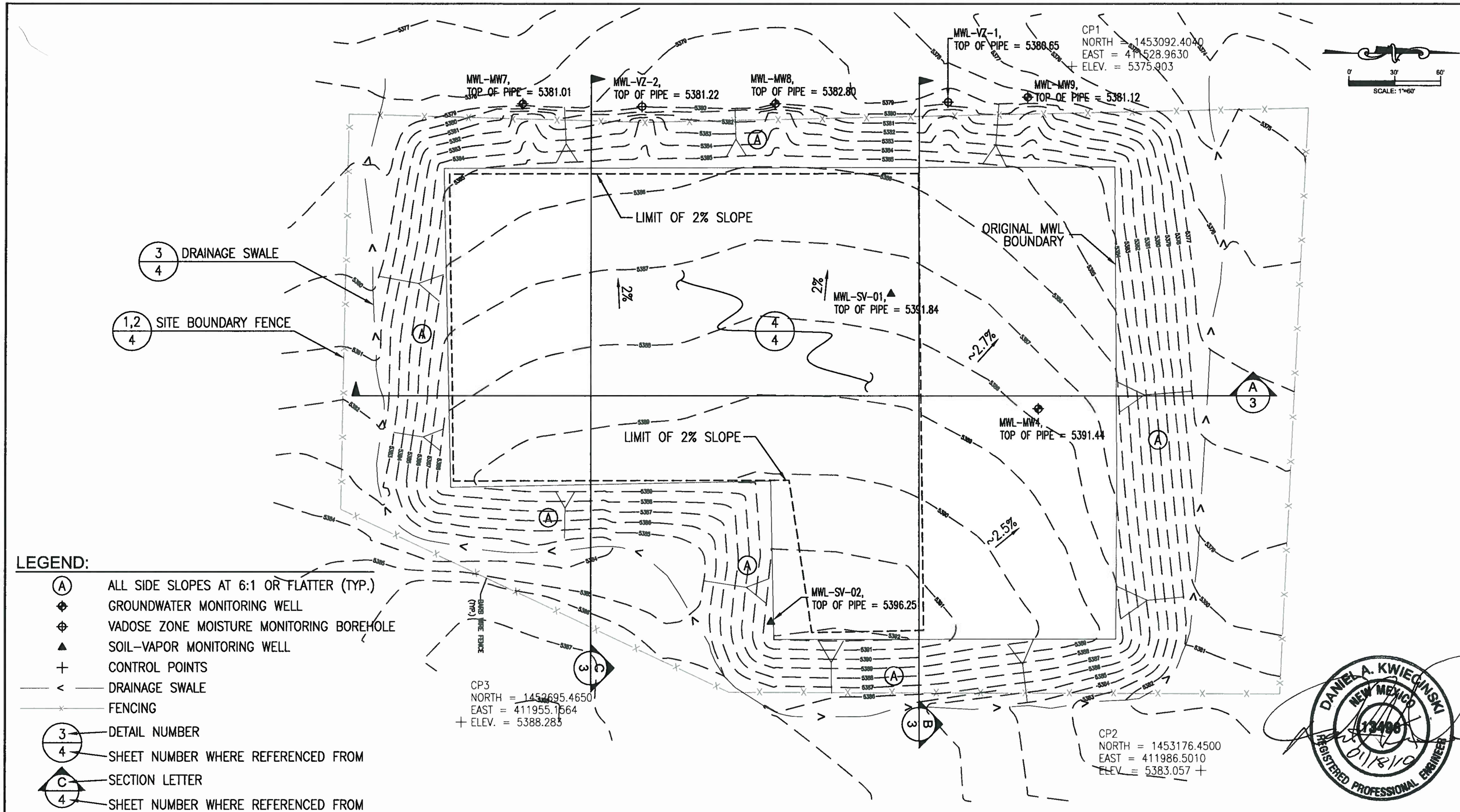


LOCATION MAP
N.T.S.

INDEX

DANIEL A. KWIECINSKI
NEW MEXICO
13496
REGISTERED PROFESSIONAL ENGINEER
01/18/10

SANDIA NATIONAL LABORATORIES		DWN BY: BDP CHK'D BY: CW	PROJECT MIXED WASTE LANDFILL ALTERNATIVE EVAPOTRANSPIRATIVE COVER	DATE: JAN 2010 CONTRACT NO: 9-517-00022G
AMEC Earth & Environmental 8519 Jefferson, NE Albuquerque, NM 87113	amec	DATUM: N/A PROJECTION: N/A SCALE: AS SHOWN	TITLE TITLE SHEET	REV. NO.: - FIGURE NO. 1



SOURCE:
SURVEY PROVIDED BY ALBUQUERQUE SURVEYING CO. INC., 2119 Menaul Blvd. N.E., Albuquerque, New Mexico 87107 (1.4.2010)

SANDIA NATIONAL LABORATORIES

AMEC Earth & Environmental
8519 Jefferson, NE
Albuquerque, NM 87113

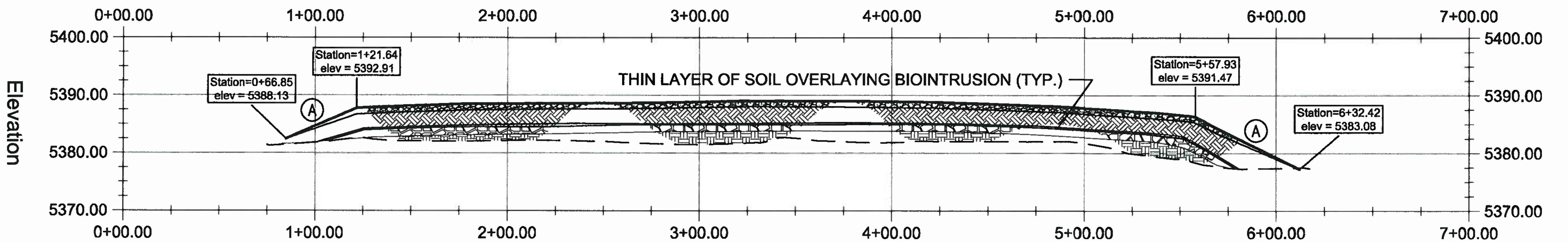
amec

DWN BY:	BDP
CHK'D BY:	CW
DATUM:	N/A
PROJECTION:	N/A
SCALE:	AS SHOWN

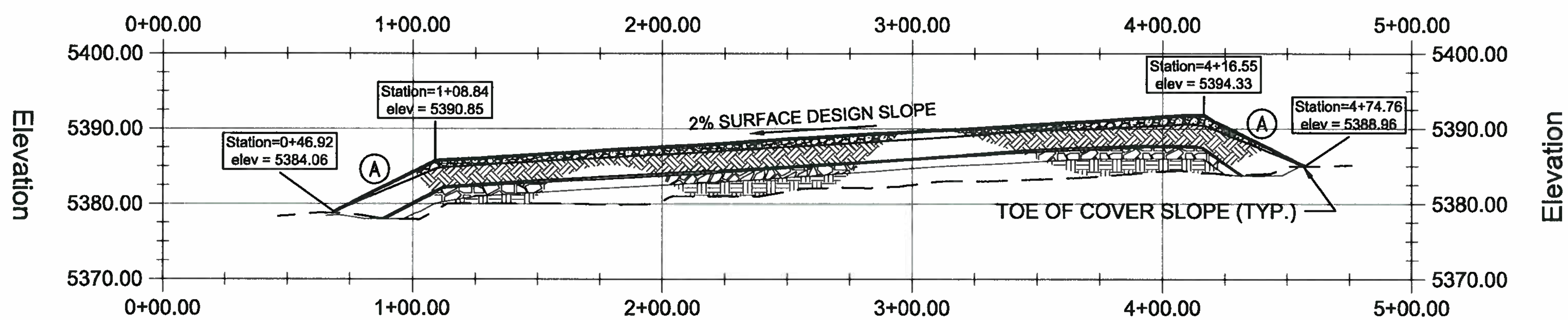
PROJECT
MIXED WASTE LANDFILL ALTERNATIVE EVAPOTRANSPIRATIVE COVER

TITLE
SITE PLAN

DATE:	JAN 2010
CONTRACT NO:	9-517-00022G
REV. NO.:	-
FIGURE NO.	2



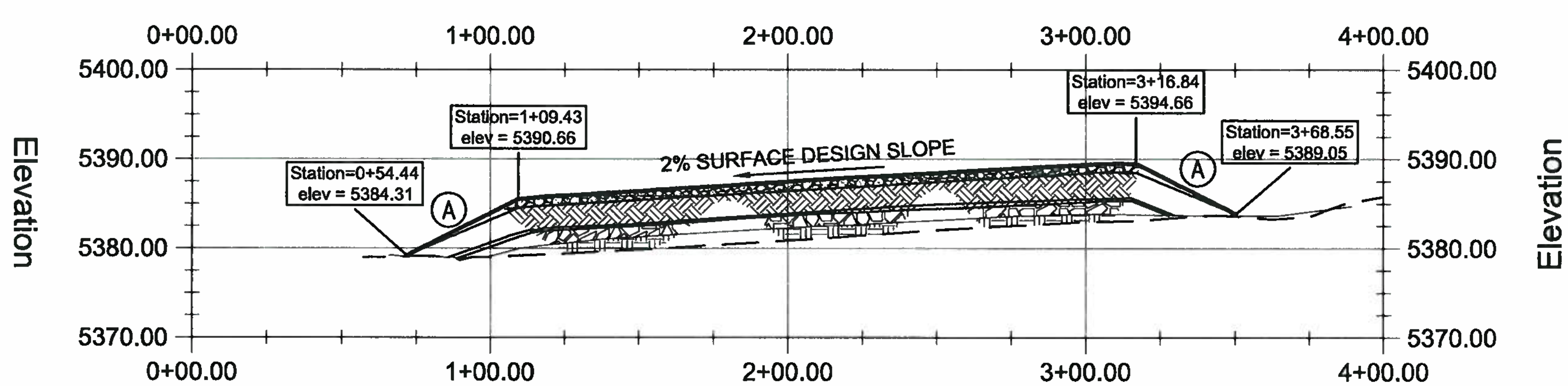
A/2 SECTION
SCALE: VERTICAL 1" = 20', HORIZONTAL 1" = 60'



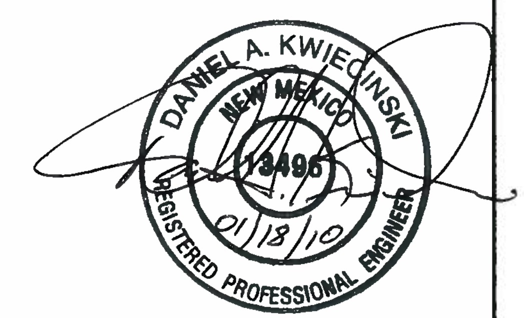
B/2 SECTION
SCALE: VERTICAL 1" = 20', HORIZONTAL 1" = 60'

LEGEND:

- TOPSOIL
- NATIVE SOIL
- BIOINTRUSION
- SUBGRADE
- - - - EXISTING SURFACE
- (A) ALL SIDE SLOPES AT 6:1 OR FLATTER (TYP.)
- C — SECTON LETTER
- 2 — SHEET NUMBER WHERE REFERENCED FROM

