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ENTERED Kieling

**DEPARTMENT OF ENERGY**
National Nuclear Security Administration
Los Alamos Field Office
Los Alamos, New Mexico 87544

SEP 26 2014

CERTIFIED MAIL-RETURN RECEIPT REQUESTED

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NMED
Hazardous Waste Bureau

Mr. John Kieling
Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
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Dear Mr. Kieling:

References:

1. NMED Letter, from J. Kieling, HWB, NMED, to P. Maggiore, EPO, NA-LA, and J. Mousseau, ADEP, LANS, Subject: "Request for a Waiver for the Implementation of Active Gas Collection Using Blowers at the Airport Landfill Technical Area-73, Solid Waste Management Unit-73-001 (A); Los Alamos National Laboratory; EPA ID# NM0890010515:HWB-LANL-13-070, dated July 25, 2014 (COR-EPO-7.30.2014-587146)
2. NA-LA Letter from D. Rhodes, EPO, NA-LA, to J. Kieling, HWB, NMED, Subject: "Formal Notification of Methane Levels at 100 Percent of the Lower Explosive Limit at Vent Risers along the North Edge of the Los Alamos Airport Landfill Cap and Request for a Waiver of the Implementation of an Active Gas Collection using Blowers," dated December 12, 2013 (COR-EP-11.26.2013-549708)

Subject: Response to Waiver Denial Letter

In response to Reference 1, enclosed is the "Pre-Design Work Plan Los Alamos County Airport Landfill," as an alternative remedial measure. Because the Department of Energy (DOE) is planning on replacing the poorly-performing landfill cover in Fiscal Year 2015, the installation of an active gas collection system using blowers would delay the primary replacement of the landfill cover. The administrative controls currently in-place sufficiently ensure the health and safety of personnel and the environment. As the pre-design work plan is executed, the DOE will continue monitoring the cover inclusive of gas on the currently approved schedule.

If you have any questions, please contact Ramoncita N. Massey at (505) 665-7771.

David S. Rhodes
Federal Project Director
Environmental Projects Office

Enclosure: Pre-Design Work Plan Los Alamos County Airport Landfill

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COR-EPO-9,18, 214-5941000

# PRE-DESIGN WORK PLAN
# LOS ALAMOS COUNTY AIRPORT LANDFILL

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# PRE-DESIGN WORK PLAN
# LOS ALAMOS COUNTY AIRPORT LANDFILL

*September 2014*

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|---|---|---|---|---|
| Stephen F. Dwyer | Stephen F. Dwyer | Principal Engineer | Dwyer Engr. LLC | Sept. 22, 2014 |

Responsible DOE representative:

| Printed Name | Signature | Title | Organization | Date: |
|---|---|---|---|---|
| Ramoncita Massey | David S. Rhodes Sr | Project Manager | DOE-LASO | 9-24-2014 |

Responsible DOE manager:

| Printed Name | Signature | Title | Organization | Date: |
|---|---|---|---|---|
| David Rhodes | David S. Rhodes | Supervisor | DOE-LASO | 9-24-2014 |

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# 1.0 INTRODUCTION

A cover system was installed in early 2007 on the solid waste landfill located adjacent to the Los Alamos County (LAC) Airport. This cover system is composed of an asphalt surface (MatCon) in conjunction with five reinforced concrete slabs (Figure 1). A passive gas collection system was also incorporated into the cover system. The north and east perimeter of the LAC Airport Landfill are side slopes composed of compacted soil with a vegetated surface. There is no waste beneath these side slopes. The eastern slope is reinforced by retaining structures. The existing airport hangar facilities are located adjacent to the western edge of the landfill. A surface water drainage trench is located to the south.

The LAC airport landfill was closed as a hazardous waste landfill following guidelines set forth in the Resource Conservation and Recovery Act (RCRA) Subtitle C closures (40 CFR 264, Subpart N as incorporated by 20.4.1.600 NMAC). The intent of the cover system was to perform equivalent to a prescriptive cover for at least the duration of the 30-year post-closure care period (DOE/EA-1515 Final Environmental Assessment for Proposed Closure of the Airport Landfills within TA73). The additional intent of the reinforced concrete slabs was to provide a foundation for future airplane hangars to be built upon. The surrounding asphalt surface was to provide access for the airplanes in and out of the hangars. The asphaltic surface was a specialty product produced by MatCon, Inc. marketed to be relatively impermeable.

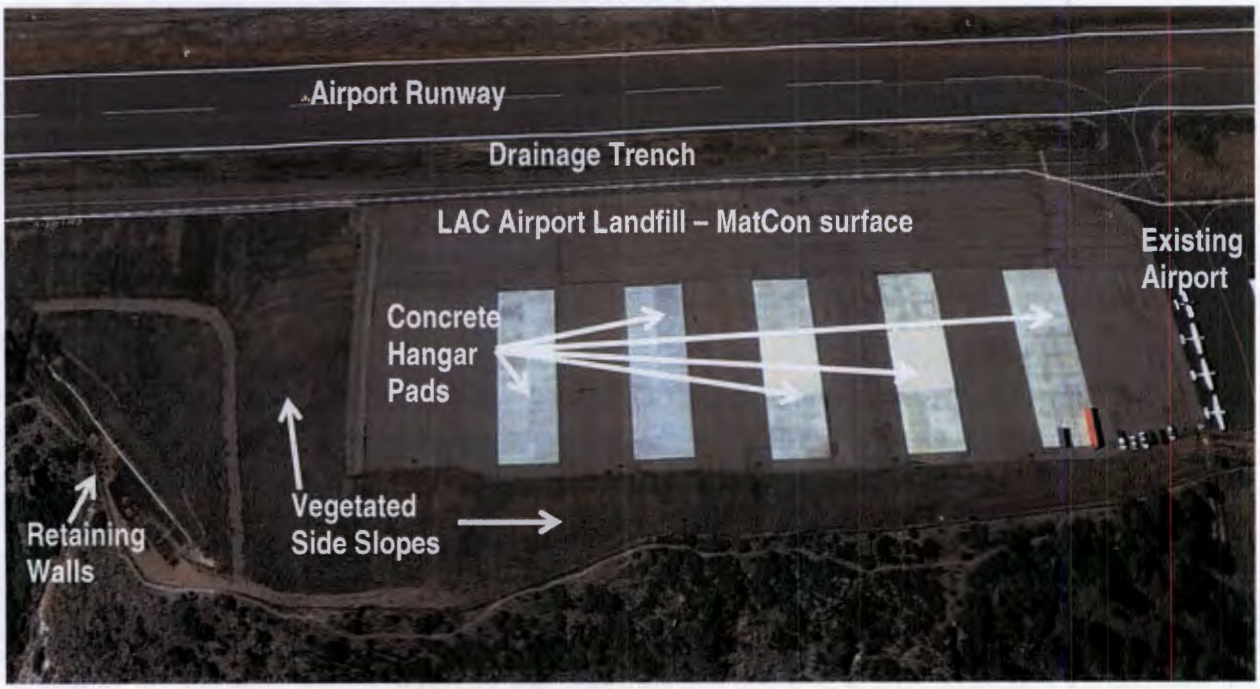



*Figure 1. Aerial View of Airport Landfill with MatCon Cover & Concrete Hangar Pads*

The US Department of Energy (DOE) began monitoring the LAC Airport Landfill in 2010. In December 2013, the DOE submitted to the New Mexico Environment Department (NMED) a *Formal Notification of Methane Levels at 100 Percent of the Lower Explosive Limit at Vent Risers along the North Edge of the Los Alamos Airport Landfill Cap and Request for a Waiver of*

*the Implementation of an Active Gas Collection Using Blowers (Notification).* The NMED replied to this notification and waiver for active gas collection on July 25, 2014 (Appendix C). The reply stated *"The Permittees must implement an active gas collection system or propose an alternative remedial measure to reduce infiltration of water into the landfill and to reduce methane levels below 100% LEL."* The reply further stated: *"The Permittees must submit a work plan for the implementation of an active gas collection system or an alternate remedial measure to NMED no later than September 30, 2014. Until the work plan is submitted to NMED, the Permittees must continue weekly monitoring at SWMU 73-001 (a) and continue to submit data to NMED on a monthly basis."* In response to this reply, the DOE is submitting this Pre-Design Work Plan.

## 1.1 NOTICE TO REPLACE EXISTING LANDFILL COVER SYSTEM

The DOE is formally notifying the NMED that it intends to replace the existing final cover system on the LAC Airport Landfill in lieu of installing an active gas collection. The existing landfill cover is not performing as intended – refer to Section 3 and 4 for specifics. In addition, due to the noted degradation; the cover system is no longer able to effectively serve as a foundation for the airport hangars planned for installation on the concrete hangar pads. Converting the methane collection system from a full passive system to a partial active system will not correct the cover deficiencies identified as summarized in Section 3 and 4.

The existing cover is composed of five reinforced concrete pads surrounded by an asphaltic MatCon surface underlain by base coarse containing a gas collection system. The MatCon asphalt cover surface and reinforced concrete pads will be removed. The cover will be replaced with a monolithic soil cover referred to as an Evapotranspiration (ET) Cover. This ET Cover will meet the requirements of the final cover system for the site as described in 40 CFR 264, Subpart N. Refer to Section 7 for more information on the proposed replacement cover system.

## 1.2 METHANE COLLECTION

The DOE is requesting NMED's approval to *not* implement an active gas collection system, but rather replace the final cover system. Therefore, a passive gas collection system will remain and monitoring will continue until the replacement cover construction begins.

The DOE believes that the extensive maintenance, differential settlement and ongoing infiltration through the final cover system into the underlying waste will best be addressed by replacement of the cover system. Changing the gas collection system to an active gas collection system will not solve the identified problems at the site (refer to Section 3 and 4).

The replacement cover will minimize flux into the underlying waste. The reduction of moisture in the waste will slow waste biodegradation, thereby slowing the production of methane. Furthermore, the addition of a soil cover will allow for oxidation of methane as it migrates through the soil.

