EMID-700521

DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

JUL 30 2019

Mr. John Kieling
Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Dear Mr. Kieling:

Subject: Submittal of the 2018/2019 Annual Long-Term Monitoring Status Report (July 2018 through June 2019) for Los Alamos County Airport Landfill Cover System Replacement, Solid Waste Management Units 73-001(a,d), Technical Area 73

Enclosed please find two hard copies and electronic files of the 2018/2019 Annual Long-Term Monitoring Status Report (July 2018 through June 2019) for the Los Alamos County Airport Landfill Cover System Replacement, Solid Waste Management Units 73-100(a,d), Technical Area 73 (LTSR).

If you have any questions, please contact Cheryl Rodriguez at (505) 665-5330 or (cheryl.rodriguez@em.doe.gov).

Sincerely,

Arturo Q. Duran
Compliance and Permitting Manager
Environmental Management
Los Alamos Field Office

Enclosures:
Two hard copies with electronic files – 2018/2019 Annual Long-Term Monitoring Status Report (July 2018 through June 2019) for the Los Alamos County Airport Landfill Replacement, Solid Waste Management Units 73-100(a,d), Technical Area 73

cc (letter w/enclosure):
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EM-LA-30AD-00479

2018/2019 ANNUAL LONG-TERM MONITORING STATUS REPORT (JULY 2018 THROUGH JUNE 2019)

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER SYSTEM REPLACEMENT
SOLID WASTE MANAGEMENT UNITS 73-001(a,d)
TECHNICAL AREA 73

Report Date: *July 25, 2019*

prepared for:
Department of Energy
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, NM 87544

prepared by:
Dwyer Engineering LLC under contract to The Lakeworth Group
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Revision 0

2018/2019 ANNUAL LONG-TERM MONITORING STATUS REPORT (JULY 2018 THROUGH JUNE 2019)

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

Responsible Inspection Engineer:

Stephen F. Dwyer	Stephen F. Dwyer	Principal Engineer	Dwyer Engineering LLC	July 25, 2019
Printed Name	Signature	Title	Organization	Date:

Responsible Federal Project Manager:

Cheryl Rodriguez	Cheryl Rodriguez	Program Manager	Office of Project Completion Delivery	07/25/2019
Printed Name	Signature	Title	Organization	Date:

Responsible DOE Field Office Manager:

Arturo Q. Duran		Compliance and Permitting Manager	Office of Quality and Regulatory Compliance	7/29/19
Printed Name	Signature	Title	Organization	Date:

EXECUTIVE SUMMARY

This report summarizes the third annual (set of four engineering inspections performed from July 2018 to June 2019) monitoring of the Los Alamos County Airport Landfill Cover Replacement and associated facilities. The inspections and subsequent reports were performed in accordance with the approved Long-Term Monitoring Plan [Dwyer 2017, NMED 2017] by Dwyer Engineering, LLC (Dwyer). The remedy tasks were completed as described in the applicable Remedy Completion Reports [Dwyer 2016, Remedy Completion Report *replacement pages* 2017, NMED Approval Letter 2016, and North Wind and Weston 2007].

The remedy elements inspected (as described in Remedy Completion Report [Dwyer 2016]), include the final cover system referred to as an Evapotranspiration (ET) Cover inclusive of water balance and methane monitoring, surface water control features, erosion controls, and site access. Construction of these remedy tasks began on October 7, 2015 and were successfully installed and completed in accordance with the New Mexico Environment Department (NMED) approved 2015 Work Plan, Los Alamos County Airport Landfill Cover Replacement [Dwyer 2015, NMED 2015] by July 1, 2016. Settlement surveys began in October 2017. Prior remedy elements completed by North Wind and Weston (2007), including retaining structures along the eastern perimeter of the airport landfill and the side slopes of the previously completed landfill cover, were also inspected and included in the checklists provided in Attachment A.

This monitoring report includes a summary of the inspections and any findings. The inspection check lists for each respective quarterly inspection are included in Attachment A. The water balance monitoring of the ET Cover includes data collected continually since its installation (Attachment B). Methane monitoring recorded zero percent of the lower explosive limit (LEL) during each of the four inspections (Attachment C). Site inspections performed after significant precipitation events are included in Attachment D. Differential settlement of the cover system is monitored in the form of quarterly elevation surveys (Attachment E). Settlement within the landfill has slowed considerably whereby there is no practical change during the past couple of surveys.