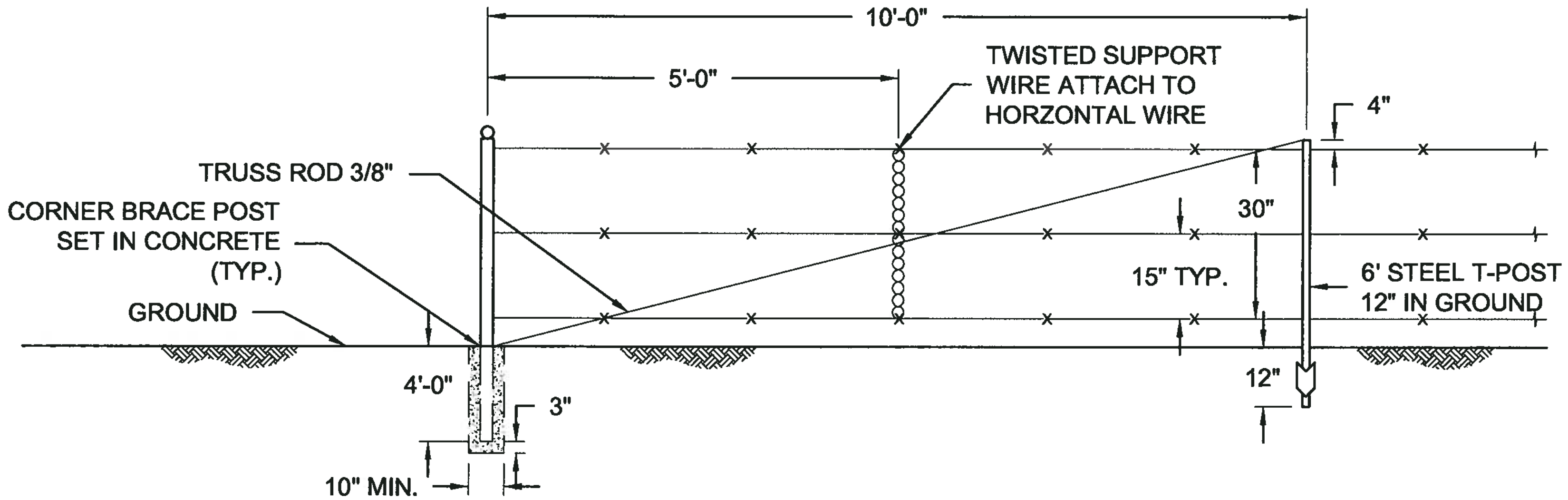


C/2 SECTION
SCALE: VERTICAL 1" = 20', HORIZONTAL 1" = 60'

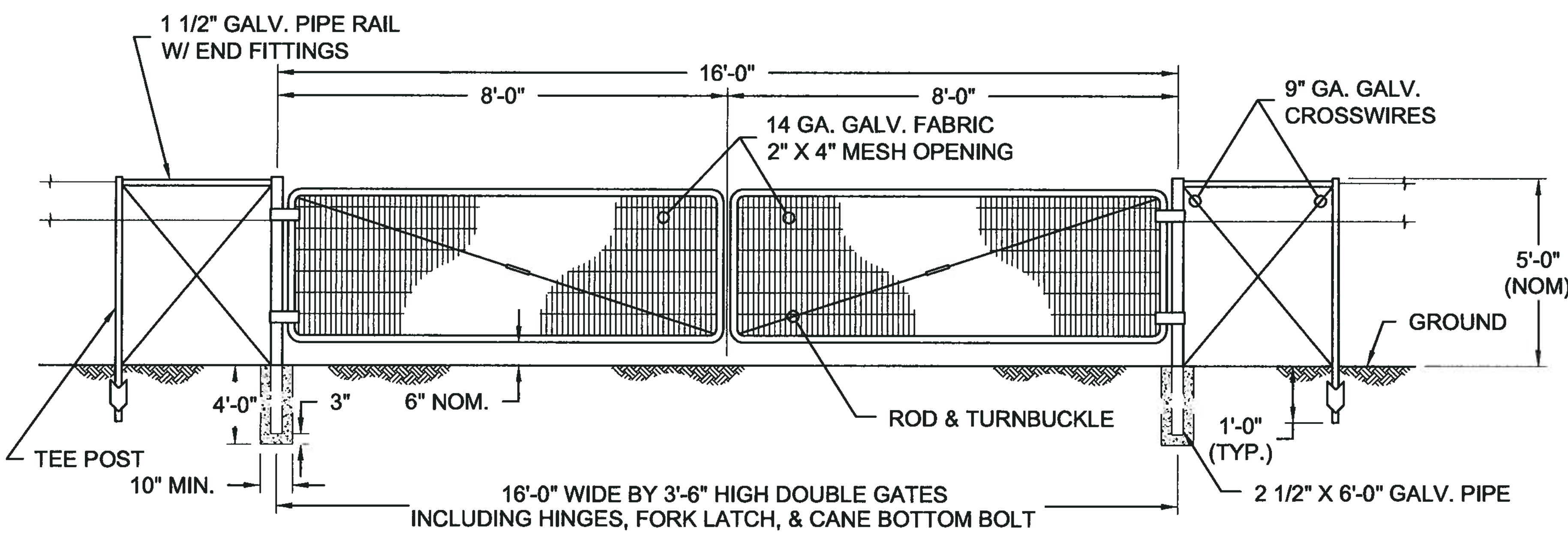


NOTE:
EXISTING SURFACE BASED ON MAY 10, 2006
PRE-CONSTRUCTION SURVEY PERFORMED BY URS CORP.

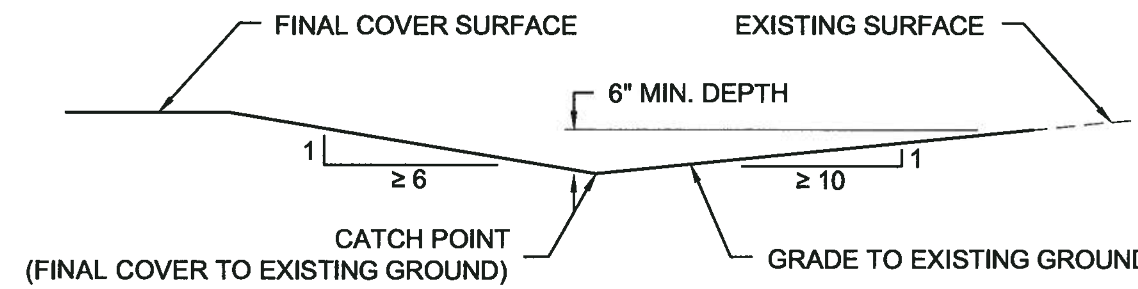
SANDIA NATIONAL LABORATORIES	DWN BY: BDP CHK'D BY: CW	PROJECT: MIXED WASTE LANDFILL ALTERNATIVE EVAPOTRANSPIRATIVE COVER	DATE: JAN 2010 CONTRACT NO: 9-517-00022G
AMEC Earth & Environmental 8519 Jefferson, NE Albuquerque, NM 87113	DATUM: N/A PROJECTION: N/A SCALE: AS SHOWN	TITLE: SECTIONS	REV. NO.: - FIGURE NO. 3



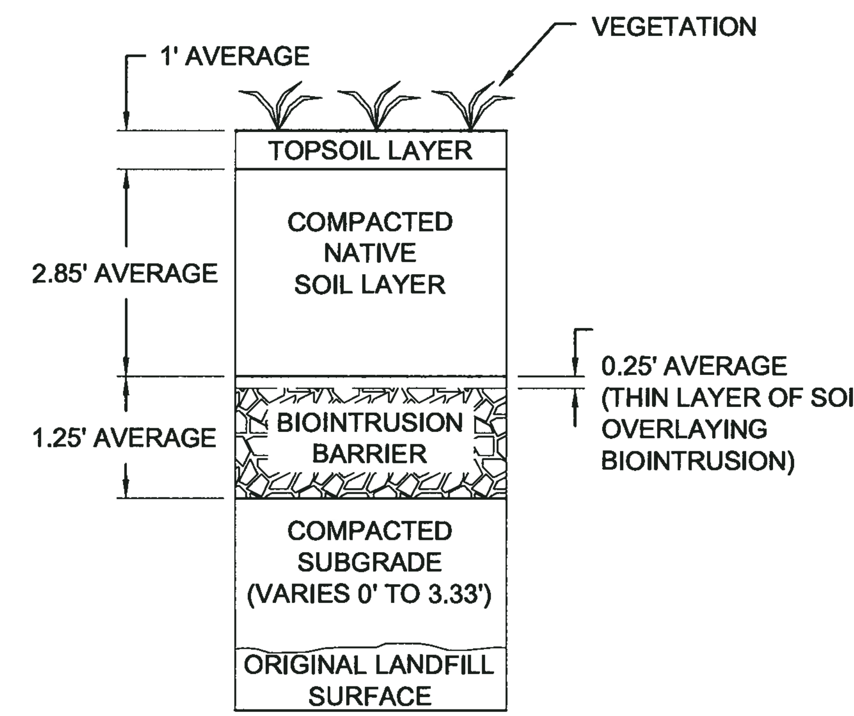
1/2 ADMINISTRATIVE CONTROL FENCE AND GATE (See Note) DETAIL NTS



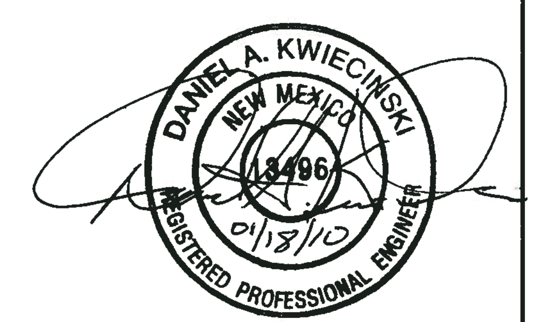
2/2 ADMINISTRATIVE CONTROL FENCE AND GATE (See Note) DETAIL NTS



3/2 TYPICAL DRAINAGE SWALE SECTION DETAIL NTS



4/2 GENERALIZED COVER CROSS SECTION DETAIL NTS



LEGEND:

3 — DETAIL NUMBER
2 — SHEET NUMBER WHERE REFERENCED FROM

NOTE:

ADMINISTRATIVE CONTROL FENCE IS 3-STRAND BARBED WIRE WITH TEE-POSTS DRIVEN INTO THE GROUND AND STEEL CORNER POSTS SET IN CONCRETE. GATE IS A TUBULAR STEEL GALVANIZED GATE, 2-IN DIAMETER. ALL END AND CORNER POSTS ARE BRACED BY MEANS OF 3/8-IN ø DIAGONAL TRUSS RODS.