## 1.3 DESIGN WORK PLAN

DOE will submit a Design Work Plan containing specifics of the proposed ET Cover. This Design Work Plan will contain the design details of the final closure including design

specifications and drawings; a construction quality assurance plan; maintenance and operations plan to include any post-construction monitoring activities and the physical observations of the cover system.

Additionally, the Design Work Plan will include a detailed schedule summarizing estimated start and completion dates for key activities such as construction, submission of final as-built report, and post-closure monitoring.

# 2.0 SITE HISTORY AND BACKGROUND

## 2.1 LAC AIRPORT LANDFILL BACKGROUND

Two inactive solid waste disposal sites [the airport landfill, SWMU 73-001(a) and the debris disposal area (DDA), SWMU 73-001(d)] are located at the LAC Airport (Figure 1). This report focuses on the airport landfill, not the DDA. The DDA is mentioned for background information only. In late 2006 and early 2007, the Final Remedy landfill cover system was installed at the LAC airport landfill. The Final Remedy design and completion activities for the LAC airport landfill and the DDA are provided in the *Remedy Completion Report, DOE LASO TA-73 Airport Landfill SWMUs 73-001(a) and 73-001(d) April 2007.* As a condition of the remedy approval, NMED required post-closure care and monitoring of these two inactive solid waste disposal sites and submission of an annual report summarizing results from this activity.

The LAC airport landfill operated from 1943 to 1973 for the disposal of solid waste consisting of household trash from the Los Alamos town site and office trash from Los Alamos Scientific Laboratory. Before 1965, some of the waste was incinerated and subsequently buried in the airport landfill. Approximately 489,500 cubic yards of waste was disposed of in the landfill. The LAC airport landfill continued to receive waste until June 1973. From 1984 to 1986, wastes were excavated from the western portion of the LAC airport landfill and placed in the DDA (Figure 2). The excavations were backfilled in preparation for construction of airport hangars and tie-down areas (LANL, 1998).

From 1984 to 1986, approximately 126,000 cubic yards of burned debris were excavated from the western end of the airport landfill and reburied in a pair of parallel trenches at the DDA. In late 2006 and early 2007, the final remedy landfill cover system was installed at the airport landfill (Figure 1). The final remedy design and completion activities for the landfill and the DDA are provided in the "Remedy Completion Report, DOE LASO TA-73 Airport Landfill, SWMUs 73-001(a) and 73-001(d)" (North Wind and Weston 2007). Approximately 50,000 cubic yards of waste were relocated within the SWMU boundary during the 2006 final remedy construction activities. With the exception of a single container of Freon-113, uncovered and subsequently managed off-site, no other hazardous or radioactive materials were discovered. After waste relocation, regrading and compaction were conducted; the following features were installed for the LAC airport landfill cover (Figure 1):

- Approximately six acres of MatCon (Modified Asphalt Technology for Waste Containment) asphalt pavement;
- Five concrete hangar pads within the MatCon pavement area;
- Landfill-gas collection system;
- Two rock retaining walls;
- Concrete retaining wall;
- Turf reinforcement matting (TRM);
- Revegetation of approximately four acres with native grasses; and
- A storm water collection system consisting of five trench drains, seven drain inlets, approximately 1950-ft of associated buried concrete storm-sewer lines, an 18-in.-diameter high-density polyethylene outfall pipe approximately 110-ft in length, and three riprap drainage channels.

- Side slopes composed of a vegetated 2.5-ft thick earthen cover with a composite drainage layer within its profile.

The first formal inspection of the airport landfill was conducted in July 2009. Inspection activities were conducted as part of post-closure and care and monitoring requirements required under 40 Code of Regulations 265.310 for Resource Conservation and Recovery Act (RCRA) Subtitle C landfill facilities. The inspection focused on the individual elements of the landfill cover including: the MatCon pavement area and hangar pads, vegetated areas, rip rap drainage channels, concrete and rock retaining walls, the storm water collection system and all temporary erosion control features. Inspection activities and findings were documented in annual inspection reports generally submitted to NMED by February of the following year.

Several erosion control modifications and storm water enhancements were made in late 2009 and the spring of 2010; however, noticeable settlement directly impacting hangar pads was not addressed. Significant differential settlement (as much as 2-ft in areas) has been measured in the cover surface to date (Figure 15).

Although the land and hangar pads have been under LAC ownership and management since the 2007 land transfer, the County has not built hangars on the pads to date.

In 2009 and 2010, erosion features (rills and small gullies) associated with storm water runoff from the paved areas above the vegetated slopes were repaired. In addition, the curb along the taxiway was repaired and extended to redirect storm water away from the main vegetated slope. These repairs and enhancements are detailed in the "Final Construction Report for Los Alamos Airport Landfill TA-73, SWMU 73-001(a) Cover Improvements, Los Alamos, New Mexico."

The NMED's approval with modifications for the remedy completion report requires monitoring of the storm water runoff from the site. This monitoring is being performed under the Laboratory's individual permit for storm water discharges from SWMUs and areas of concern.

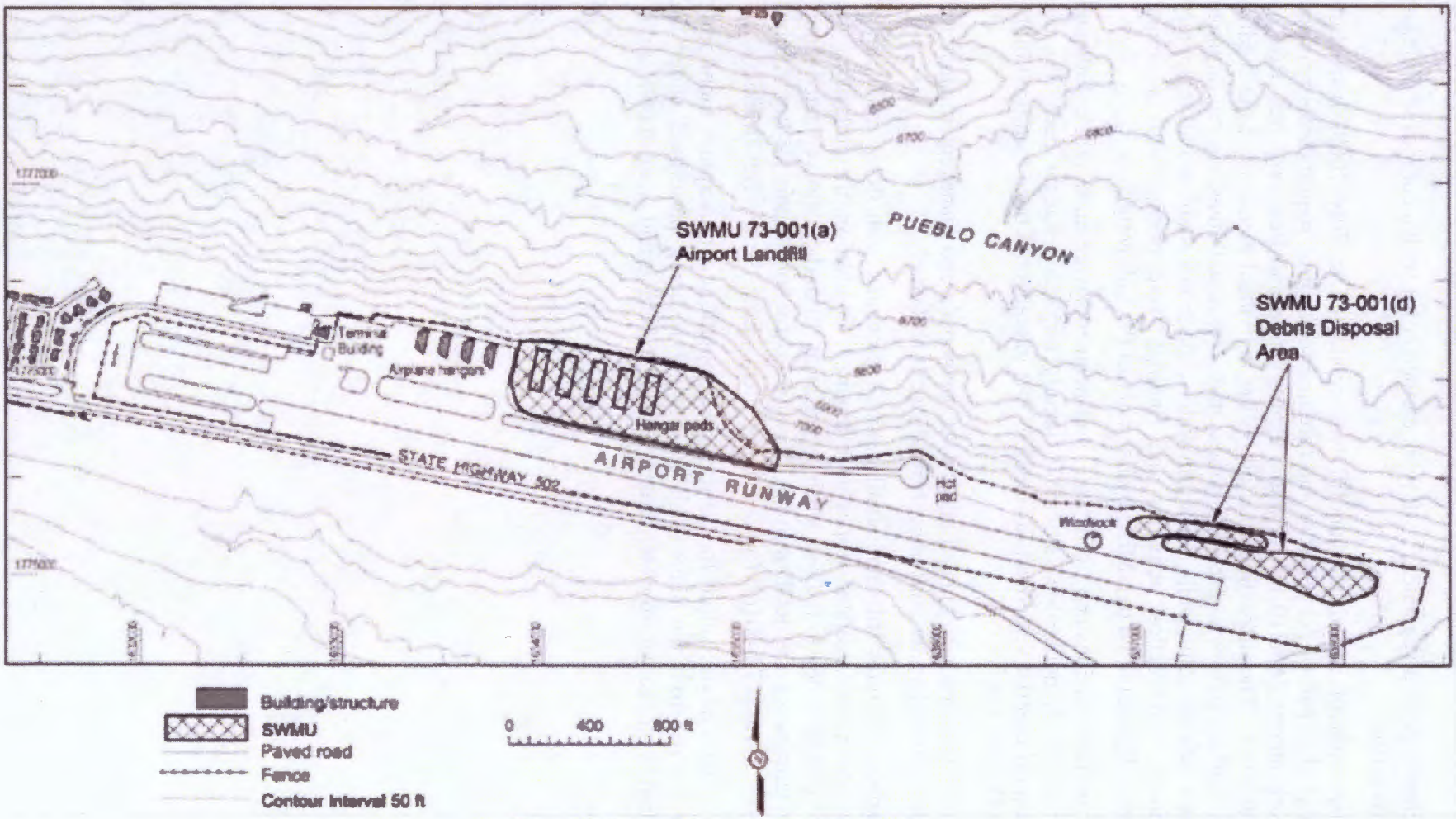



*Figure 2. Landfill Locations (LANL 1998)*

## 2.2 PHYSICAL SETTING

### 2.2.1 LAC Airport Land Use

The LAC Airport is situated on the eastern edge of the town site of Los Alamos, NM on a narrow mesa between State Road 502 and Pueblo Canyon (Figure 1). The LAC Airport was built in 1947 by the Atomic Energy Commission (predecessor to DOE) to serve the transportation needs of the Los Alamos National Laboratory. The airport is currently owned and operated by the County of Los Alamos. The airport property was conveyed from DOE to the Los Alamos County in October 2008 and was formerly part of LANL Technical Area (TA) 73.

The airport is predominately used for general aviation purposes such as recreation and air taxi. An average of 30 operations (takeoffs and landings) occur daily (Ploeger 2009). The vast majority of operations involve single-engine propeller aircraft. Business jets and air-ambulance helicopters occasionally use the airport.

The single runway is 5,500-ft long. The airport facilities consist of a terminal building, a two-story storage building (formerly the landfill incinerator building), four rows of T-hangars, various taxiways, two parking aprons, a self-service fueling station, the Hot Pad, and a strip of older hangars on the west end of the airport. Prior to 2000, the Hot Pad was used for loading and unloading LANL sensitive cargo. The Hot Pad is now used for aircraft parking and has six tie-down spots.