Vegetation has uniformly emerged across the entire surface of the landfill. The growth of the vegetation is good. The emerging grasses vary from a couple of inches high to about 2.5-ft (prior to mowing). Existing subsurface moisture appears to be the dominant variable related to vegetation height at this time; this uneven height should diminish as the native vegetation matures. The ET Cover is periodically mowed by the Los Alamos County in an attempt to limit the height of vegetation and discourage burrowing animals.

Water balance monitoring of the ET Cover revealed that with each precipitation event, rainfall infiltrated to varied depths within the cover system (few inches to a couple of feet), but quickly dried thereafter. Matric potential probes (soil suction) were replaced on May 19, 2017 with the most advanced sensors available from Decagon Inc.

Settlement survey monuments were installed on August 31, 2017 to measure and quantify any differential settlement. There was some differential settlement initially as expected but not enough to create ponding or warrant maintenance at this time. Recent surveys (Attachment E) have showed that settlement has considerably slowed or stopped.

Surface water control features appear to be working as designed with no degradation noted to date. Temporary erosion controls including the erosion control blankets around the perimeter of

the ET Cover have degraded past their usefulness but performed as expected during initial establishment of vegetation. Permanent erosion control features including the rock check dams and riprap lined side slope east of the landfill are all in good condition and functioning as designed. There did not appear to be any degradation of the retaining features along the eastern perimeter of the landfill.

The Debris Disposal Area (DDA) cover system appears to be stable at this time with a maturing vegetation cover and no signs of significant degradation or settlement.

The cover systems are currently in good condition and working as designed. There was some minor rill erosion noted at the base of the eastern side slope of the landfill. It is recommended that measures be taken to limit the continuance of erosion in this localized area (Attachment A – Inspection Reports 11 and 12). Measures taken will be reported on in the next Annual Report due to NMED July 30, 2020.

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Acronyms

BGS	below ground surface
DDA	Debris Disposal Area
DOE	Department of Energy
EM-LA	Environmental Management, Los Alamos Field Office
ET	Evapotranspiration
FAA	Federal Aviation Administration
LAC	Los Alamos County
LEL	Lower Explosive Limit
LTMP	Long-Term Monitoring Plan
NMED	New Mexico Environment Department
RCRA	Resource Conservation and Recovery Act
SWMU	Solid Waste Management Unit
SWPPP	Storm Water Pollution Prevention Plan

1.0 INTRODUCTION

The Los Alamos County Airport Landfill Cover Replacement Project [SWMUs 73-001(a) and 73-001(d)] site elements were inspected and monitored in compliance with the approved Long-Term Monitoring Plan for Los Alamos County Landfill Cover Replacement Solid Waste Management Units 73-001(a,d) Technical Area 73 (Dwyer 2017, NMED Approval 2017). The Remedy Completion Report (Dwyer 2016) was approved with modifications on December 22, 2016 (NMED 2016) by the New Mexico Environment Department (NMED). The Long-Term Monitoring Plan was approved on March 30, 2017 (NMED 2017). Generally, landfills regulated under the Resource Conservation and Resource Act (RCRA) are subject to a 30-year post closure monitoring period. However, under §§ 265.117 (Post-closure care and use of property), the time period may be reduced or increased dependent on findings, the integrity of the closure and agreement by applicable officials and regulators. Time period changes are discussed in Section 1.2 of this report.

The Airport Landfill project consisted of the design and construction of a replacement cover for the asphaltic cover previously installed in 2007 (North Wind and Weston 2007). The new cover system is a vegetated soil cover referred to as an Evapotranspiration (ET) Cover (Dwyer Engineering 2015). Details of the landfill design are found in the construction drawings, specifications, and calculations included in the Remedy Completion Report (Dwyer 2017).

A project file containing records of all inspections, monitoring, and maintenance performed is maintained by Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA). An annual Long-Term Monitoring Report will be prepared and provided to the NMED each year. This document is the third annual report satisfying this requirement.

The name, address, and telephone number for the individual to contact during the post-closure period is as follows:

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Phone: (505) 665-5330
Email: cheryl.rodriguez@em.doe.gov