SANDIA NATIONAL LABORATORIES

AMEC Earth & Environmental
8519 Jefferson, NE
Albuquerque, NM 87113

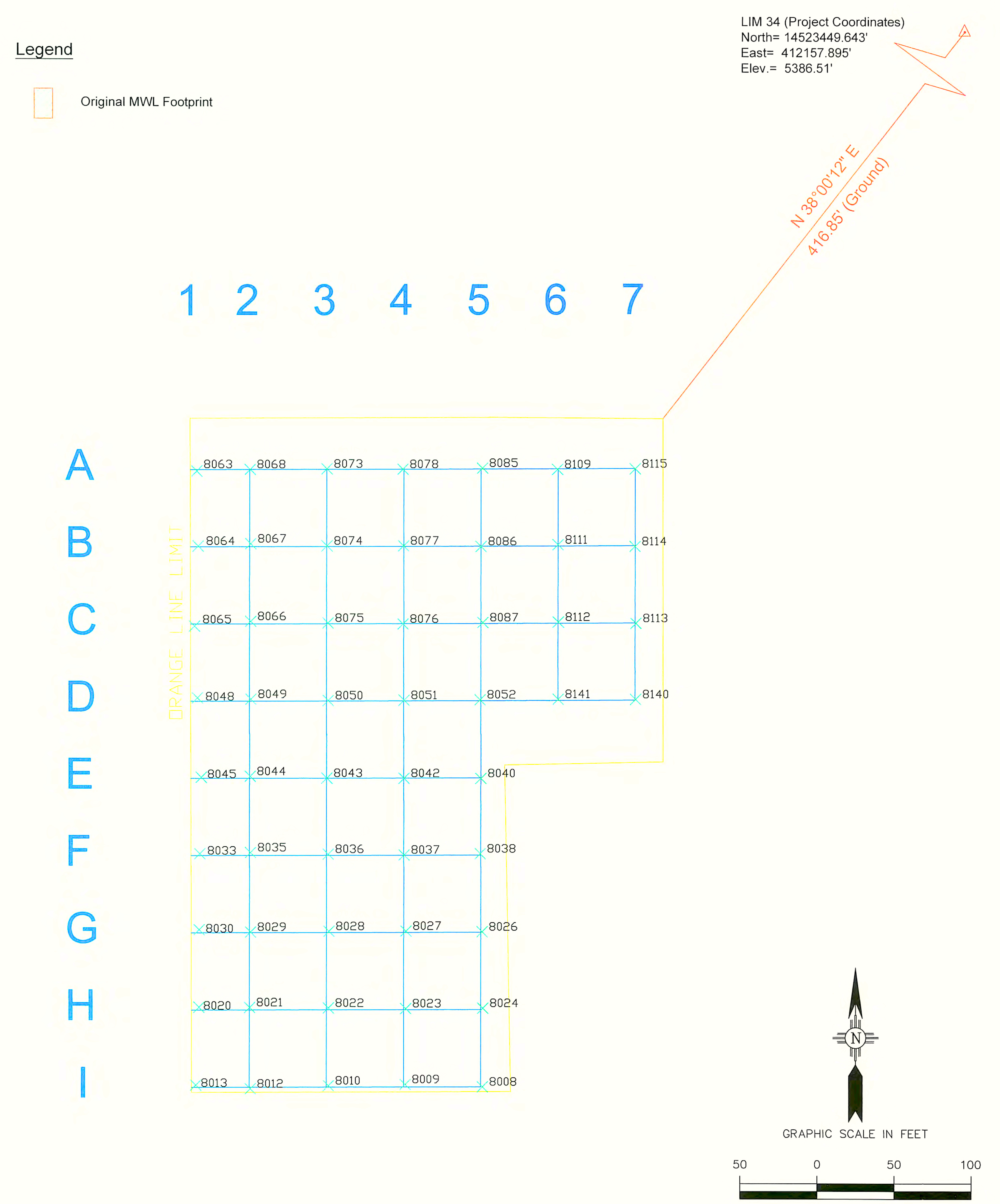
DWN BY:	BDP
CHK'D BY:	CW
DATUM:	N/A
PROJECTION:	N/A
SCALE:	AS SHOWN
PROJECT	MIXED WASTE LANDFILL ALTERNATIVE EVAPOTRANSPIRATIVE COVER
TITLE	DETAILS
DATE:	JAN 2010
CONTRACT NO:	9-517-00022G
REV. NO.:	-
FIGURE NO.	4

G:\ACA\MIXED WASTE LANDFILL\951700022G\FIG 4.dwg Jan 18,2010 12:51pm

QA Verification Survey Plates

MIXED WASTE LANDFILL
BIOINTRUSION LAYER QA SURVEY

MWL



URS BIO LAYER QA SHOTS

GRID	URS PT #	TOP BIO ELEV	ASCI PT #	SUB GRADE ELEV	FILL
A1	8063	5380.81	1043	5379.49	1.32
A2	8068	5381.35	1071	5380.15	1.20
A3	8073	5382.32	1080	5380.94	1.38
A4	8078	5383.27	1095	5381.97	1.30
A5	8085	5384.63	1106	5383.08	1.55
A6	8109	5385.28	1127	5383.83	1.45
A7	8115	5386.02	1139	5384.83	1.19
B1	8064	5381.59	1044	5380.16	1.43
B2	8067	5382.37	1070	5380.88	1.49
B3	8074	5383.29	1081	5382.03	1.26
B4	8077	5384.22	1094	5382.97	1.25
B5	8086	5385.35	1112	5384.18	1.17
B6	8111	5386.24	1126	5385.06	1.18
B7	8114	5387.27	1140	5386.02	1.25
C1	8065	5382.24	1048	5380.74	1.49
C2	8066	5383.02	1069	5381.65	1.37
C3	8075	5383.51	1082	5382.47	1.04
C4	8076	5384.80	1093	5383.43	1.37
C5	8087	5385.90	1113	5384.80	1.10
C6	8112	5387.14	1125	5385.76	1.38
C7	8113	5387.89	1141	5386.37	1.52
D1	8048	5382.20	1049	5381.12	1.07
D2	8049	5383.18	1068	5381.85	1.33
D3	8050	5383.83	1083	5382.71	1.12
D4	8051	5384.82	1092	5383.55	1.27
D5	8052	5385.89	1114	5384.75	1.14
D6	8141	5387.26	1124	5385.90	1.36
D7	8140	5387.72	1142	5386.36	1.36
E1	8045	5382.44	1054	5381.20	1.24
E2	8044	5383.06	1067	5381.76	1.30
E3	8043	5383.95	1084	5382.76	1.19
E4	8042	5384.68	1091	5383.58	1.10
E5	8040	5385.43	1115	5384.28	1.15
F1	8033	5382.08	1055	5380.98	1.10
F2	8035	5382.85	1066	5381.78	1.07
F3	8036	5383.82	1085	5382.73	1.09
F4	8037	5384.91	1090	5383.53	1.38
F5	8038	5385.44	1117	5384.19	1.25
G1	8030	5382.01	1058	5380.64	1.37
G2	8029	5382.58	1065	5381.27	1.31
G3	8028	5383.63	1086	5382.40	1.23
G4	8027	5385.04	1089	5383.14	1.90
G5	8026	5385.24	1118	5383.98	1.26
H1	8020	5381.70	1063	5380.35	1.35
H2	8021	5382.30	1064	5381.28	1.02
H3	8022	5383.54	1087	5382.00	1.54
H4	8023	5384.46	1088	5382.97	1.49
H5	8024	5385.04	1119	5383.87	1.17
I1	8013	5381.33	1189	5379.82	1.51
I2	8012	5381.72	1183	5380.56	1.14
I3	8010	5383.11	1180	5381.40	1.71
I4	8009	5383.93	1177	5382.56	1.37
I5	8008	5384.52	1172	5383.51	1.01
				AVERAGE	1.29

TECH AREA III

Sandia National Laboratories
Bernalillo County, New Mexico
June, 2009

Survey Notes:

1.) Biointrusion Layer conditions based on spot elevations surveyed by URS, June 2009.

2.) Elevations for this survey are based on SNL/KAFB Monument "LIM 35" with an NGVD 29 elevation of 5388.52'.

3.) Survey Control Coordinates are modified state plane (or "Ground"), based on New Mexico State Plane, Central Zone, North American Datum of 1927. A Combined Scale Factor of .999651675 was used to derive project coordinates. State Plane (or "Grid") values of Control Points Used:
LIM 34 (North= 1452943.37, East= 412014.33) and LIM 35 (North= 1451943.65, East= 412012.13)

4.) No surface appurtenances of underground utilities are shown. Other utilities may exist that are not shown on this survey. SNL ESD files were not incorporated into this survey.

5.) Distances shown are ground.

6.) This is not a boundary survey. No property corners or lines are shown.

7.) The table compares URS survey data (the 2 left-hand columns), shot on the top of the Biointrusion Layer with earlier ASCI survey data (the next 2 columns), shot on the top of the Subgrade. The FILL column shows the thickness of the Biointrusion Layer.

8.) Survey was not collected by URS on grid points E5.1, E6, and E7 for the Biointrusion Layer. See Figure 17 for Surveyed Verification Grid Points And Filed Testing Grid Blocks Description.

SURVEYOR'S CERTIFICATION

I, KIM STELZER, NEW MEXICO PROFESSIONAL SURVEYOR No. 7482, HEREBY CERTIFY THAT A TOPOGRAPHIC SURVEY, AS SHOWN HEREON, HAS BEEN SURVEYED AND PLATTED IN ACCORDANCE WITH THE STANDARDS FOR TOPOGRAPHIC SURVEYS IN THE STATE OF NEW MEXICO, RULE 500.5, AND IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. I FURTHER CERTIFY THAT THIS SURVEY AND PLAT DO NOT MEET THE REQUIREMENTS OF ANY (MUNICIPAL, COUNTY AND/OR STATE) SUBDIVISION ORDINANCES AND IS NOT INTENDED TO SUBDIVIDE ANY EXISTING PARCEL. THIS IS NOT A BOUNDARY SURVEY.