Pueblo Canyon extends along the north side of the airport and is undeveloped land. An unpaved road trends along the floor of the canyon. Road traffic typically consists of a few vehicles a day. The newer LAC waste-water treatment plant is located approximately 1.1 miles down the canyon from the Airport landfill.

The airport property and Pueblo Canyon are not located within the boundaries of the Santa Fe National Forest. There have been no burned areas in the canyon or nearby area due to recent forest fires, including the 2000 Cerro Grande fire.

### 2.2.2 Regional Climate

Los Alamos, NM has a temperate mountain climate with four distinct seasons (LANL 1999). For the LANL meteorological station nearest the airport, the mean precipitation including snowmelt is approximately 18.7-in per year (LANL 2006). The peak months for precipitation are July and August (Figure 3) when afternoon thunderstorms can produce high intensity rainfall. Figure 3 depicts the average monthly distribution of precipitation as well as the monthly climatic demand for water, referred to as potential evapotranspiration (PET).

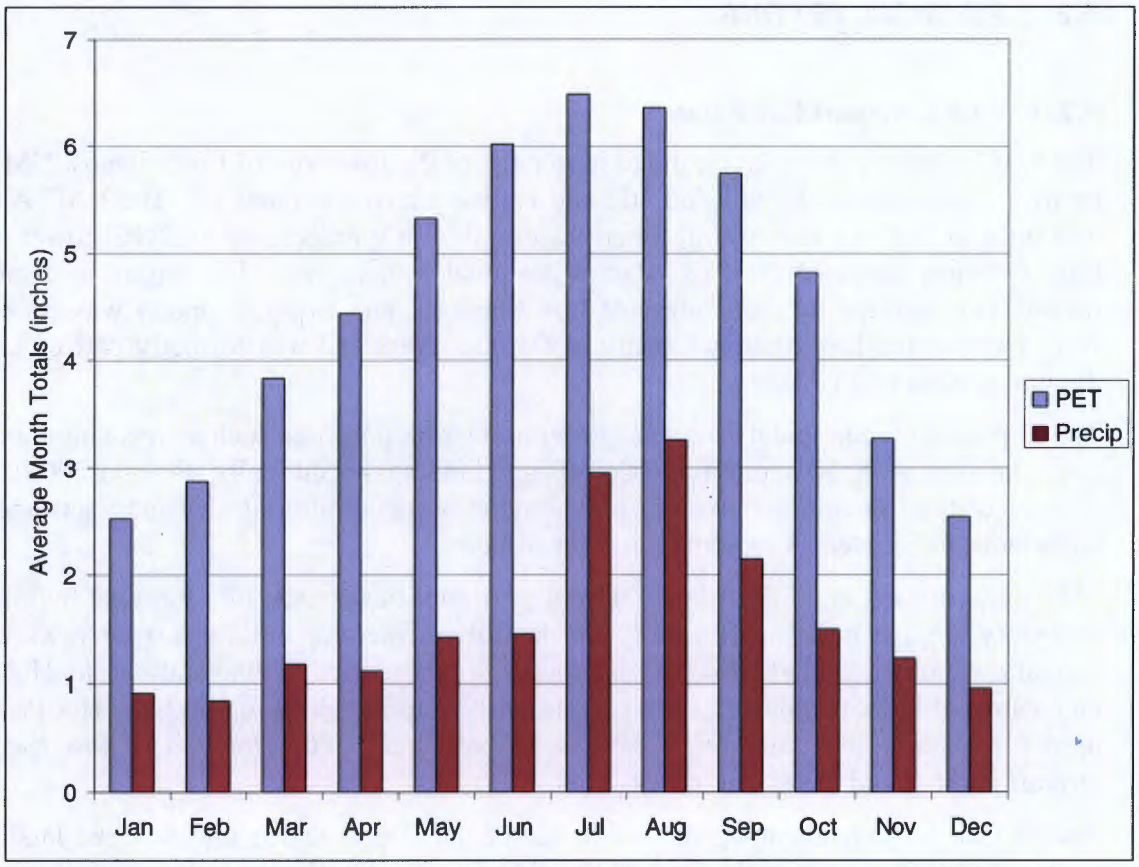



*Figure 3. Los Alamos, NM Typical Climate's Demand for Water (PET) vs. Supply of Water (Precipitation)*

### 2.2.3 Physiography

The airport is situated on one of the narrow mesas of the Pajarito Plateau that flank the eastern edge of the Jemez Mountains. The airport covers approximately 89 acres. Ground elevations range from about 7170-ft above mean sea level (MSL) on the western end of the airport to about 7050-ft on the eastern end. The runway grade is approximately 1.5-degrees toward the east. The airport is bounded on the north and east by steep slopes of the Pueblo Canyon. State Road 502 trends along the south side of the property. Single unit housing is located on the west side of the airport.

The Bandelier Tuff (consolidated volcanic ash) forms the bedrock underlying the airport. The Hackroy series is developed from the tuff and is characterized as a well-drained sandy loam (NRCS 2008). The uppermost north-facing slope near the airport is steep and rocky with scattered scrub oak, chamisa, bunch grass, and juniper. Near the canyon floor, the slope lessens and the vegetation is dominated by ponderosa pine. The channel along the canyon floor is ephemeral and has stream flow only in response to heavy precipitation. The vertical relief from the airport paved area to the canyon floor is approximately 500-ft. The depth to groundwater beneath the airport is about 1200-ft (North Wind 2006). No water supply wells are located on the airport property or nearby in Pueblo Canyon.

## 2.3 AIRPORT LANDFILL DESIGN BACKGROUND

The initial remedy design included a vegetated earthen cover referred to as an evapotranspiration (ET) cover combined with passive landfill gas control measures, and was approved by NMED, with stipulations, in September 2004. Weston Solutions, Inc. subcontracted to North Wind Inc. in the preparation of the design package. Los Alamos County expressed concern that this initial design would not accommodate airport expansion plans. To address this concern, alternative designs were prepared which then required compliance with the National Environmental Policy Act (NEPA), i.e. preparation of an Environmental Assessment (EA). The EA was released for public comment on April 4, 2005 and a Finding of No Significant Impact (FONSI) was issued by DOE in May 2005. After considering stakeholder input, Alternative 1 was selected. This alternative included: leaving waste in place at the main landfill; relocating waste from the east side and placing it to achieve rough grade at the main landfill; installing a passive gas collection system; constructing hangar pads and aircraft tie-downs; and paving over much of the Airport Landfill with a proprietary product referred to as Modified Asphalt Technology for Waste Containment (MatCon). The combination of hangar pads and paving were to serve as an impermeable cover over the Landfill with vegetation covering the surface of the side slopes (North Wind, 2006).

# 3.0 PREVIOUS INVESTIGATIONS / CHARACTERIZATION

A series of investigations of the Los Alamos Airport Landfill were performed prior to the design and construction of the existing MatCon cover system. These investigations were conducted under the direction of the Los Alamos National Laboratory and documented in the Remedial Feasibility Investigation (RFI) completed in 1998 (LANL 1998).

## 3.1 WASTE INVESTIGATIONS

The waste investigation of the Airport Landfill was conducted in several phases that included three primary tasks: Task 1 - Field Surveys; Task 2 - Surface Sampling: and Task 3 - Subsurface Sampling (LANL 1998). Specific investigations performed included a site survey, surface radiological survey, geophysical surveys, geomorphologic mapping, infrared photography survey, soil gas surveys, surface soil and channel sediment sampling, borehole drilling, and cone penetrometer testing (CPT).

The intent of the investigations was to identify the volume, location and type of waste. The type of waste was determined to be typical solid waste as compared to municipal waste found in 60 municipal landfills in the State of California (LANL 1998). The depth and extent of waste estimated from the investigations performed as described in the RFI (LANL 1998) is depicted in Figure 4.

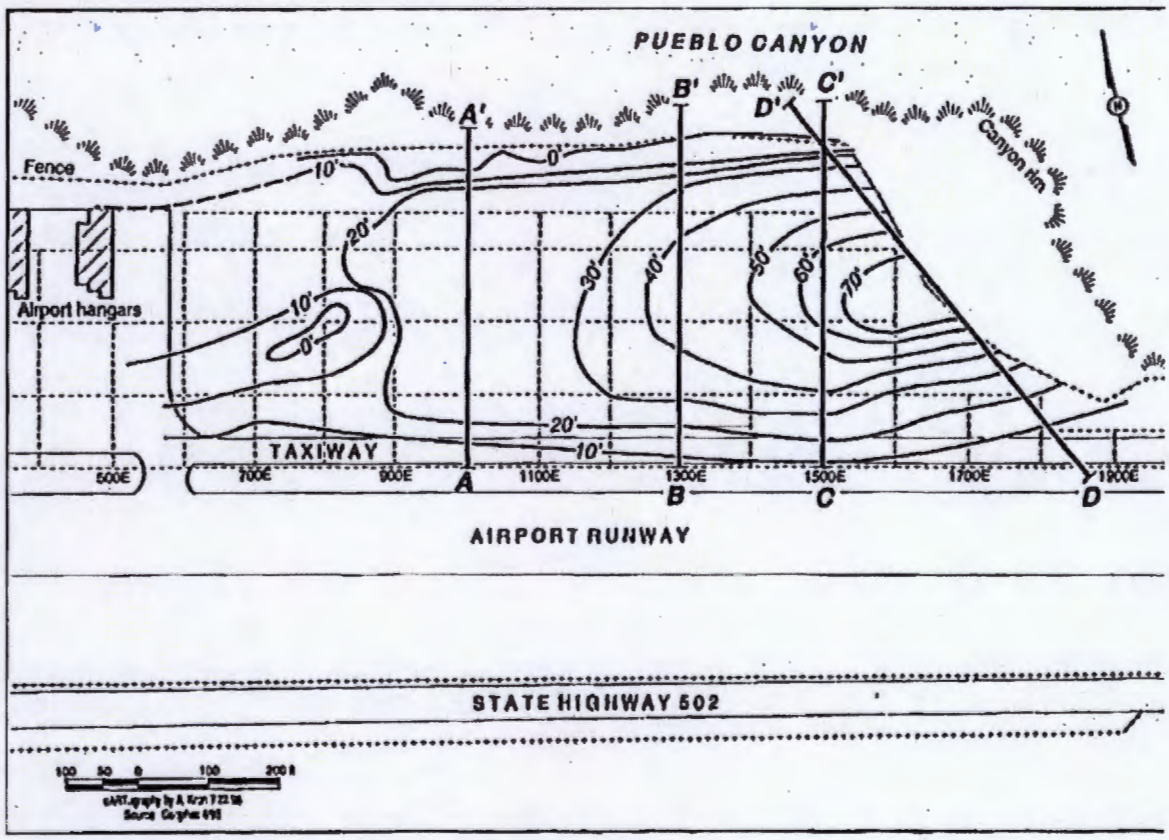



*Figure 4. Estimated Waste Volume and Extent (LANL 1998)*

## 3.2 POST-CONSTRUCTION INSPECTIONS

Post-closure inspections began in July 2009 in accordance with the submitted Inspection and Maintenance Plan (North Wind 2006). The prior annual inspection reports have been submitted to NMED. Findings from these inspections have identified significant