KIM STELZER N.M.P.S. No. 7482 — Dec. 29, 2009 DATE

KIM STELZER NEW MEXICO 7482 LICENSED PROFESSIONAL LAND SURVEYOR

URS

URS CORPORATION

CAD DRAWING

FILE NAME: MWL-QA SURVEY 9-4-2009

P.O. OR W.O. / PROJECT NO.	REV	DATE	DESCRIPTION	DWN	CKD	APP

U.S. DEPARTMENT OF ENERGY
KIRTLAND AREA OFFICE — ALBUQUERQUE, NEW MEXICO

SANDIA NATIONAL LABORATORIES
ALBUQUERQUE, NEW MEXICO; LIVERMORE, CALIFORNIA; TONOPAH, NEVADA

SNL/NM MIXED WASTE LANDFILL
Biointrusion Layer

SURVEY

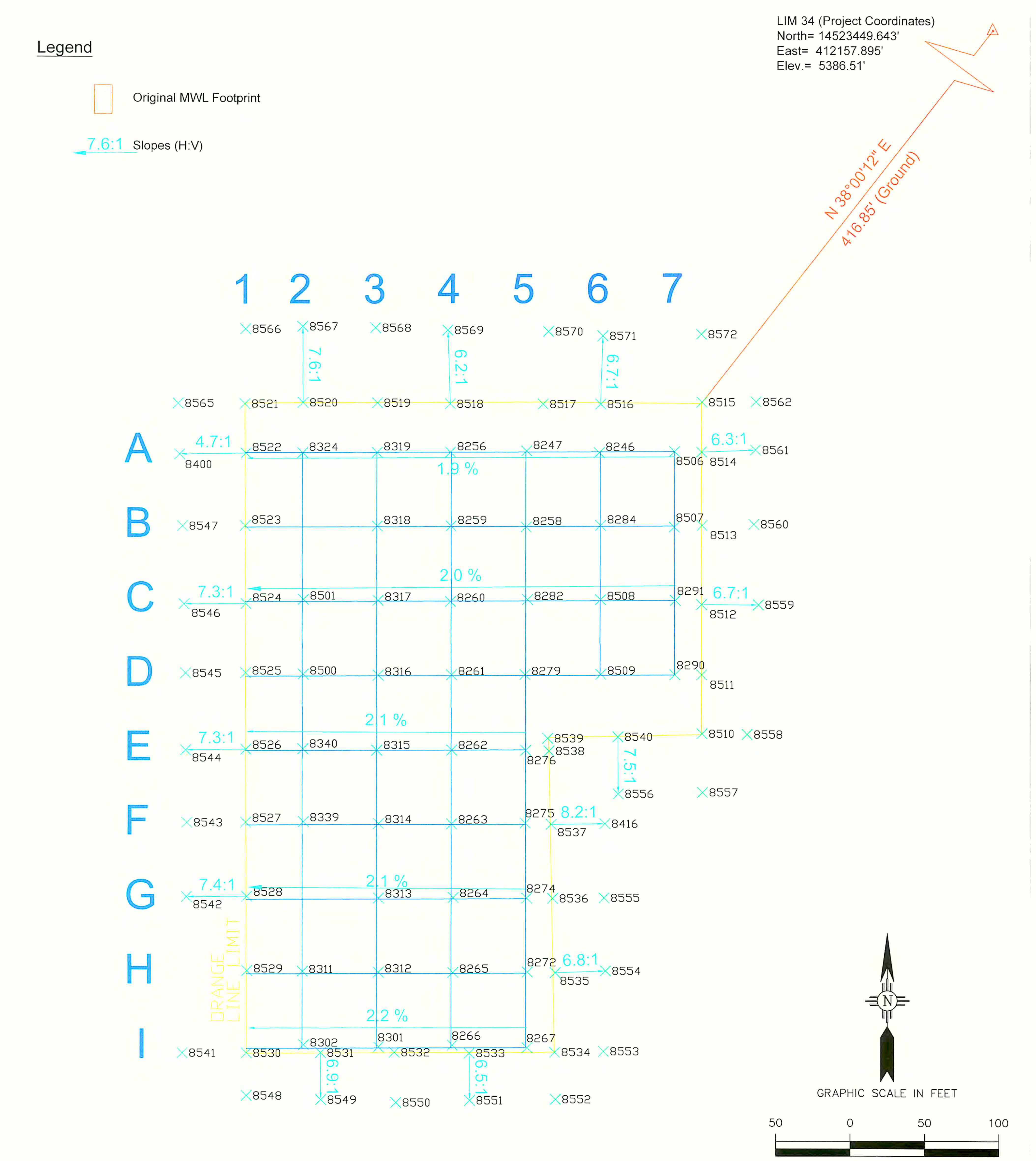
P.O. OR W.O.	
PROJECT NO.	
DRAWN BY	HFB
CHECKED BY	RDE
APPROVED BY	RDE
DATE	06/09

SIZE — PLATE NO: 1 — SEQ. 1/1

24342640\07 Design\Survey\Bio Intrusion Layer\dwg\MWL-URS QA SURVEY-FINAL BIO LAYER EXHIBIT 9-4-2009.dwg

MIXED WASTE LANDFILL
NATIVE SOIL LAYER QA SURVEY

MWL



TECH AREA III

Sandia National Laboratories
Bernalillo County, New Mexico
June, 2009

GRID	URS PT #	TOP NAT ELEV	ASCI PT #	TOP THIN SOIL	FILL
A1	8522	5383.37	1905	5380.94	2.43
A2	8324	5384.01	1904	5381.54	2.47
A3	8319	5384.87	1903	5382.43	2.44
A4	8256	5386.11	1923	5383.46	2.65
A5	8247	5387.27	1929	5384.78	2.49
A6	8246	5387.98	1940	5385.4	2.58
A7	8506	5388.88	1955	5386.35	2.53
B1	8432	5384.38	1900	5381.74	2.64
B3	8318	5385.95	1901	5383.51	2.44
B4	8259	5387.02	1902	5384.47	2.55
B5	8258	5388.10	1928	5385.61	2.49
B6	8284	5388.91	1939	5386.39	2.52
B7	8507	5389.81	1950	5387.26	2.55
C1	8433	5384.92	1898	5382.38	2.54
C2	8501	5385.69	1920	5383.15	2.54
C3	8317	5386.51	1897	5384.05	2.46
C4	8260	5387.72	1896	5384.94	2.78
C5	8282	5388.62	1895	5386.01	2.61
C6	8508	5389.78	1938	5387.26	2.52
C7	8291	5390.38	1949	5387.96	2.42
D1	8434	5385.07	1889	5382.59	2.48
D2	8500	5385.91	1892	5383.35	2.56
D3	8316	5386.76	1891	5384.07	2.69
D4	8261	5387.90	1893	5385.08	2.82
D5	8279	5388.73	1894	5386.01	2.72
D6	8509	5389.88	1931	5387.35	2.53

GRID	URS PT #	TOP NAT ELEV	ASCI PT #	TOP THIN SOIL	FILL
D7	8290	5391.03	1953	5387.94	3.09
E1	8435	5385.27	1882	5382.71	2.56
E2	8340	5385.78	1886	5383.2	2.58
E3	8315	5386.87	1883	5384.24	2.63
E4	8262	5387.95	1884	5384.97	2.98
E5	8276	5388.90	1885	5385.75	3.15
F1	8436	5385.12	1887	5382.34	2.78
F2	8339	5385.60	1880	5383.11	2.49
F3	8314	5386.73	1879	5384.09	2.64
F4	8263	5387.80	1878	5384.89	2.91
F5	8275	5388.89	1877	5385.67	3.22
G1	8437	5385.01	1868	5382.25	2.76
G3	8313	5386.60	1872	5383.92	2.68
G4	8264	5387.63	1873	5384.99	2.64
G5	8274	5388.63	1874	5385.54	3.09
H1	8438	5384.82	1866	5382.02	2.80
H2	8311	5385.39	1869	5382.62	2.77
H3	8312	5386.32	1864	5383.74	2.58
H4	8265	5387.36	1865	5384.68	2.68
H5	8272	5388.32	1863	5385.28	3.04
I1	8530	5383.46	1853	5381.34	2.12
I2	8302	5385.03	1855	5382.07	2.96
I3	8301	5385.84	1857	5382.99	2.85
I4	8266	5386.81	1861	5384.14	2.67
I5	8267	5387.73	1859	5384.78	2.95
				AVERAGE	2.67

URS NATIVE SOIL LAYER TOP SHOTS

URS PT #	ELEV
8255	5385.99
8510	5391.13
8511	5391.23
8512	5390.67
8513	5389.68
8514	5388.77
8515	5387.44
8516	5386.50
8517	5385.49
8518	5385.13
8519	5383.50

URS PT #	ELEV
8520	5382.80
8521	5382.58
8531	5384.84
8532	5385.92
8533	5386.75
8534	5387.87
8535	5388.57
8536	5388.47
8537	5388.77
8538	5389.13
8539	5389.04
8540	5390.06

URS NATIVE SOIL LAYER TOE SHOTS

URS PT #	ELEV
8400	5373.96
8416	5384.39
8541	5377.84
8542	5379.20
8543	5379.76
8544	5379.44
8545	5379.16
8546	5379.02
8547	5377.59
8548	5379.21

URS PT #	ELEV
8549	5380.24
8550	5380.94
8551	5381.86
8552	5383.03
8553	5383.44
8554	5383.62
8555	5383.79
8556	5384.93
8557	5385.57
8558	5385.93
8559	5384.93

URS PT #	ELEV
8560	5384.31
8561	5383.02
8562	5382.15
8565	5375.88
8566	5375.41
8567	5376.12
8568	5376.76
8569	5377.18
8570	5378.88
8571	5379.68
8572	5380.55

Survey Notes:

1.) Native Soil Layer data based on spot elevations surveyed by URS, June 2009.

2.) Elevations for this survey are based on SNL/KAFB Monument "LIM 35" with an NGVD 29 elevation of 5388.52'.

3.) Survey Control Coordinates are modified state plane (or "Ground"), based on New Mexico State Plane, Central Zone, North American Datum of 1927. A Combined Scale Factor of .999651675 was used to derive project coordinates. State Plane (or "Grid") values of Control Points Used:
LIM 34 (North= 1452943.37, East= 412014.33) and LIM 35 (North= 1451943.65, East= 412012.13)

4.) No surface appurtenances of underground utilities are shown. Other utilities may exist that are not shown on this survey. SNL ESD files were not incorporated into this survey.

5.) Distances shown are ground.

6.) This is not a boundary survey. No property corners or lines are shown.

7.) The 6 columned table titled "URS NATIVE SOIL LAYER QA SHOTS" compares URS survey data (columns 2&3), shot on the top of the Native Soil Layer with earlier ASCI survey data (columns 4&5), shot on the top of the thin soil layer. The "FILL" column shows the thickness of the Native Soil Layer.

8.) The tables titles "URS NATIVE SOIL LAYER TOP SHOTS" and "URS NATIVE SOIL LAYER TOE SHOTS" are shown for slope verification only. No thickness can be inferred from this data.

9.) The northwest corner side slope of the Native Soil Layer is 4.7:1 in lieu of 6:1. The northwest corner side slope will be adjusted to 6:1 during the construction of the Topsoil Layer.

10.) Survey was not collected by URS on grid points B2, E5.1, E6, E7, and G2 for the Native Soil Layer. See Figure 17 for Surveyed Verification Grid Points And Field Testing Grid Blocks Description.

SURVEYOR'S CERTIFICATION

I, KIM STELZER, NEW MEXICO PROFESSIONAL SURVEYOR No. 7482, HEREBY CERTIFY THAT A TOPOGRAPHIC SURVEY, AS SHOWN HEREON, HAS BEEN SURVEYED AND PLATTED IN ACCORDANCE WITH THE STANDARDS FOR TOPOGRAPHIC SURVEYS IN THE STATE OF NEW MEXICO, RULE 500.5, AND IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. I FURTHER CERTIFY THAT THIS SURVEY AND PLAT DO NOT MEET THE REQUIREMENTS OF ANY (MUNICIPAL, COUNTY AND/OR STATE) SUBDIVISION ORDINANCES AND IS NOT INTENDED TO SUBDIVIDE ANY EXISTING PARCEL. THIS IS NOT A BOUNDARY SURVEY.

KIM STELZER N.M.P.S. No. 7482 — Dec. 29, 2009 DATE

KIM STELZER NEW MEXICO 7482 LICENSED PROFESSIONAL LAND SURVEYOR

P.O. OR W.O. PROJECT NO.	REV	DATE	DESCRIPTION	DWN	CKD	APP

U.S. DEPARTMENT OF ENERGY
KIRTLAND AREA OFFICE — ALBUQUERQUE, NEW MEXICO
ALBUQUERQUE, NEW MEXICO; LIVERMORE, CALIFORNIA; TONOPAH, NEVADA

SNL/NM MIXED WASTE LANDFILL
Native Soil Layer

SURVEY

P.O. OR W.O.	
PROJECT NO.	
DRAWN BY	HFB
CHECKED BY	RDE
APPROVED BY	RDE
DATE	06/09

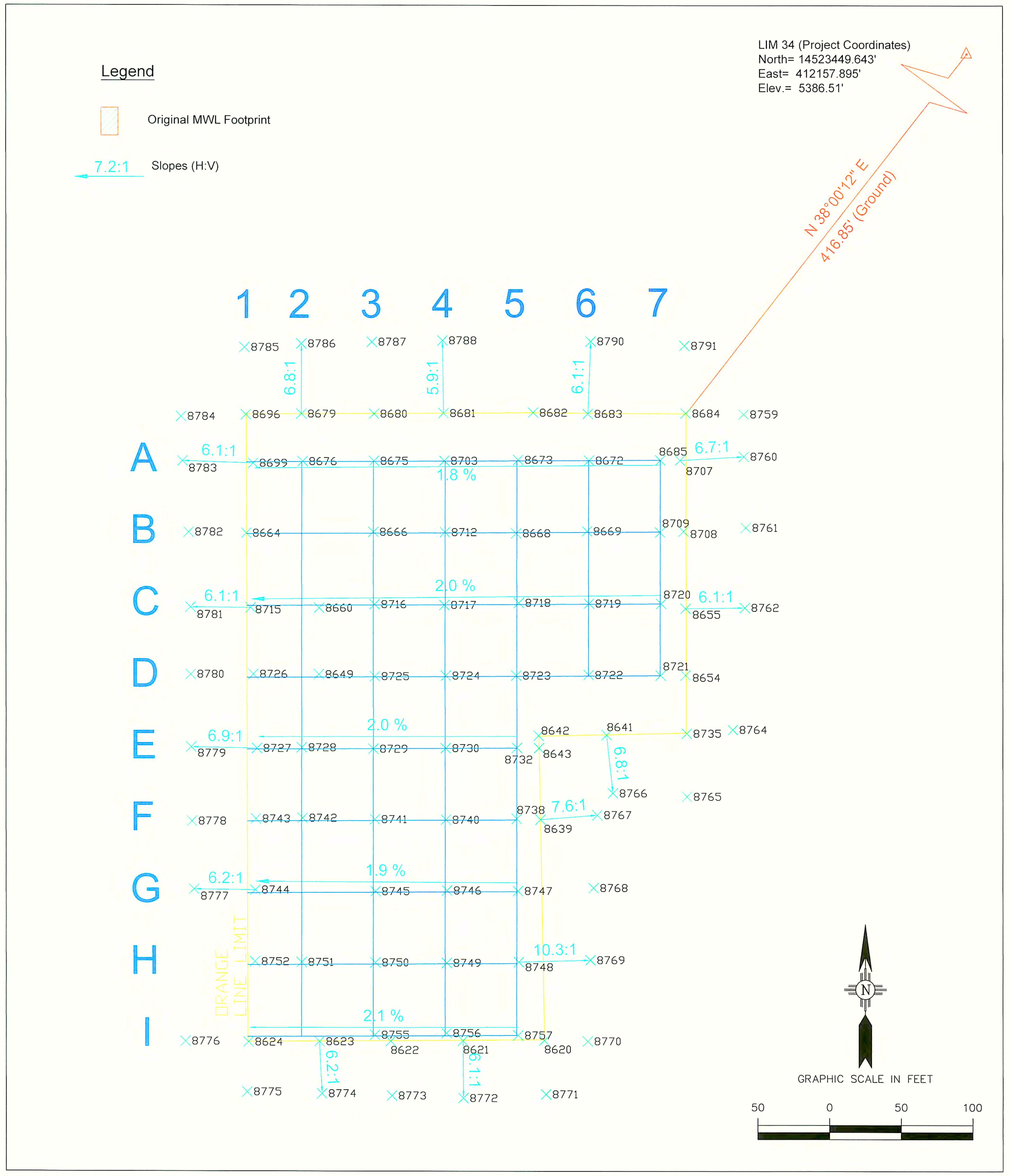
FILE NAME: MWL-URS QA SURVEY-FINAL NAT SOIL LAYER EXHIBIT 9-1-2009.dwg
SIZE — Plate No: 2 — SEQ. 1/1

URS
URS CORPORATION

24342640\07 Design\Survey\Bio Intrusion Layer\dwg\MWL-URS QA SURVEY-FINAL NAT SOIL LAYER EXHIBIT 9-1-2009.dwg

MIXED WASTE LANDFILL
TOPSOIL LAYER QA SURVEY

MWL



URS TOPSOIL LAYER QA SHOTS

GRID	URS PT #	TOP SOIL ELEV	URS PT #	TOP NAT ELEV	FILL
A1	8699	5384.54	8522	5383.37	1.17
A2	8676	5385.00	8324	5384.01	0.98
A3	8675	5385.89	8319	5384.87	1.02
A4	8703	5387.00	8256	5386.11	0.89
A5	8673	5388.28	8247	5387.27	1.01
A6	8672	5389.00	8246	5387.98	1.02
A7	8685	5389.76	8506	5388.88	0.88
B1	8664	5385.31	8432	5384.38	0.93
B3	8666	5386.97	8318	5385.95	1.02
B4	8712	5388.00	8259	5387.02	0.98
B5	8668	5389.07	8258	5388.10	0.97
B6	8669	5389.88	8284	5388.91	0.96
B7	8709	5390.63	8507	5389.81	0.82
C1	8715	5385.71	8433	5384.92	0.79
C2	8660	5386.87	8501	5385.69	1.17
C3	8716	5387.60	8317	5386.51	1.09
C4	8717	5388.55	8260	5387.72	0.83
C5	8718	5389.53	8282	5388.62	0.91
C6	8719	5390.57	8508	5389.78	0.79
C7	8720	5391.41	8291	5390.38	1.03
D1	8726	5386.08	8434	5385.07	1.01
D2	8649	5387.05	8500	5385.91	1.14
D3	8725	5387.80	8316	5386.76	1.04
D4	8724	5388.80	8261	5387.90	0.90
D5	8723	5389.74	8279	5388.73	1.01
D6	8722	5390.84	8509	5389.88	0.96

GRID	URS PT #	TOP SOIL ELEV	URS PT #	TOP NAT ELEV	FILL
D7	8721	5392.01	8290	5391.03	0.98
E1	8727	5386.27	8435	5385.27	1.00
E2	8728	5386.90	8340	5385.78	1.12
E3	8729	5387.80	8315	5386.87	0.93
E4	8730	5388.73	8262	5387.95	0.78
E5	8732	5389.90	8276	5388.90	1.00
F1	8743	5386.03	8436	5385.12	0.91
F2	8742	5386.73	8339	5385.60	1.14
F3	8741	5387.70	8314	5386.73	0.97
F4	8740	5388.61	8263	5387.80	0.81
F5	8738	5389.70	8275	5388.89	0.80
G1	8744	5385.93	8437	5385.01	0.92
G3	8745	5387.60	8313	5386.60	1.00
G4	8746	5388.54	8264	5387.63	0.91
G5	8747	5389.40	8274	5388.63	0.77
H1	8752	5385.77	8438	5384.02	1.75
H2	8751	5386.37	8311	5385.39	0.97
H3	8750	5387.43	8312	5386.32	1.11
H4	8749	5388.36	8265	5387.36	1.00
H5	8748	5389.24	8272	5388.33	0.91
I3	8755	5387.00	8301	5385.84	1.16
I4	8756	5387.90	8266	5386.81	1.09
I5	8757	5388.70	8267	5387.73	0.97
				AVERAGE	0.99

URS TOPSOIL LAYER TOP SHOTS

URS PT #	ELEV
8620	5389.00
8621	5387.90
8622	5386.89
8623	5385.81
8624	5384.68
8639	5389.93
8641	5391.07
8642	5390.15
8643	5390.03
8654	5392.17

URS PT #	ELEV
8655	5391.93
8679	5383.88
8680	5384.62
8681	5386.14
8682	5386.70
8683	5387.36
8684	5388.65
8696	5383.63
8707	5389.79
8708	5390.57
8735	5391.92

URS TOPSOIL LAYER TOE SHOTS

URS PT #	ELEV
8759	5382.11
8760	5383.13
8761	5384.42
8762	5385.13
8764	5386.7
8765	5385.99
8766	5385.06
8767	5384.7
8768	5384.17
8769	5384.37

URS PT #	ELEV
8770	5384.11
8771	5382.83
8772	5381.37
8773	5380.65
8774	5379.96
8775	5379.08
8776	5377.91
8777	5379.11
8778	5379.76
8779	5379.64

URS PT #	ELEV
8780	5379.27
8781	5378.89
8782	5377.91
8783	5376.39
8784	5376.11
8785	5375.73
8786	5376.74
8787	5377.14
8788	5377.55
8790	5379.08
8791	5380.54

TECH AREA III

Sandia National Laboratories
Bernalillo County, New Mexico
September, 2009

Survey Notes:

1.) Topsoil Layer data based on spot elevations surveyed by URS, June 2009.

2.) Elevations for this survey are based on SNL/KAFB Monument "LIM 35" with an NGVD 29 elevation of 5388.52'.

3.) Survey Control Coordinates are modified state plane (or "Ground"), based on New Mexico State Plane, Central Zone, North American Datum of 1927. A Combined Scale Factor of .999651675 was used to derive project coordinates. State Plane (or "Grid") values of Control Points Used:
LIM 34 (North= 1452943.37, East= 412014.33) and LIM 35 (North= 1451943.65, East= 412012.13)

4.) No surface appurtenances of underground utilities are shown. Other utilities may exist that are not shown on this survey. SNL ESD files were not incorporated into this survey.

5.) Distances shown are ground.

6.) This is not a boundary survey. No property corners or lines are shown.

7.) The 6 columned table titled "URS TOPSOIL LAYER QA SHOTS" compares URS survey data (columns 2&3), shot on the top of the Topsoil Layer with earlier URS survey data (columns 4&5), shot on the top of the Native Soil Layer. The FILL column shows the thickness of the Topsoil Layer above the Native Soil Layer.

7.) The tables titled "URS TOPSOIL LAYER TOP SHOTS" and "URS TOPSOIL LAYER TOE SHOTS" are shown for slope verification only. No thickness can be inferred from this data

8.) Survey was not collected by URS on grid points B2, E5.1, E6, E7, G2, I1, and I2 for the Topsoil Layer. See Figure 17 for Surveyed Verification Grid Points And Field Testing Grid Blocks Description.

SURVEYOR'S CERTIFICATION

I, KIM STELZER, NEW MEXICO PROFESSIONAL SURVEYOR No. 7482, HEREBY CERTIFY THAT A TOPOGRAPHIC SURVEY, AS SHOWN HEREON, HAS BEEN SURVEYED AND PLATTED IN ACCORDANCE WITH THE STANDARDS FOR TOPOGRAPHIC SURVEYS IN THE STATE OF NEW MEXICO, RULE 500.5, AND IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. I FURTHER CERTIFY THAT THIS SURVEY AND PLAT DO NOT MEET THE REQUIREMENTS OF ANY (MUNICIPAL, COUNTY AND/OR STATE) SUBDIVISION ORDINANCES AND IS NOT INTENDED TO SUBDIVIDE ANY EXISTING PARCEL. THIS IS NOT A BOUNDARY SURVEY.