differential settlement and subsequent degradation of the MatCon cover surface, (Figures 5 to 7) including cracking in the asphalt and separation of dissimilar materials (asphalt separating from adjacent concrete hangar pads). Cracking in the reinforced concrete (Figure 6) hangar pads and surface water collection gutters has also been documented. The surface cracking appears to be in response to ongoing differential settlement in the landfill subsurface. The material separation is predominantly in response to this ongoing differential settlement as well as the different expansion and contraction rates of the dissimilar materials.

*Figure 5. Differential Settlement: Asphalt below Concrete Hangar Pad*

*Figure 6. Surface Cracking*

*Figure 7. Ponding due to Differential Settlement*

## 3.3 METHANE MONITORING

A gas collection system was installed beneath the final MatCon cover system. It consists of slotted PVC piping laid within the base coarse under the MatCon asphalt surface connected to six risers with passive venting (Figure 8). Methane monitoring was scheduled to be completed on a quarterly basis beginning with the conclusion of construction. It was to continue for a period of not less than two years. If after two years

methane concentrations did not exceed 25% of the lower explosive limit (LEL), the monitoring would be reduced to semi-annual for the third year. If measurements were still below 25% during the third year, monitoring could be discontinued.

The inspections and monitoring did not begin until about three years after the completion of construction. Monitoring began in July 2010, where all methane readings were below 25% of the LEL. Subsequent measurements found lower methane with the exception of a 25% exceedance in January 2011. In December 2011, measurements at vents PS-04 and PS-05 reached 100% of LEL. By 2013 methane readings at PS-02 were consistently high. Measurements at PS-05 were sporadically at 100% of LEL or zero.

*Figure 8. Methane Monitoring Locations*

## 3.4 ENGINEERING INSPECTION OF LANDFILL

Dwyer Engineering LLC was contracted to perform an engineering inspection of the LAC Airport Landfill in 2012. Dr. Stephen F. Dwyer, PE performed the inspection and evaluated available data. Findings from this inspection concluded that differential settlement due to waste biodegradation has caused significant degradation of the cover system including cracking in both the asphalt cover and reinforced concrete hangar pads. It has allowed for ponding that can easily allow water to migrate though the degraded cover surface into the underlying waste. The increased infiltration of meteoric water into the waste has increased the biodegradation rate of the underlying waste and increased methane production from the landfill. The site was surveyed and compared to the as-built condition where it was found to have significant differential settlement - as much as 2-ft in some areas of deeper waste (Figure 15). The differential settlement is generally aligned

with the volume and depth of waste. Variation in underlying waste (household waste versus construction debris) disallowed a full correlation of measured settlement compared with waste depths. However, it was noted that earlier investigations (LANL 1998) noted a deep pocket of waste (approximately 75-ft deep) near PS-02 that appears to correlate with this methane monitoring location having the highest methane measurements on average (Table 1). The deeper waste correlates with differential settlement above this area that allows for frequent ponding and thus increased infiltration in this localized area (Figure 9).

*Table 1. Average Methane Levels (% of LEL)*

| Monitoring Location | Average Methane Level (% of LEL) |
|---|---|
| PS-01 | 0.0 |
| PS-02 | 71.9 |
| PS-03 | 16.7 |
| PS-04 | 7.2 |
| PS-05 | 30.6 |
| PS-06 | 13.4 |

The inspection also identified that the installed surface water collection system is not working as intended. The significant settlement has left the installed surface water drainage system ineffective. The surface water is designed to be routed to concrete gutters adjacent to the hangar pads where it is gravity fed to collection points leading to a subsurface drainage piping network located along the southern perimeter of the landfill. However, the slope of the gutters has reversed due to settlement; consequently drainage is not routed to the collection points. That is, the gutters were designed and built to drain water from the north toward the south, but the settlement has left much of the gutter drainage system sloping from south to north. This results in some ponding along the northern end of these gutter systems (Figure 9).

*Figure 9. Ponding near PS-02*

The findings of this inspection concluded that maintenance of the site would likely be required for decades. The significant increase in infiltration due to the cover degradation has allowed for biodegradation to increase and thus methane levels to increase. This would not stop or slow until the infiltration was minimized.

The airport concrete pads have settled and cracked to the point where they cannot be used for their intended use as a surface and foundation for future airplane hangars. The sliding doors on the hangar pads would be inoperable with a very small amount of differential settlement. The settlement received has already far exceeded this minimal level.

The MatCon asphalt cover does not allow for the natural climatic conditions to remove any infiltrated water from the system (Figure 3). That is, Los Alamos, NM has a climate with a significantly higher demand for water or PET than supply of water or precipitation. With this type of semi-arid climate; water that infiltrates into a shallow soil profile will easily be removed by the combination of surface evaporation and plant transpiration. However, the MatCon and concrete cover surface blocks the removal of infiltrated water. The asphalt cover underlain by gravel base coarse allows for water to infiltrate through the various cracks inclusive of cracking in the concrete gutter system. This water quickly flows through the underlying gravel into the waste and soil beneath the gravel. At this point the water is no longer able to be removed from the system via ET because the overlying gravel and underlying finer grained soils that have created a reverse capillary barrier and are preventing the water from moving upward. Thus the water can only move down. This has created an environment where moisture within the waste has increased leading to the higher biodegradation and methane production. This will be corrected by removal of the existing MatCon cover system and replacing it with a soil cover.

The existing MatCon/concrete cover will be removed and replaced with a soil cover referred to as an Evapotranspiration (ET) Cover that will be designed to minimize flux

and erosion while being able to accommodate some settlement. Furthermore, the soil profile would enable the oxidation of a significant portion of the ongoing methane emitted. The ET Cover is consistent with that approved in the initial remedy design which included a vegetated earthen cover combined with passive landfill gas control measures, approved by NMED with stipulations, in September 2004.

# 4.0 MAINTENANCE AND REPAIRS PERFORMED ON THE AIRPORT LANDFILL

The DOE has performed maintenance and repairs on the existing LAC Airport Landfill cover system. Asphalt contractors have been hired multiple times to repair cracking in the asphalt and concrete surface. Significant erosion and fencing damaged was incurred at the site as a result of the extreme intensity of the precipitation received in September 2013. This set of precipitation events exceeded the hundred year design amounts the site was designed for. The fencing has been repaired while the erosion remediation is underway.

## 4.1 MAINTENANCE PERFORMED ON THE LAC AIRPORT LANDFILL COVER SURFACE

Differential settlement and degradation of the cover surface was first identified by DOE in 2009. The following repairs were made between July 2009 and June 2010 (One-Stop Environmental and North Wind 2010).

- Repair of Erosional Rills;
- Repair of Subsidence at the Rip Rap Bench;
- Replacement of Seed and Turf Reinforcement Mat (TRM);
- Filling of Cracks within Hangar Pads;
- Construction of a Curb and Gutter and Earthen Berm Barrier; and
- Construction of Porous Detention Areas east of the Retaining Walls.

MatCon, Inc. provided additional repairs to the asphaltic surface through their cover warranty in 2011. Non-warranty work was also performed by MatCon, Inc. to repair cracks resulting from differential settlement. The contractor filled observed cracking with liquid applied asphalt. This maintenance activity has required reapplication as the cracking increase and the prior patch degrades (Figure 10).

*Figure 10. Repaired Crack from May 2010 with Degradation since Application*

The most recent asphaltic patching work was completed in May 2014 (Figure 11). This work was performed under the supervision of engineers from CTI and Associates. Refer to Appendix A for the recent report of maintenance work performed on the landfill.

*Figure 11. Repaired Cracking in Landfill Asphalt Cover*

## 4.2 REPAIRS PERFORMED AT THE AIRPORT LANDFILL SITE

Los Alamos received rainfall events of extreme intensity in September 2013. These rains caused widespread flooding and significant damage County-wide. The Los Alamos County received FEMA aid to help repair and rebuild infrastructure damaged as a result of these storms. The LAC Airport Landfill received flooding damage to a security fence located at the eastern perimeter of the site (Figure 12).

*Figure 12. Damaged Perimeter Fence on Eastern edge of Airport Landfill Site*

The damaged fence was replaced and the eroded area was repaired (Figure 13). A design intended to implement a permanent fix for the erosion incurring along the outer perimeter of the retaining walls at the eastern edge of the landfill is currently underway.

*Figure 13. Repaired Airport Landfill Perimeter Fence*

# 5.0 PRE-DESIGN ACTIVITIES

The pre-design activities include information gathering and additional investigations. Specific activities include interactions with Los Alamos County and Airport officials on their future growth requirements and how the replacement of the cover system will impact them. A borrow soil investigation is currently underway for cover soil (Section 5.2).

A site elevation survey of the existing cover system was performed to assess the amount of settlement experienced to date compared with the as-built condition (Section 5.3). A slope stability evaluation of the northern slope of the Airport Landfill was completed (Section 5.4). Compilation and review of applicable regulations was performed (Section 6.0).

A detailed aerial survey of the area will be performed to be utilized in the design of the new cover system. An investigation of the interim cover soil available for final cover soil will be performed as well as an investigation of extent and depth of waste along the western perimeter of the Airport Landfill (Section 5.5 and 5.6). After these activities are completed a design will commence for the final cover system to be included in the Airport Landfill Design Work Plan.

## 5.1 LOS ALAMOS COUNTY REQUIREMENTS

LAC requirements could be incorporated into the final design. DOE and LAC personnel are establishing these requirements.

## 5.2 SOIL BORROW INVESTIGATION

The requested replacement cover is to be a monolithic soil cover referred to as an ET Cover. The cover is estimated to be about 6.8 acres and 3-ft thick; therefore about 33,000 cubic yards (CY) of cover soil are required. The need for a quality cover soil is complicated because the town site is surrounded by federal lands that are generally not accessible for borrow material. Furthermore, deep excavated soil in the Los Alamos area is typically volcanic tuff. Potential sources in the Los Alamos are currently being investigated both for the quality of soil and its availability. Should those sources not prove viable, additional sources outside of the Los Alamos area will be investigated.

Requirements of the cover soil include adequate water storage capacity while having the ability to serve as a rooting medium for native vegetation. Loamy soil tend to be the best as they have the highest storage capacity and are less susceptible to desiccation cracking compared to expansive clays (Figure 14). Laboratory analyses of borrow soil and rock to be used within the final closure will be evaluated by the project engineer for its quality and suitability for cover material and erosion resistance. The data will be compiled and evaluated to include modeling for moisture flux and erosion resistance. Additionally, the data will be evaluated to apply a set of construction specifications for the borrow material and quality assurance (QA) requirements during installation of the cover system.

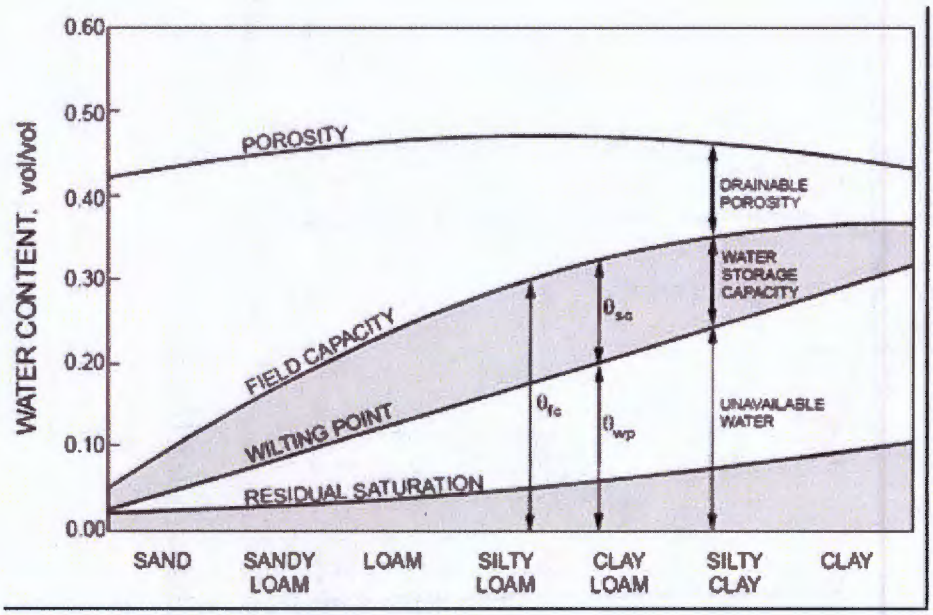



*Figure 14. Relationship Between water Storage Capacity and Soil Texture (Schroder et al 1994)*

Soil samples will be collected from potential borrow sources and analyzed for agronomic parameters, including available salts and nutrient availability. The purpose of the agronomic testing is to ensure post-construction revegetation success. Topsoil often has adequate nutrients for vegetation establishment but subsurface soils often do not. If the borrow soil identified does not have adequate nutrients, the soil will be amended as required. Adequate soil nutrients must be available in the cover soil to adequately establish native vegetation on the cover surface. The borrow soil will also be evaluated to ensure that there is not excessive salts in it.

The surface of the cover conceptually will have a rock/soil admixture or 'desert pavement' in it to resist erosion and help promote native vegetation establishment. The size, volume and depth of rock within this layer will be designed as outlined in Dwyer et al (2006) and EPA (2012). The rock will be durable. The base coarse beneath the MATCON asphalt cover will be evaluated for this use.

## 5.3 SURVEY

A cursory elevation survey was performed to evaluate the amount of settlement the site has experienced since the MatCon cover was installed. The survey was completed (May 2014) to compare the elevation of the site today compared to its as-built condition. The survey revealed that at the corners of the concrete hangar pads, there has been a varied settlement between 0.2-ft to about 2-ft (Figure 15). There are isolated locations within the asphaltic surface where settlement has exceeded 2-ft.

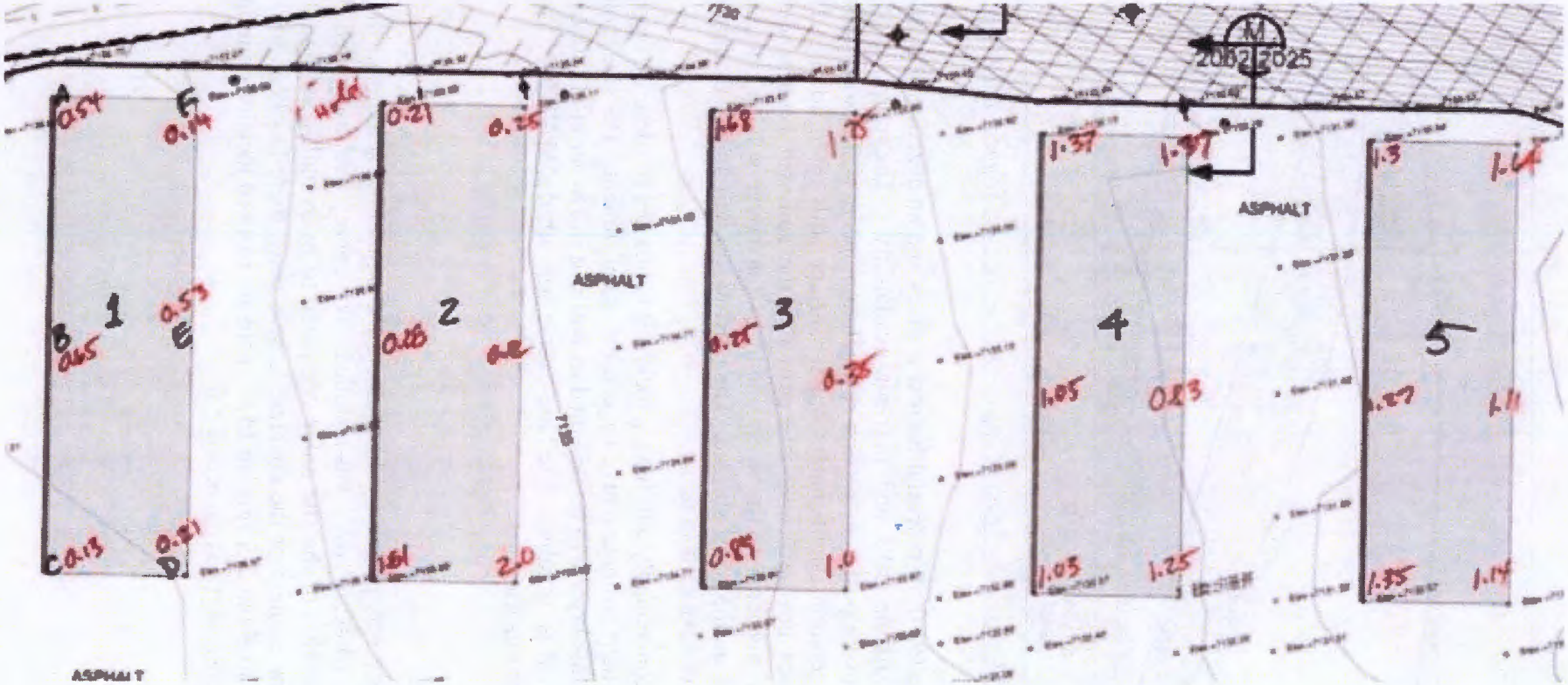



*Figure 15. Sketch with Measured Settlement Noted at Corners and Mid-Point of each Hangar Pad*

A detailed aerial survey will be performed of the Airport Landfill and surrounding area. This detailed aerial survey will be utilized in the final design of the replacement cover system and surface water management system.

## 5.4 SLOPE STABILITY

A prior slope stability analysis of the eastern portion of the Airport Landfill was performed by Weston Engineers (Weston 2005). The analysis stated that the eastern slope was stable. Subsequent engineering resulted in removal of some of the waste in the eastern portion of the landfill and relocated elsewhere within the Landfill. Reinforced retaining walls (concrete and secured rock) were installed to provide additional stability of the eastern perimeter of the Landfill.

The Weston (2005) analysis also stated that the northern slope of the Landfill was stable based on the 2004 permit application for construction of the landfill cover system. The original analysis was not located by the authors of this report. Consequently, a recent evaluation of the slope was performed by CTI & associates. This analysis stated that the northern slope is stable and poses no issues to the final cover system or Landfill. The evaluation is contained in Appendix B.

## 5.5 INTERIM COVER SOIL INVESTIGATION

An interim soil cover was placed over the landfill. The date of interim cover placement and depth of soil is not known. A site visit in 2002 by Dwyer Engineering revealed a quality stand of native vegetation on the landfill cover surface as well as evidence of significant differential settlement (Figure 16).