KIM STELZER NEW MEXICO 7482 LICENSED PROFESSIONAL LAND SURVEYOR

KIM STELZER N.M.P.S. No. 7482 — Dec. 29, 2009 — DATE

P.O. OR W.O. / PROJECT NO.	REV	DATE	DESCRIPTION	DWN	CKD	APP

U.S. DEPARTMENT OF ENERGY
KIRTLAND AREA OFFICE — ALBUQUERQUE, NEW MEXICO
ALBUQUERQUE, NEW MEXICO; LIVERMORE, CALIFORNIA; TONOPAH, NEVADA

SNL/NM MIXED WASTE LANDFILL
Topsoil Layer

SURVEY

P.O. OR W.O.	
PROJECT NO.	
DRAWN BY	HFB
CHECKED BY	RDE
APPROVED BY	RDE
DATE	09/09

SIZE — Plate No: 3 — SEQ. 1/1

FILE NAME: MWL-URS QA SURVEY-FINAL TOPSOIL LAYER EXHIBIT 9-28-2009.dwg

24342640\07 Design\Survey\Bio Intrusion Layer\dwg\MWL-URS QA SURVEY-FINAL TOPSOIL LAYER EXHIBIT 9-28-2009.dwg

URS
URS CORPORATION

Photographic Logs

Log No. 1

Mixed Waste Landfill
2006 Subgrade Construction Photographic Log

Date: 06/14/06 Time: 1457

Photo Taken by: Dave Ransbarger

Description: MWL Borrow Pit Area site preparation

Facing: South

Date: 06/14/06 Time: 1457

Photo Taken by: Dave Ransbarger

Description: MWL Borrow Area site preparation

Facing: South-Southwest

Date: 06/14/06 Time: 1457

Photo Taken by: Dave Ransbarger

Description: Excavating soils for screening to 2-inch minus

Facing: North-Northeast

	Date: 06/15/06 Time: 1029 Photo Taken by: Dave Ransbarger Description: Screening soils to 2-inch minus at the MWL Borrow Pit Area Facing: South-Southwest
	Date: 06/15/06 Time: 1029 Photo Taken by: Dave Ransbarger Description: Excavated soils stockpiled at the MWL Borrow Pit Area Facing: North
	Date: 06/15/06 Time: 1029 Photo Taken by: Dave Ransbarger Description: Screening soils to 2-inch minus at the MWL Borrow Pit Area Facing: Southwest

Date: 06/15/06 Time: 1029

Photo Taken by: Dave Ransbarger

Description: Screening soils at the MWL Borrow Pit Area

Facing: South

Date: 06/19/06 Time: 1511

Photo Taken by: Dave Ransbarger

Description: Screening soils to 2-inch minus at the MWL Borrow Pit Area

Facing: North-northeast

Date: 06/19/06 Time: 1511

Photo Taken by: Dave Ransbarger

Description: Excavating soils at the MWL Borrow Pit Area

Facing: Northeast

	Date: 06/20/06 Time: 1427 Photo Taken by: Dave Ransbarger Description: Berm around the MWL Borrow Pit Area Facing: North-northeast
	Date: 06/20/06 Time: 1427 Photo Taken by: Dave Ransbarger Description: Berm around the MWL Borrow Pit Area Facing: Northeast
	Date: 06/20/06 Time: 1428 Photo Taken by: Dave Ransbarger Description: Berm around the MWL Borrow Pit Area Facing: East

	Date: 06/27/06 Time: 1509 Photo Taken by: Dave Ransbarger Description: Berm around the MWL Borrow Pit Area Facing: Northeast
	Date: 06/27/06 Time: 1511 Photo Taken by: Dave Ransbarger Description: Berm around the MWL Borrow Pit Area Facing: East
	Date: 06/27/06 Time: 1511 Photo Taken by: Dave Ransbarger Description: Screened soil stockpile at the MWL Borrow Pit Area Facing: East

Date: 06/27/06 Time: 1515

Photo Taken by: Dave Ransbarger

Description: Berm around the MWL Borrow Pit Area

Facing: North-northeast

Date: 06/28/06 Time: 1622

Photo Taken by: Dave Ransbarger

Description: MWL Borrow Pit Area after rain

Facing: North-northeast

Date: 06/28/06 Time: 1622

Photo Taken by: Dave Ransbarger

Description: MWL Borrow Pit Area after rain

Facing: North

Date: 10/02/06 Time: 1516

Photo Taken by: Dave Ransbarger

Description: Overhead view of MWL prior to site work

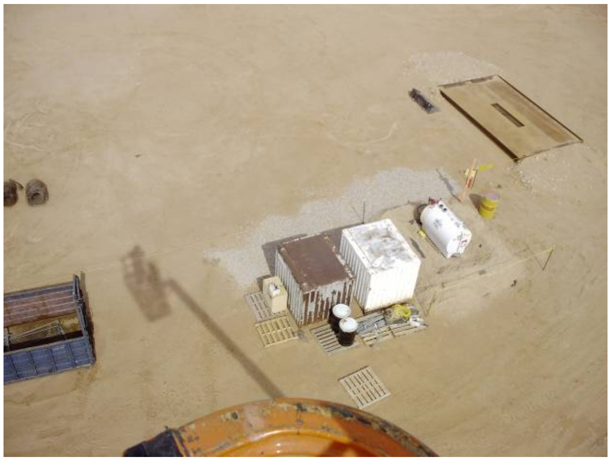
Facing: North-northeast

Date: 10/02/06 Time: 1517

Photo Taken by: Dave Ransbarger

Description: Screened soil stockpile at MWL

Facing: East



Date: 10/02/06 Time: 1517

Photo Taken by: Dave Ransbarger

Description: Overhead view of staging area at MWL

Facing: Northeast

	<u>Date:</u> 10/02/06 <u>Time:</u> 1007 <u>Photo Taken by:</u> Dave Ransbarger <u>Description:</u> Removal of fence around unclassified area. <u>Facing:</u> Southeast
	<u>Date:</u> 10/04/06 <u>Time:</u> 1328 <u>Photo Taken by:</u> Dave Ransbarger <u>Description:</u> Removing fenceposts around unclassified area <u>Facing:</u> North-northeast
	<u>Date:</u> 10/04/06 <u>Time:</u> 1551 <u>Photo Taken by:</u> Dave Ransbarger <u>Description:</u> Removal of vegetation in unclassified area <u>Facing:</u> East

Date: 10/04/06 Time: 1551

Photo Taken by: Dave Ransbarger

Description: Dust control

Facing: Southeast

Date: 10/05/06 Time: 1511

Photo Taken by: Dave Ransbarger

Description: Clearing and grubbing existing surface, unclassified area

Facing: East-southeast

Date: 10/05/06 Time: 1511

Photo Taken by: Dave Ransbarger

Description: Clearing and grubbing existing surface

Facing: East-southeast

	Date: 10/05/06 Time: 1512 Photo Taken by: Dave Ransbarger Description: Progress at end of day Facing: Southeast
	Date: 10/05/06 Time: 1512 Photo Taken by: Dave Ransbarger Description: Overhead view of existing surface after clearing/grubbing Facing: Northeast
	Date: 10/11/06 Time: 1553 Photo Taken by: Dave Ransbarger Description: Removal of fence around classified area. Facing: South-southwest

	Date: 10/11/06 Time: 1553 Photo Taken by: Dave Ransbarger Description: Pulling fenceposts around classified area Facing: South
	Date: 10/11/06 Time: 1553 Photo Taken by: Dave Ransbarger Description: Hauling fence material to staging area for radiological screening Facing: East
	Date: 10/11/06 Time: 1553 Photo Taken by: Dave Ransbarger Description: Soil subsidence above a classified area pit before backfilling and compacting to grade Facing: East

Date: 10/12/06 Time: 1542

Photo Taken by: Dave Ransbarger

Description: Cutting fenceposts from concrete

Facing: North

Date: 10/12/06 Time: 1542

Photo Taken by: Dave Ransbarger

Description: Screening grubbed material from classified area

Facing: South

Date: 10/12/06 Time: 1542

Photo Taken by: Dave Ransbarger

Description: Overhead view of screening/staging grubbed material

Facing: Northeast

Date: 10/18/06 Time: 1624

Photo Taken by: Dave Ransbarger

Description: Overhead view of fence material staging area

Facing: North

Date: 10/18/06 Time: 1624

Photo Taken by: Dave Ransbarger

Description: Breaking up concrete pad in SE corner of classified area

Facing: Southeast

Date: 10/18/06 Time: 1624

Photo Taken by: Dave Ransbarger

Description: Monitoring radiological conditions at concrete pad, southeast corner of classified area

Facing: East

	Date: 10/18/06 Time: 1624 Photo Taken by: Dave Ransbarger Description: Soil subsidence above a classified area pit after removal of concrete cap before backfilling and compacting to grade Facing: East
	Date: 10/18/06 Time: 1625 Photo Taken by: Dave Ransbarger Description: Removal of concrete cap in SE corner of classified area Facing: South
	Date: 10/18/06 Time: 1625 Photo Taken by: Dave Ransbarger Description: Area of soil subsidence in classified area after backfilling and compacting to grade Facing: Southwest

	Date: 10/23/06 Time: 1608 Photo Taken by: Dave Ransbarger Description: Fence material staging area Facing: East
	Date: 10/23/06 Time: 1608 Photo Taken by: Dave Ransbarger Description: Completion of screening and shredding material grubbed from existing surface Facing: East
	Date: 10/25/06 Time: 0859 Photo Taken by: Dave Ransbarger Description: Overhead view of existing surface after completion of clearing/grubbing Facing: North-northeast

Date: 10/25/06 Time: 0859

Photo Taken by: Dave Ransbarger

Description: Performing Existing Landfill Surface and Perimeter Clear and Grub inspection.

Facing: East

Date: 10/30/06 Time: 1618

Photo Taken by: Dave Ransbarger

Description: Placement of subgrade material in low-lying areas of unclassified area, Lift 1.

Facing: West

Date: 10/30/06 Time: 1619

Photo Taken by: Dave Ransbarger

Description: Placement of stakes by URS for elevation reference in low-lying areas.

Facing: North

	Date: 10/31/06 Time: 1554 Photo Taken by: Dave Ransbarger Description: Performing compaction testing, Lifts 2 and 3. Facing: Northwest
	Date: 10/31/06 Time: 1555 Photo Taken by: Dave Ransbarger Description: Compaction of subgrade material, Lift 3. Facing: Northeast

	Date: 11/01/06 Time: 1717 Photo Taken by: Dave Ransbarger Description: Placement of subgrade material in low-lying areas of northern unclassified area, Lift 5. Facing: West
	Date: 11/01/06 Time: 1717 Photo Taken by: Dave Ransbarger Description: Placement of subgrade to elevation marked by surveyors, Lift 5. Facing: Southwest
	Date: 11/02/06 Time: 1627 Photo Taken by: Dave Ransbarger Description: Placement of subgrade material in low-lying areas of central unclassified area, Lift 6. Facing: North-northeast

Date: 11/06/06 Time: 1716

Photo Taken by: Dave Ransbarger

Description: Continued placement of subgrade material, Lift 8.

Facing: Northeast

Date: 11/06/06 Time: 1716

Photo Taken by: Dave Ransbarger

Description: Installing subgrade, Lift 8.

Facing: Northeast

Date: 11/07/06 Time: 1552

Photo Taken by: Dave Ransbarger

Description: Performing compaction tests, Lift 9.

Facing: Northwest

Date: 11/07/06 Time: 1552

Photo Taken by: Dave Ransbarger

Description: Screened subgrade material stockpile.

Facing: East

Date: 11/07/06 Time: 1552

Photo Taken by: Dave Ransbarger

Description: Placement of subgrade material, Lift 9.

Facing:

Date: 11/07/06 Time: 1552

Photo Taken by: Dave Ransbarger

Description: Installing subgrade, Lift 9.

Facing: East-Southeast

	Date: 11/08/06 Time: 1723 Photo Taken by: Dave Ransbarger Description: Compacting subgrade material, Lift 10. Facing: Southwest
	Date: 11/08/06 Time: 1723 Photo Taken by: Dave Ransbarger Description: Installing and compacting subgrade material, Lift 10. Facing: Northeast
	Date: 11/08/06 Time: 1725 Photo Taken by: Dave Ransbarger Description: Progress at end of day. Facing: North-northeast

	Date: 11/09/06 Time: 1647 Photo Taken by: Dave Ransbarger Description: Continued placement of subgrade material, Lift 10. Facing: East
	Date: 11/09/06 Time: 1647 Photo Taken by: Dave Ransbarger Description: Continued placement of subgrade material, Lift 10. Facing: Northeast
	Date: 11/09/06 Time: 1647 Photo Taken by: Dave Ransbarger Description: Loose lift to elevation marked by surveyors. Facing: North

	Date: 11/13/06 Time: 1742 Photo Taken by: Dave Ransbarger Description: Continued placement of subgrade material, Lift 10. Facing: South
	Date: 11/13/06 Time: 1742 Photo Taken by: Dave Ransbarger Description: Progress at end of day. Facing: North
	Date: 11/15/06 Time: 1710 Photo Taken by: Dave Ransbarger Description: Installation of subgrade material, Lift 11. Facing: East-northeast

	Date: 11/15/06 Time: 1711 Photo Taken by: Dave Ransbarger Description: Installation of subgrade material, Lift 11. Facing: East-Northeast
	Date: 11/16/06 Time: 1716 Photo Taken by: Dave Ransbarger Description: Finished surface, Classified Area Lift 11. Facing: North
	Date: 11/20/06 Time: 1648 Photo Taken by: Dave Ransbarger Description: Screened subgrade material stockpile. Facing: East

	Date: 11/21/06 Time: 1824 Photo Taken by: Dave Ransbarger Description: Installation of subgrade material, Lift 11. Facing: East
	Date: 11/22/06 Time: 1312 Photo Taken by: Dave Ransbarger Description: Subgrade material stockpile. Facing: East
	Date: 11/22/06 Time: 1313 Photo Taken by: Dave Ransbarger Description: Overhead view of unclassified area, Lift 11. Facing: North-northeast

	Date: 11/28/06 Time: 1727 Photo Taken by: Dave Ransbarger Description: Completed Lift 11 surface. Facing: Northeast
	Date: 11/28/06 Time: 1727 Photo Taken by: Dave Ransbarger Description: Beginning installation of Lift 12. Facing: East-northeast
	Date: 11/29/06 Time: 1703 Photo Taken by: Dave Ransbarger Description: Stockpile of soil existing prior to field operations, soil not used as subgrade. Facing: Southeast

	Date: 11/29/06 Time: 1703 Photo Taken by: Dave Ransbarger Description: Hauling subgrade for placement in Lift 12. Facing: Southeast

Date: 12/04/06 Time: 1712

Photo Taken by: Dave Ransbarger

Description: Placement of Subgrade material, Lift 12.

Facing: Northeast

Date: 12/04/06 Time: 1457

Photo Taken by: Dave Ransbarger

Description: Installation of Subgrade, Lift 12

Facing: North

Date: 12/18/06 Time: 1650

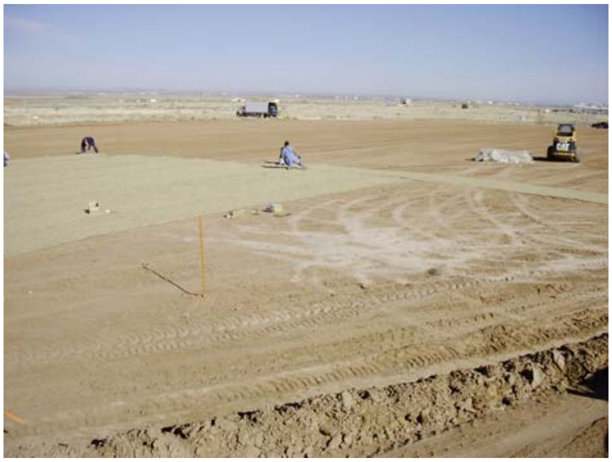
Photo Taken by: Dave Ransbarger

Description: Overhead view, final surface of Subgrade Lift 12 prior to final grading

Facing: North

	<u>Date:</u> 12/20/06 <u>Time:</u> 1046 <u>Photo Taken by:</u> Dave Ransbarger <u>Description:</u> No personnel on site due to snow, material too wet to perform final grading. <u>Facing:</u> South
	<u>Date:</u> 12/20/06 <u>Time:</u> 1046 <u>Photo Taken by:</u> Dave Ransbarger <u>Description:</u> No personnel on site due to snow, material too wet to perform final grading. <u>Facing:</u> Northeast

	Date: 01/30/07 Time: 1527 Photo Taken by: Dave Ransbarger Description: Erosion of Subgrade slopes following snow melt. Facing: East
	Date: 01/30/07 Time: 1528 Photo Taken by: Dave Ransbarger Description: Erosion of Subgrade slopes following snow melt. Facing: Southeast
	Date: 01/30/07 Time: 1529 Photo Taken by: Dave Ransbarger Description: Erosion of Subgrade slopes following snow melt. Facing: East

	Date: 04/03/07 Time: 1233 Photo Taken by: Dave Ransbarger Description: Installation of erosion control blanket. Facing: Northwest
	Date: 04/03/07 Time: 1233 Photo Taken by: Dave Ransbarger Description: Anchor trench for erosion control blanket. Facing: West
	Date: 04/03/07 Time: 1233 Photo Taken by: Dave Ransbarger Description: Installing staple to hold erosion control blanket in place Facing: Northeast

Log No. 2

Mixed Waste Landfill
2009 Evapotranspirative Cover Construction
Photographic Log

	<u>Date:</u> 05/18/09 <u>Time:</u> 1445 <u>Photo Taken by:</u> C. M. Timm II <u>Description:</u> Silt Fence Installation <u>Facing:</u> South
	<u>Date:</u> 05/20/09 <u>Time:</u> 0740 <u>Photo Taken by:</u> C. M. Timm II <u>Description:</u> MWL Subgrade before 2009 clearing and preparation activities <u>Facing:</u> South
	<u>Date:</u> 05/20/09 <u>Time:</u> 1443 <u>Photo Taken by:</u> C. M. Timm II <u>Description:</u> Removal of vegetation from the Subgrade surface <u>Facing:</u> North

<table>
<tr><td></td><td>Date: 05/22/09 Time: 0826
Photo Taken by: C. M. Timm
Description: In-situ density and moisture tests of Subgrade
Facing: South</td></tr>
<tr><td></td><td>Date: 05/22/09 Time: 0740
Photo Taken by: C. M. Timm
Description: MWL Subgrade after vegetation was removed and prior to placement of the Biointrusion Layer rock
Facing: North</td></tr>
</table>

Date: 05/26/09 Time: 1150

Photo Taken by: C. M. Timm

Description: Placement of Biointrusion Layer installation test

Facing: Southwest

Date: 05/26/09 Time: 1151

Photo Taken by: C. M. Timm

Description: Surveying the biointrusion rock layer during installation test to verify thickness

Facing: Southwest

Date: 05/26/09 Time: 1159

Photo Taken by: C. M. Timm

Description: Compacting thin soil layer over Biointrusion Layer during installation test to determine effectiveness of installation approach to fill rock void

Facing: Northeast

	Date: 05/28/09 Time: 0834 Photo Taken by: C. M. Timm Description: Start of Biointrusion Layer rock installation – south-central part of MWL Facing: Southwest
	Date: 05/28/09 Time: 1517 Photo Taken by: C. M. Timm Description: Biointrusion Layer rock placed on Subgrade surface and spread by bulldozer Facing: South
	Date: 05/28/09 Time: 0733 Photo Taken by: C. M. Timm Description: Close up of biointrusion rock placed on Subgrade Facing: South

	Date: 06/1/09 Time: 1026 Photo Taken by: C. M. Timm Description: Surveyor recording elevation of the Biointrusion Layer during installation to check and control thickness Facing: East
	Date: 06/2/09 Time: 0741 Photo Taken by: C. M. Timm Description: View of MWL during installation of Biointrusion Layer – MWL partially covered with ~1.25 feet of biointrusion rock Facing: North
	Date: 06/03/09 Time: 0758 Photo Taken by: C. M. Timm Description: Delivery of biointrusion rock by dump trucks and spreading with bulldozer near northwest end of MWL Facing: Southwest

	Date: 06/08/09 Time: 0727 Photo Taken by: C. M. Timm Description: Biointrusion rock layer over the Subgrade except the for northeast corner (classified area) Facing: North
	Date: 06/12/09 Time: 1421 Photo Taken by: J. Schermerhorn Description: Biointrusion Layer installation completed in the northeast corner (classified area) – thin soil layer installation over the Biointrusion Layer proceeding over northeast corner Facing: Northeast

Date: 06/08/09 Time: 0941

Photo Taken by: J. Schermerhorn

Description: Spreading the thin soil layer over the Biointrusion Layer with the grader to fill in voids and make a level surface

Facing: Southwest

Date: 06/09/09 Time: 0727

Photo Taken by: J. Schermerhorn

Description: The southern half of the MWL covered with the thin soil layer overlying the Biointrusion layer

Facing: North

Date: 06/09/09 Time: 0738

Photo Taken by: J. Schermerhorn

Description: Close up of the dry, loose soil filling voids in the upper part of the Biointrusion Layer

Facing: South

	Date: 06/12/09 Time: 1305 Photo Taken by: J. Schermerhorn Description: Dry loose soil penetrating down into the rock layer filling the voids at the northwest corner Facing: Southeast
	Date: 06/12/09 Time: 1259 Photo Taken by: J. Schermerhorn Description: Biointrusion rock showing through the thin soil layer – location was scraped with the grader to make sure the overlying soil layer was as thin as possible Facing: Southwest
	Date: 06/17/09 Time: 0718 Photo Taken by: J. Schermerhorn Description: The completed thin soil layer overlying the Biointrusion Layer before installation of the Native Soil Layer – view of northeast corner of MWL – note steep side slopes Facing: Southwest

	Date: 06/17/09 Time: 0814 Photo Taken by: J. Schermerhorn Description: Soil compaction test (in-place density and moisture test) on east slope at the north end of the MWL during initial slope build up to 6 to 1 – first phase of Native Soil Layer installation Facing: Northwest
	Date: 06/18/09 Time: 1003 Photo Taken by: J. Schermerhorn Description: Building north end side slope of the cover during initial Native Soil Layer installation – survey stakes show extent of the slope (i.e., the toe) Facing: West