*Figure 16. Airport Landfill, February 2002*

Available cover soil is not abundant in the Los Alamos area. Consequently, an investigation to determine how much interim cover soil may be available for incorporation into the replacement ET Cover and the quality of that soil will be performed prior to the final design. Geoprobing will be performed on a grid (Figure 17) to determine the depth and quality of interim cover across the Landfill. The subsurface soil investigation field work will consist of performing a total of seventy (70) borings within the footprint of the paved area. The soil borings will be spaced on an approximately 60-feet grid (Figure 17). All locations indicated on Figure 17 will include drilling test borings and obtaining core samples (3-inch diameter) of the subsurface materials to determine the volume of soil. The investigation will include an engineering analysis and development of recommendations for design and construction of the proposed ET cover. Dependent on the volume of quality available soil identified in the investigation, the physical properties and hydraulic characteristics of the soil will be determined in a geotechnical laboratory.

Fifty bore holes (SB-21 to SB-70) will be drilled through the MatCon paved area to determine the soil profile below the pavement (MatCon and base coarse) and above the buried waste. Drilling at these locations will be terminated once the bottom of interim cover soil/fill or top of waste is identified. On this basis, the total drilling at these bore holes was estimated to be between two to ten-feet below the existing ground surface. Additionally, twenty bore holes (SB-1 to SB–20) will be drilled to a depth to identity the bottom of the waste in the western end (refer to Section 5.7).

The conceptual method to be used is the direct push drilling method (i.e. Geoprobe). The direct push method will provide a continuous soil samples to the required depth. The

drilling company will have a coring device available on-site in the event the Geoprobe cannot bore through the pavement/gravel layer. The Field Engineer will classify soil, take pictures and place the soil in sample jars. The soil sample jars can either be stored locally or transported to a soil laboratory for future laboratory analysis, if deemed necessary. The laboratory analysis for the soil index properties and characteristics to design the ET cover will include the following tests:

- Grain Size Distribution (ASTM D1140, ASTM D422)
- Moisture Retention:
  - Hanging Column (ASTM D6836; Klute, A. 1986. Porosity. Chp.26, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI)
  - Pressure Plate Method (ASTM D6836; ASTM D2325)
  - Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity: (ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991)
- Hydraulic Conductivity (ASTM D5084 or ASTM D2434)
- Standard Compaction Proctor (ASTM D698)

Prior to drilling, New Mexico One Call system, Inc. (1-800-321-ALERT) will be contacted to locate the existing underground utility lines outside the property line. A utility locator company may also be contacted to mark the passive gas vent pipes within the property, prior to drilling. Federal Aviation Administration (FAA) formal notification will be given prior to these field activities.

Since most of the boreholes will have direct contact with the solid waste, all field personnel along with the selected drilling service provider will all be 40 hour Hazwoper certified. Safety equipment such as PID, FID, landfill gas meter, and CO meters etc. will be readily available to measure the gas levels. All the equipment including tools and samples will be deconed prior to leaving the site in order to avoid the potential for spreading of contamination, if any.

Each borehole will be backfilled with auger cuttings and the paved area will be patched with a cold asphalt patch upon completion of the boring. Borings will be performed at the locations presented in the Boring Location Plan (Figure 17). The total drilling is not expected to exceed 700 lineal feet.

The results of the investigation together with evaluations and recommendations will be presented in a report including, but not limited to, the following items:

1. General subsurface conditions at the boring locations.
2. Soil profile and soil volume in graphical representation and detailed calculations.
3. Suitability of on-site soils for reuse with an ET cover.
4. Boring Location Plan.
5. Soil boring logs.
6. Summary of laboratory test data (if conducted)

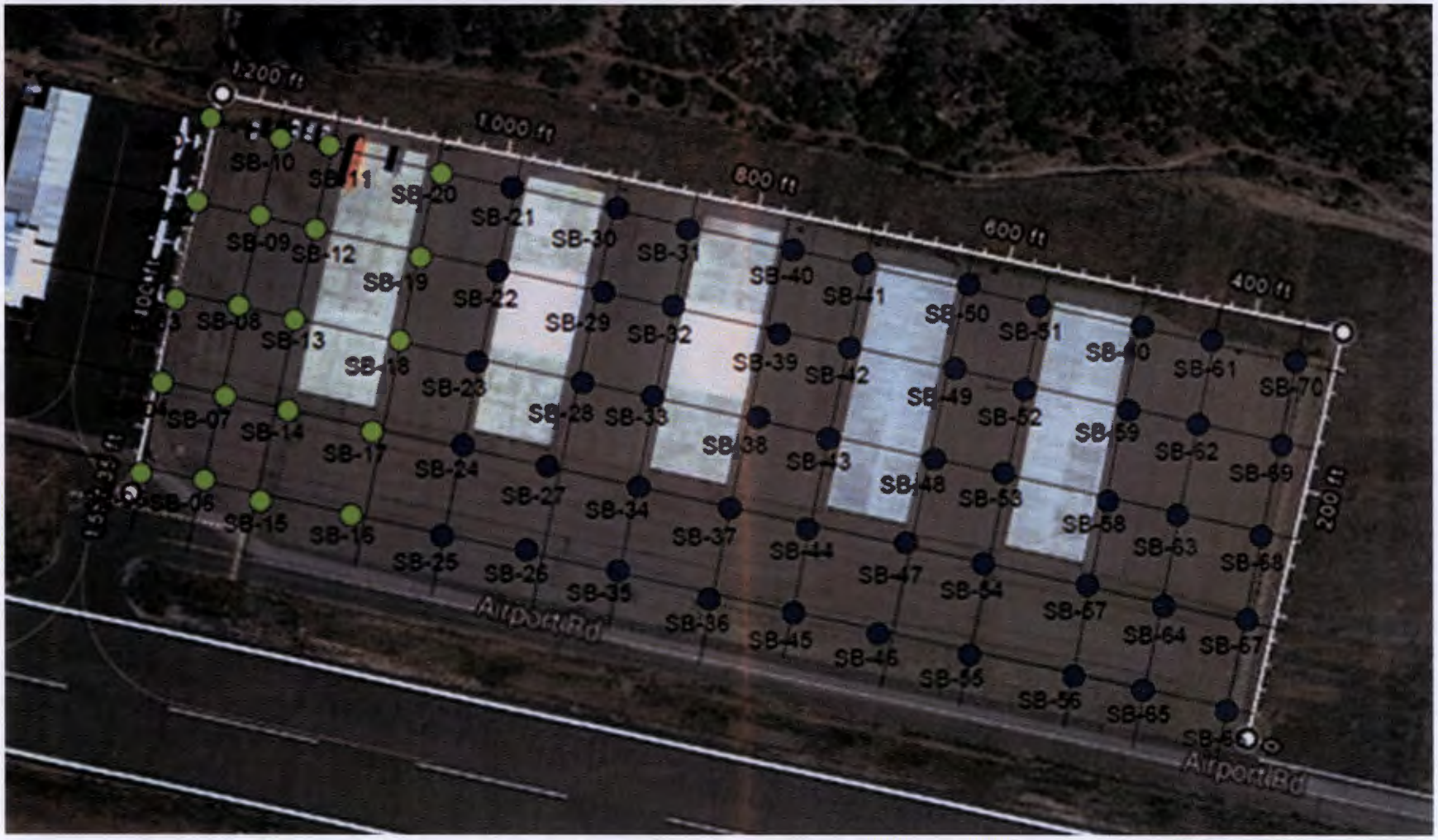



*Figure 17. Preliminary Geoprobe Locations (Blue Denotes Depth to Top of Waste, Green Denotes Depth to Bottom of Waste)*

## 5.6 SHALLOW WASTE INVESTIGATION

Twenty (20) bore holes (SB-1 to SB–20 – Figure 17) will be drilled through the waste in the western end as identified in the shaded area in Figure 18. These boreholes will be drilled to the bottom of the waste to evaluate the waste depth. Based on the depth of waste contour in Figure 4, it is estimated the maximum drilling depth at these borehole locations will be approximately ten-feet below the existing ground surface. The remaining fifty (50) boreholes (SB-21 to SB-70) will be drilled at various locations across the MatCon paved area to determine the soil profile below the pavement (MatCon and gravel layer) and above the buried waste (refer to section 5.5).

Minimum growth requirements for the airport hangar facilities deemed necessary as determined through the ongoing negotiations between the DOE and County of Los Alamos may be constructed above the western area of the landfill (Figure 18). This area has been estimated to have minimal waste deposited within it. This is reinforced by the fact that there have been no measurements of methane from the vent riser in this area (PS-01). The geoprobing effort will be expanded to clarify the extent of waste in this area. This will provide confidence and flexibility in the final cover design to potentially include foundation pads for future airplane hangars in this area.

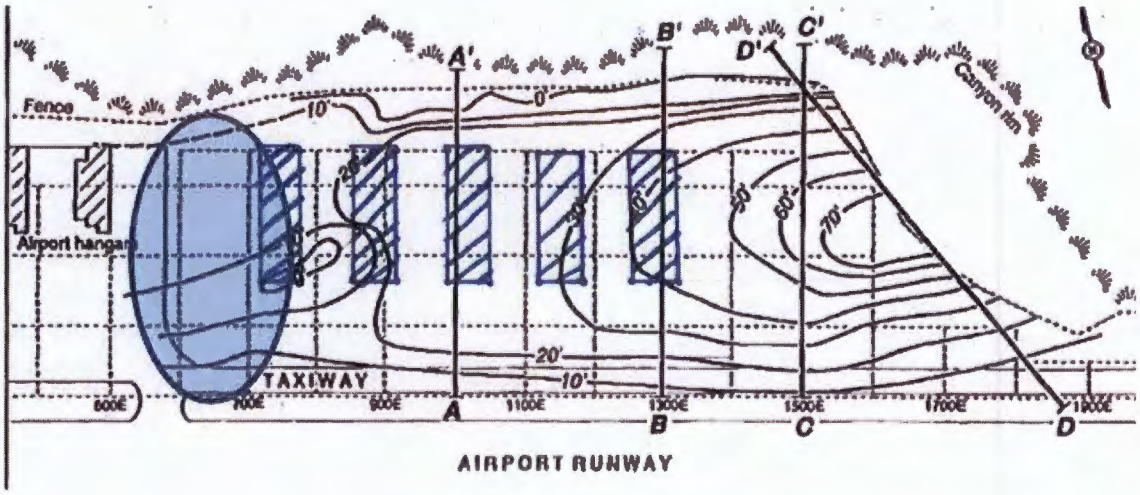



*Figure 18. Location of Shallow Waste*

## 5.7 VOC SAMPLING

During the soil sampling described in sections 5.5 and 5.6, Volatile Organic Compounds (VOC) will be sampled for in key geoprobe locations. Specifically, soil cores from locations SB-20, SB-11, SB-19, SB-12 (Figure 17) near PS-02 (methane riser vent #2 – Figure 8) and SB-50 and SB-51 (Figure 17) near PS-05 (methane riser vent #5 – Figure 8) will be sampled for VOCs. The PS-02 and PS-05 have experienced the highest methane concentrations measured to date (Table 1).

One sample will be collected from each of the boring locations SB-11, 12, 19, 20, 50 and 51 at the interval that coincides with a strata change, staining or unusual soil condition. The collected soils will be screened visually, olfactory and with a photoionization detector (PID). PID readings will be recorded on the soil boring logs. CTI will submit one soil sample from each boring (interval exhibiting highest PID value or notable soil characteristic) for up to six (6) total soil samples for potential laboratory analysis. The selected soil samples will be

placed on ice, submitted to the environmental laboratory under Chain-of-Custody (COC) protocols and analyzed for volatile organic compounds (VOCs) in soil per United States Environmental Protection Agency (USEPA) Method 5035/8260."

# 6.0 APPLICABLE REGULATIONS

On April 1, 2003, NMED granted conditional approval of a VCM Plan for the main landfill and the debris disposal area designated potential release sites (PRSs) 73-001(a)-99 and 73-001(b)-99, respectively. Conditions of this approval were 1) the remedy must be equivalent to RCRA Subtitle C requirements, 2) the proposed engineered alternative cover (cap) must perform equivalent to or better than a standard Subtitle C prescriptive cover outlined in 40 CFR 264 Subpart N, incorporated by 20.4.1.500 NMAC, and 3) the alternative cover must function efficiently and in accordance with the design parameters for the duration of the 30-year post closure care period (DOE/EA-1515).

Consistent with the prior agreement, the DOE will follow 40 CFR 264 closure standards outlined in Subparts G and N, as adopted by the State of New Mexico in NMAC Title 20, Chapter 4 (20.4.1.500) in the design and construction of the proposed replacement cover system. The DOE plans to submit an alternative cover design in compliance with NMAC 20.9.6.9.A (2):

> (2) The secretary may permit an alternative final cover design that includes:
>
> (a) an infiltration layer that achieves an equivalent reduction in infiltration as specified in Subparagraph (a) or (b) of Paragraph (1) of this subsection, as applicable; and
>
> (b) an erosion layer that provides equivalent protection from wind and water erosion as the erosion layer specified in Subparagraph (c) of Paragraph (1) of this subsection;
>
> (c) for landfills that stopped accepting waste prior to the effective date of this part, finished grades different from those specified in Subparagraph (e) of Paragraph (1) of this subsection, provided a demonstration is made that the alternate grades will prevent erosion and will provide equivalent reduction in infiltration; and
>
> (d) for landfills accepting waste after the effective date of this part and lateral expansions permitted after the effective date of this part, finished grades different than those specified in Subparagraph (e) of Paragraph (1) of this subsection, provided no grade is greater than 33 percent and a demonstration is made in the closure plan or permit or modification application that the alternate grades will prevent erosion and will provide equivalent reduction in infiltration.

Additionally, because the Landfill is within the general operating area of an airport, applicable FAA regulations will also be complied with. Specifically, 14 CFR 77 (SAFE, EFFICIENT USE, AND PRESERVATION OF THE NAVIGABLE AIRSPACE) including notification requirements and obstruction identification regulations are applicable.

## 7.0 PROPOSED COVER SYSTEM DESIGN

In the Los Alamos, New Mexico area, the climate's demand for water referred to as potential evapotranspiration (PET) is more than three times greater than the actual supply of water (precipitation) (Figure 3). Consequently "store and release" type covers that take advantage of large variances between the demand for water and actual supply of that water such as an ET Covers is well suited for this climate.

An ET Cover (Figure 19) consists of a single, vegetated soil layer constructed to represent an optimum mix of soil texture, soil thickness, and vegetation cover (Dwyer et al 2006). The ET Cover is a monolithic soil layer that has adequate soil water storage capacity to retain any infiltrated water until it can be removed via ET (Figure 1). ET Covers have been deployed throughout the country in arid and semi-arid climates. The EPA maintains a fact sheet on ET Covers available on the internet (http://www.clu-n.org/download/remed/epa542f03015.pdf#search='evapotranspiration%20epa%20fact%20sheet).

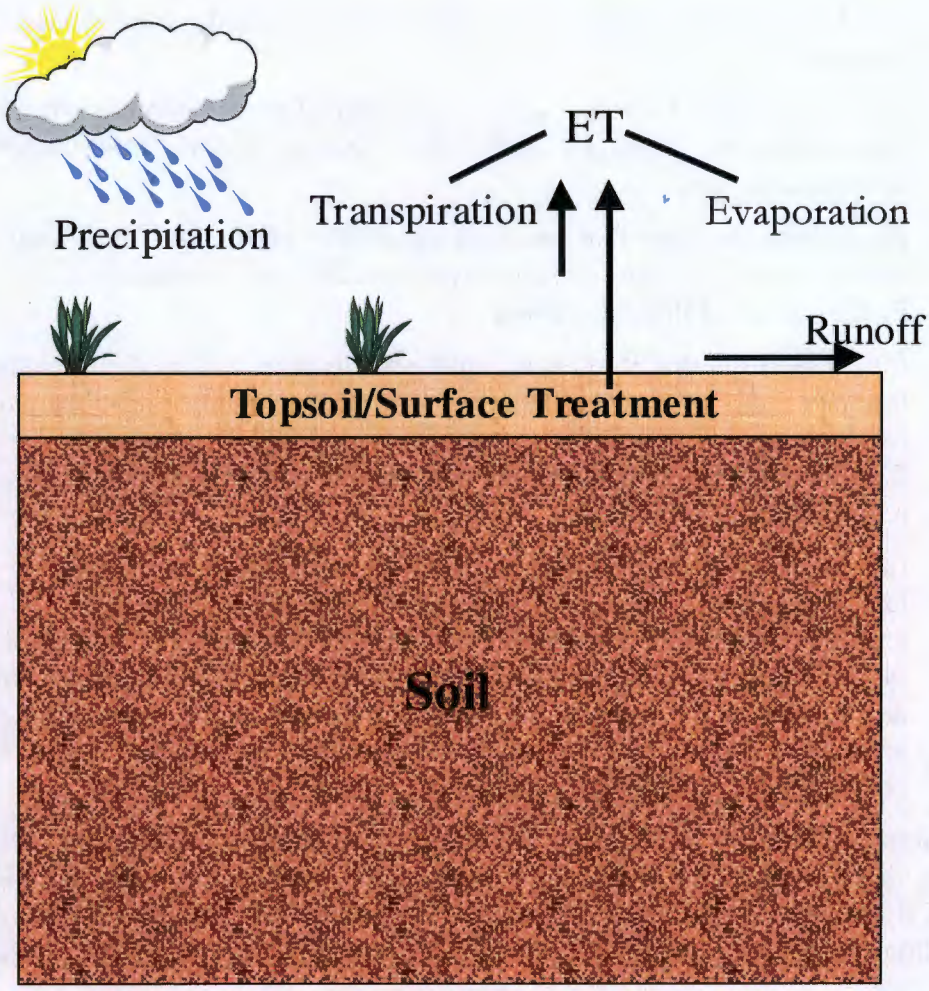



*Figure 19. Typical ET Cover Profile*

The ET Cover is based on the "store and release" concept whereby the cover soil is designed to act like a sponge. Any infiltrated water is held in this "sponge" until it can be released via ET. ET is defined as the combination of evaporation from the soil surface and transpiration through vegetation. Previous research has shown that a simple soil cover can be very effective at minimizing percolation and erosion (Khire 1995, Scanlon et al. 2002, Dwyer 2003, Benson et al, 2005, Dwyer et al 2006).

ET provides the mechanism to remove stored water from the cover soil layer. Water can move upward in response to matric potential gradients induced from evaporation drying the upper portion of the cover soil layer. Matric potential gradients can be many orders of magnitude greater than the gradient component due to gravity. Evaporation from the surface will decrease the water content and increase the matric potential of the soil, resulting in an upward matric potential gradient and inducing upward flow.

Plant transpiration also relies upon matric potential gradients to remove water from the cover soil layer. Figure 20 shows the large matric potential difference between the soil and atmosphere. In dry environments, the total potential difference between soil moisture and atmospheric humidity can be up to 1000 atmospheres (bars) (Hillel 1998). The largest portion of this overall potential difference occurs between the leaves and the atmosphere. The larger the soil-plant-atmosphere potential gradient, the more effective an ET Cover System can be. For this reason, well-vegetated cover systems are very effective in regions where the demand for water is greater than the supply of water because these regions are characterized by large potential evapotranspiration compared to precipitation.