Date: 06/18/09 Time: 1548

Photo Taken by: J. Schermerhorn

Description: Survey stakes outlining area of Wedge Lift 1

Facing: South

Date: 06/19/09 Time: 1050

Photo Taken by: J. Schermerhorn

Description: Compacting placed material in Wedge Lift 1

Facing: South

Date: 06/19/09 Time: 0750

Photo Taken by: J. Schermerhorn

Description: Aerial picture of construction of Wedge Lift 1 – water truck adding moisture to soil and grader spreading the soil fill to the proper thickness

Facing: Southeast

	Date: 06/23/09 Time: 1136 Photo Taken by: J. Schermerhorn Description: Constructing Lift 3 – grading lift to proper thickness based on survey grade stakes Facing: South
	Date: 06/23/09 Time: 0742 Photo Taken by: J. Schermerhorn Description: Adding water to placed soil fill material on west side of cover for Lift 4. Facing: Southwest
	Date: 06/25/09 Time: 1412 Photo Taken by: J. Schermerhorn Description: Compacting soil material during Lift 4 installation Facing: Southeast

	Date: 06/24/09 Time: 0731 Photo Taken by: J. Schermerhorn Description: Aerial picture of Native Soil Lift 3 construction Facing: South
	Date: 06/29/09 Time: 1358 Photo Taken by: J. Schermerhorn Description: Compacting soil around the extended groundwater monitoring well MWL-MW4 with a manually-operated compactor during Native Soil Lift 4 construction Facing: Northeast
	Date: 07/07/09 Time: 1604 Photo Taken by: J. Schermerhorn Description: Adding water to increase the moisture to Lift 5 soil (grid blocks 1 and 2) after area ripped with grader scarifier shanks to a depth of ~6 inches after initial field compaction tests failed for moisture content Facing: South

	Date: 07/15/09 Time: 0813 Photo Taken by: J. Schermerhorn Description: Soil being placed by bottom dump truck and graded during construction of Native Soil Lift 6 Facing: South
	Date: 07/15/09 Time: 0824 Photo Taken by: J. Schermerhorn Description: Adding water to soil during grading of Native Soil Lift 6 to bring the moisture content to within 2% of the optimal moisture Facing: North
	Date: 07/17/09 Time: 1337 Photo Taken by: J. Schermerhorn Description: Compacting Native Soil Lift 6 on the west slope – note groundwater monitoring wells in background (orange fencing surrounds them) Facing: Southwest

	Date: 07/20/09 Time: 0835 Photo Taken by: J. Schermerhorn Description: Grade stakes showing the thickness of soil to be placed for the next Native Soil Layer Lift (Lift 7) Facing: Northeast
	Date: 07/28/09 Time: 0835 Photo Taken by: J. Schermerhorn Description: Grade stakes after soil placed and compacted for native Soil Layer Lift 8 Facing: Northeast

Date: 08/06/09 Time: 0924

Photo Taken by: J. Schermerhorn

Description: Building the Topsoil Layer in one lift and applying water to moisture condition the soil and minimize dust generation

Facing: South

Date: 08/07/09 Time: 0921

Photo Taken by: J. Schermerhorn

Description: Close up of the 3/8-inch gravel in the Topsoil Layer fill

Facing: East- Northeast

Date: 08/10/09 Time: 1401

Photo Taken by: J. Schermerhorn

Description: Blue whiskers that indicate “blue topping” and final elevation of Topsoil Layer.

Facing: South

<table>
<tr><td></td><td>Date: 08/11/09 Time: 0657
Photo Taken by: J. Schermerhorn
Description: MWL ET Cover after Topsoil Layer placement – final CQC and CQA survey verification of thickness and slopes completed
Facing: Northeast</td></tr>
<tr><td></td><td>Date: 08/12/09 Time: 0933
Photo Taken by: J. Schermerhorn
Description: Scarifying the Topsoil Layer with the scarifier shanks on the grader after approval of thickness and slopes in preparation for seeding
Facing: South</td></tr>
<tr><td></td><td>Date: 08/12/09 Time: 1238
Photo Taken by: J. Schermerhorn
Description: MWL ET Cover (Topsoil Layer surface) after scarifying and prior to seeding
Facing: South</td></tr>
</table>

	Date: 08/20/09 Time: 1025 Photo Taken by: J. Schermerhorn Description: Tilling the soil prior to seed placement to break up any large clumps of soil Facing: West
	Date: 08/21/09 Time: 0850 Photo Taken by: J. Schermerhorn Description: Tilling to loosen the soil and help facilitate re-vegetation Facing: Southwest
	Date: 08/26/09 Time: 0953 Photo Taken by: J. Schermerhorn Description: Hand-broadcasting the seed according to the approved procedure to avoid compacting the soil with additional passes of the tractor/drill seeder to accommodate increased seeding rate – note supplemental watering irrigation pipe with sprinkler heads in photograph Facing: Northeast

	Date: 08/26/09 Time: 1401 Photo Taken by: J. Schermerhorn Description: Drill seeding on the north slope of the ET Cover Facing: Southeast
	Date: 08/28/09 Time: 0904 Photo Taken by: J. Schermerhorn Description: Blowing straw mulch to cover the planted grass seed and help retain moisture in the soil. Facing: Southeast
	Date: 08/28/00 Time: 1024 Photo Taken by: J. Schermerhorn Description: Crimping the straw mulch into the soil on the north slope of the ET Cover to keep it from blowing away Facing: Southwest

	Date: 08/31/09 Time: 1443 Photo Taken by: J. Schermerhorn Description: MWL ET Cover after seeding and crimping the straw mulch in place – irrigation piping for the supplemental watering system visible in photograph Facing: North
	Date: 09/1/09 Time: 1148 Photo Taken by: J. Schermerhorn Description: Installing the T-posts for the barbed wire Administrative Security Fence around the site Facing: West
	Date: 09/02/09 Time: 1140 Photo Taken by: J. Schermerhorn Description: The barbed wire Administrative Security Fence and gate (background) on the north end of the ET Cover Facing: East

Date: 05/27/09 Time: 1251

Photo Taken by: C. M. Timm

Description: Groundwater monitoring well MWL-MW4 PVC casing being extended prior to installation of Biointrusion Layer on this part of the ET Cover – outer steel casing cut near ground surface (yellow) and white extended PVC well casing shown

Facing: East

Date: 05/27/09 Time: 1434

Photo Taken by: C. M. Timm

Description: MWL-MW4 outer steel protective casing extended to accommodate the ET Cover thickness

Facing: East

	Date: 08/05/09 Time: 1314 Photo Taken by: J. Schermerhorn Description: Installation of Soil-Vapor Well MWL-SV2 in the northeast corner of the MWL during Topsoil Layer installation prior to seeding and mulching Facing: East
	Date: 08/05/09 Time: 1303 Photo Taken by: J. Schermerhorn Description: Aerial picture of installation of Soil-Vapor Well MWL-SV2 Soil-Vapor Well MWL-SV2 Facing: Southeast
	Date: 08/06/05 Time: 1352 Photo Taken by: J. Schermerhorn Description: Installing Soil-Vapor Well MWL-SV2 Facing: Southeast

	Date: 08/06/09 Time: 1524 Photo Taken by: J. Schermerhorn Description: Installation of Soil-Vapor Well MWL-SV1 Facing: South
	Date: 08/07/09 Time: 0842 Photo Taken by: J. Schermerhorn Description: Installation of Soil-Vapor Well MWL-SV1 Facing: Southwest

Date: 05/26/09 Time: 0843

Photo Taken by: C. M. Timm

Description: Constructing the drive-off pad on the south side of the MWL Borrow Pit

Facing: South

Date: 06/30/09 Time: 1329

Photo Taken by: J. Schermerhorn

Description: Loading native soil fill into a bottom-dump truck at the MWL Borrow Pit for transport to the MWL site

Facing: South

Date: 07/06/09 Time: 1333

Photo Taken by: J. Schermerhorn

Description: Screening soil to 2-inch minus and stockpiling at the MWL Borrow Pit

Facing: West

Date: 07/09/09 Time: 0912

Photo Taken by: J. Schermerhorn

Description: Pug Mill operation used to mix 3/8-inch gravel and topsoil fill at a 25% by volume ratio to produce the topsoil fill used to construct the Topsoil Layer of the ET Cover

Facing: West

Date: 07/15/09 Time: 0905

Photo Taken by: J. Schermerhorn

Description: Pug Mill operation (background), native soil and topsoil excavation and screening to 2-inch minus (foreground), screened soil stockpiles, and native soil loading in bottom-dump trucks (background) for transport to MWL site

Facing: Southeast

Date: 08/20/09 Time: 1139

Photo Taken by: J. Schermerhorn

Description: MWL Borrow Pit after completion of construction activities and grading to ensure proper drainage

Facing: Southeast

	Date: 08/13/09 Time: 1508 Photo Taken by: J. Schermerhorn Description: MWL ET Cover with irrigation pipe installed for the supplemental watering system Facing: South
	Date: 08/18/09 Time: 0953 Photo Taken by: J. Schermerhorn Description: Testing of the supplemental watering system prior to seeding and mulching Facing: South
	Date: 09/10/09 Time: 1317 Photo Taken by: J. Schermerhorn Description: Close up of grass growing on the north slope of the cover Facing: West

Date: 09/22/09 Time: 1108

Photo Taken by: J. Schermerhorn

Description: MWL ET Cover with seed and mulch in place – grass seedling growth indicated by green areas

Facing: South

Date: 09/22/09 Time: 1110

Photo Taken by: J. Schermerhorn

Description: Close up of grass seedling growth on surface of the ET Cover with the supplemental watering system in place

Facing: Southeast

APPENDIX A

Mixed Waste Landfill Alternative Cover Construction Quality Assurance Report January 2010

Volume 2
Attachments

(provided electronically on compact disc)

Attachments in Volume 2 of Appendix A are provided in electronic format (PDF files) on a CD. Separately bound hard copies of Volume 2 are available in the NMED Hazardous Waste Bureau document library (Santa Fe, New Mexico); the DOE/Sandia document repository (Public Reading Room, Zimmerman Library at the University of New Mexico, Albuquerque, New Mexico); and the SNL/NM Customer Funded Records Center (formerly known as the ES&H and Security Records Center).

List of Attachments

Attachment	*Title*
1	Record of Meetings and Approvals 2006 Meetings 2009 Meetings
2	CQA Submittals and Approvals 2009 QA Submittal Cover Pages 2009 Cover Layer Approval Forms
3	Daily Quality Control Reports 2006 Daily Quality Control Reports 2009 Daily Quality Control Reports
4	Receiving Inspection Forms and Documentation 2005 Biointrusion Rock 2009 Biointrusion Rock 2009 Aggregate 2009 Seed and Mulch 2009 Seed Bag Labels
5	Construction Inspection Forms 2006 Construction Inspection Forms 2009 Construction Inspection Forms
6	Testing Inspection Forms 2006 Testing Inspection Forms 2009 Testing Inspection Forms
7	Laboratory and Field Test Results and Supporting Data 2006 Standard Proctor, Gradation, and Classification Tests 2006 Density and Moisture Tests 2009 Standard Proctor, Gradation, and Classification Tests 2009 Density and Moisture Tests 2009 Saturated Hydraulic Conductivity Tests
8	Summary Report for the Extension of Monitoring Well MWL-MW4 at the Mixed Waste Landfill