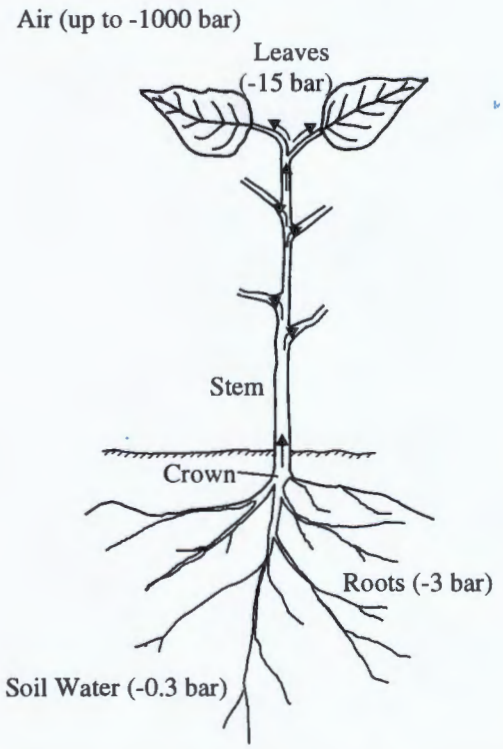



*Figure 20. Soil-Plant-Atmosphere Water Potential Variation (Hillel 1998)*

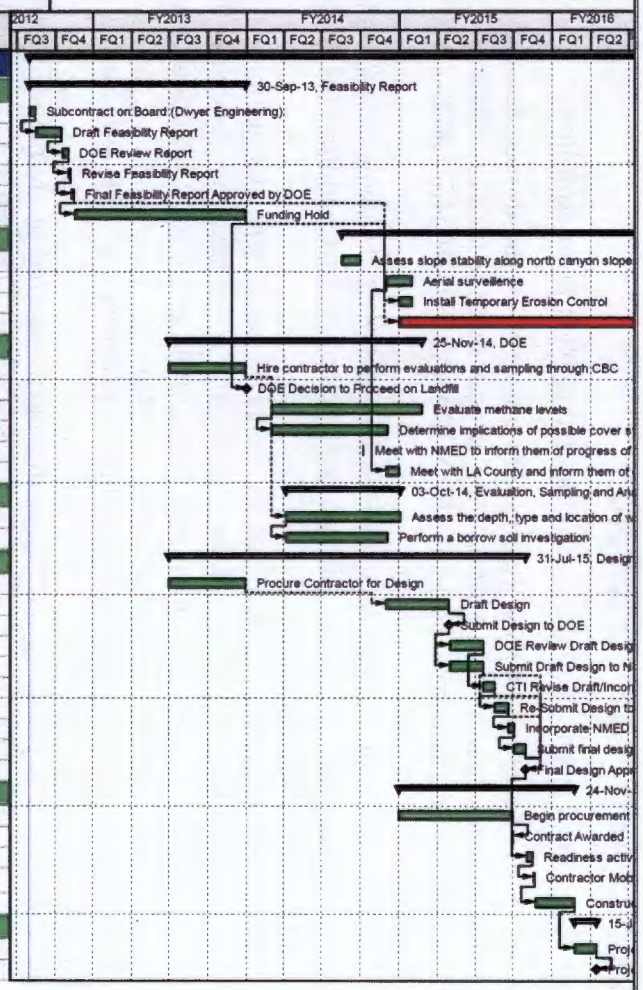
The surface of the ET Cover will be designed to resist soil loss due to erosion as well as formation of rills and gullies. A rock/soil admixture referred to as a 'desert pavement' (Dwyer et al 2006 and EPA 2012) will be incorporated for this purpose.

# 8.0 SCHEDULE

The estimated schedule is presented as a Gantt chart in Figure 21 and Appendix D. Many of the schedule tasks are dependent upon completion of previous tasks and the successful completion of each task will require securing and coordinating resources, including funding. Additionally, the ability to complete field activities as scheduled is dependent upon favorable weather conditions and securing resources in a timely fashion. Every effort will be made to follow this schedule, but given the uncertainty of some of the conditions required to complete each task, adjustments will likely be required to the schedule. Any significant changes to the schedule will be discussed with NMED.

DD 01-May-12 | Airport Landfill | 16-Sep-14 11:59

| Activity ID | Activity Name | Original Duration | Remaining Duration | Start | Finish |
|---|---|---|---|---|---|
| **Airport Landfill** | | 1,334 | 1,334 | 01-May-12 | 29-Sep-17 |
| **Feasibility Report** | | 551 | 551 | 01-May-12 | 30-Sep-13 |
| A1000 | Subcontract on Board (Dwyer Engineering) | 11 | 11 | 01-May-12 | 15-May-12 |
| A1010 | Draft Feasibility Report | 42 | 42 | 16-May-12 | 16-Jul-12 |
| A1020 | DOE Review Report | 11 | 11 | 17-Jul-12 | 31-Jul-12 |
| A1030 | Revise Feasibility Report | 5 | 5 | 01-Aug-12 | 07-Aug-12 |
| A1040 | Final Feasibility Report Approved by DOE | 6 | 6 | 08-Aug-12 | 15-Aug-12 |
| A1050 | Funding Hold | 276 | 276 | 16-Aug-12 | 30-Sep-13 |
| **CTI** | | 231 | 231 | 19-May-14 | 29-Sep-17 |
| A1230 | Assess slope stability along north canyon slope | 30 | 30 | 19-May-14* | 30-Jun-14 |
| A1210 | Aerial surveillence | 43 | 43 | 02-Sep-14* | 31-Oct-14 |
| A1200 | Install Temporary Erosion Control | 22 | 22 | 01-Oct-14* | 31-Oct-14 |
| A1300 | Provide maintenance support | 737 | 737 | 01-Oct-14* | 29-Sep-17 |
| **DOE** | | 412 | 412 | 25-Apr-13 | 25-Nov-14 |
| A1060 | Hire contractor to perform evaluations and sampling through CBC | 128 | 128 | 01-Apr-13* | 30-Sep-13 |
| A1070 | DOE Decision to Proceed on Landfill | 0 | 0 | 01-Oct-13 | |
| A1220 | Evaluate methane levels | 242 | 242 | 02-Dec-13* | 25-Nov-14 |
| A1260 | Determine implications of possible cover systems | 185 | 185 | 02-Dec-13 | 03-Sep-14 |
| A1330 | Meet with NMED to inform them of progress of landfill | 1 | 1 | 08-Jul-14* | 08-Jul-14 |
| A1250 | Meet with LA County and inform them of direction of landfill | 22 | 22 | 02-Sep-14 | 01-Oct-14 |
| **Evaluation, Sampling and Analysis Prior to Design** | | 196 | 196 | 06-Jan-14 | 03-Oct-14 |
| A1100 | Assess the depth, type and location of waste and consolidating material within the footprint of the landfill | 190 | 190 | 06-Jan-14* | 03-Oct-14 |
| A1270 | Perform a borrow soil investigation | 168 | 168 | 06-Jan-14 | 03-Sep-14 |
| **Design (CTI)** | | 577 | 577 | 01-Apr-13 | 31-Jul-15 |
| A1080 | Procure Contractor for Design | 128 | 128 | 01-Apr-13* | 30-Sep-13 |
| A1110 | Draft Design | 97 | 97 | 02-Sep-14* | 30-Jan-15 |
| A1120 | Submit Design to DOE | 0 | 0 | | 30-Jan-15 |
| A1130 | DOE Review Draft Design | 55 | 55 | 02-Feb-15 | 20-Apr-15 |
| A1280 | Submit Draft Design to NMED | 55 | 55 | 02-Feb-15 | 20-Apr-15 |
| A1140 | CTI Revise Draft/Incorporate Comments | 20 | 20 | 21-Apr-15 | 18-May-15 |
| A1290 | Re-Submit Design to NMED for Concurrence | 22 | 22 | 19-May-15 | 18-Jun-15 |
| A1340 | Incorporate NMED Comments | 10 | 10 | 18-Jun-15 | 02-Jul-15 |
| A1350 | Submit final design to NMED for final concurrence | 20 | 20 | 02-Jul-15 | 31-Jul-15 |
| A1150 | Final Design Approved | 0 | 0 | | 31-Jul-15 |
| **Construction** | | 252 | 252 | 01-Oct-14 | 24-Nov-15 |
| A1310 | Begin procurement for Construction | 181 | 181 | 01-Oct-14* | 30-Jun-15 |
| A1320 | Contract Awarded | 1 | 1 | 30-Jun-15 | 30-Jun-15 |
| A1090 | Readiness activities for mobilization | 10 | 10 | 03-Aug-15 | 14-Aug-15 |
| A1160 | Contractor Mobilize | 5 | 5 | 17-Aug-15 | 21-Aug-15 |
| A1170 | Construction | 64 | 64 | 24-Aug-15 | 24-Nov-15 |
| **Project Closeout** | | 30 | 30 | 25-Nov-15 | 15-Jan-16 |
| A1180 | Project Closeout | 30 | 30 | 25-Nov-15 | 15-Jan-16 |
| A1190 | Project Complete | 0 | 0 | | 15-Jan-16 |




Remaining Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | Summary

Page 1 of 1

TASK filter: All Activities

(c) Primavera Systems, Inc

*Figure 21. Estimated Project Schedule (refer to Appendix D)*

# 9.0 SUMMARY AND PATH FORWARD

The objectives of the Pre-Design Work Plan as submitted to NMED are as follows:

1. Reply to NMED's reply to DOE's "Request for a waiver for the implementation of active gas collection using blowers at the airport landfill TA-73, SWMU-73-001(A), Los Alamos National laboratory, EPA ID#NM0890010515, HWB-LANL-13-070" dated July 25, 2014.
2. Notify NMED that DOE's response to the NMED reply stated in objective #1 is to replace the existing cover system with a cover better suited to address the long-term issues identified at the site.
3. Request that active gas collection not be installed as it will not address the identified issues at the landfill, but rather replace the cover system. Instead DOE requests that passive venting continue on the current monitoring schedule until construction begins for the replacement cover system.
4. Provide a summary of maintenance and repairs performed on the site since the installation of the existing asphalt cover system.
5. Provide a summary of pre-design activities that have occurred or are planned to be completed prior to the design of the final cover system. The final cover system design will be submitted to NMED for approval in the Design Work Plan for the Los Alamos Airport Landfill.
6. Provide a schedule of planned activities.
7. Provide a summary of findings and suggested path forward for final closure of the Airport Landfill.

The pre-design activities not completed to date will be completed prior to the final design of the Airport Landfill cover system. A Design Work Plan will be submitted to NMED for approval prior to commencement of cover construction to include the following:

- Design drawings;
- Design specifications;
- Construction quality assurance plan;
- Maintenance and operations plan to include a schedule of post-closure monitoring;
- Summary of all investigations, testing, and sampling performed; and
- Schedule of construction activities.

## 10.0 REFERENCES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# APPENDIX