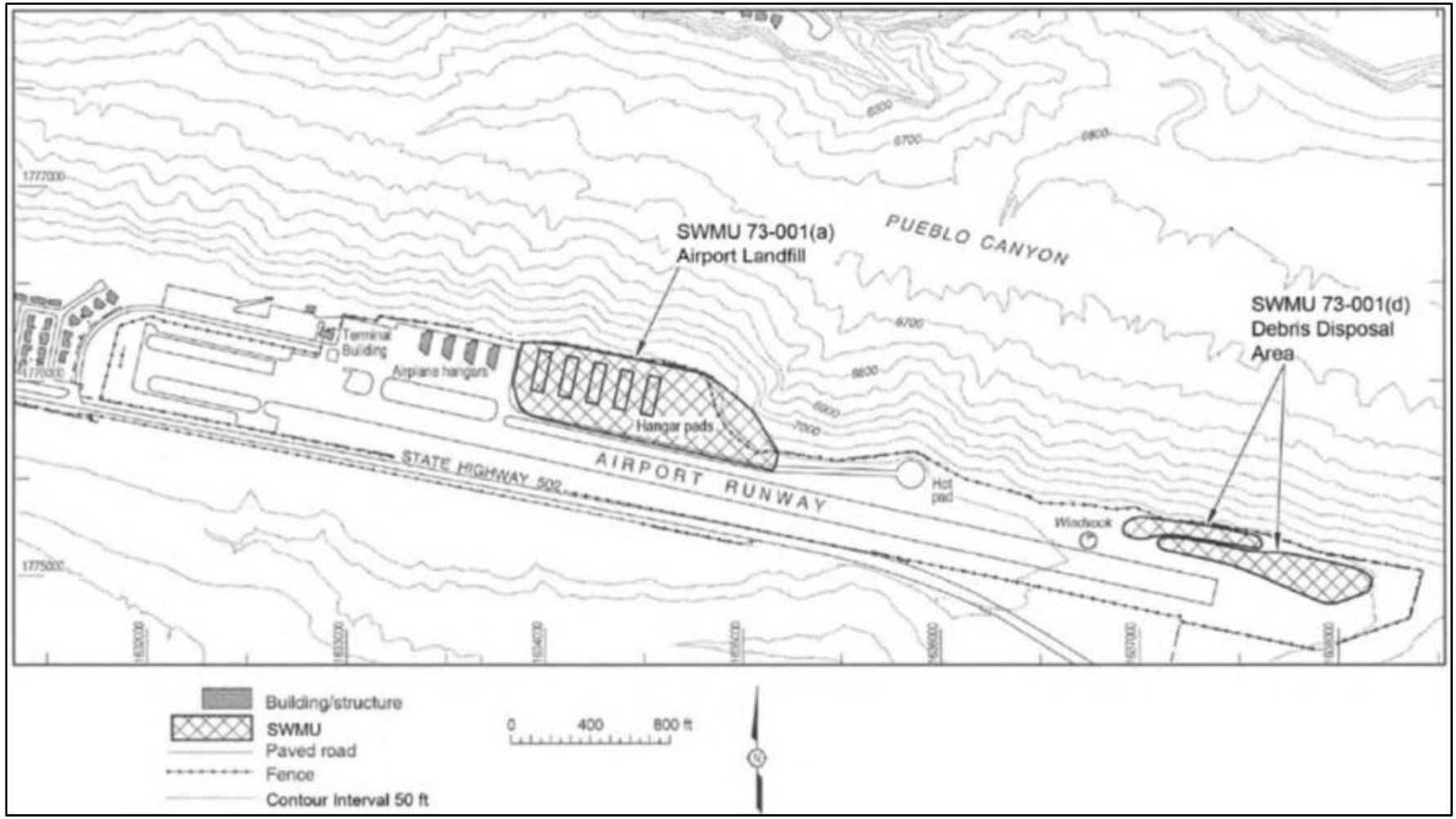
1.1 Background

The Los Alamos County (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. From 1984 to 1986, wastes were excavated from the western portion of the LAC airport landfill [SWMU 73-001(a), Figure 1] and placed in the debris disposal area (DDA) located east of the landfill [SWMU 73-001(d), Figure 1].

In late 2006 and early 2007, a landfill cover system composed of asphalt and concrete hangar pads allowing for expansion of the airport hangar facilities was installed at the airport landfill in compliance with an approved NMED Work Plan (North Wind 2004) for remediation of this

landfill [SWMU 73-001(a), Figure 1]. The final remedy design and completion activities for the landfill and the DDA [SWMU 73-001(d)] were provided in the Remedy Completion Report (North Wind and Weston 2007). Subsequent inspections of the landfill beginning in 2009 through 2012 identified significant problems with the site and the newly installed asphalt cover system [SWMU 73-001(a)] including differential settlement greater than 2-ft, elevated methane gas, surface cracking, ponding, poor surface drainage, and significant infiltration of water into the underlying waste through cracking in the asphalt cover. The elevated methane measurements at the landfill in 2011 reached 100% of the lower explosive limit (LEL).

The site was evaluated in 2012 (Dwyer 2012) where it was decided the site had severely degraded and required replacement. A Work Plan (Dwyer 2015) to replace the cover system was submitted to the New Mexico Environment Department (NMED) in July 2015 with 'Approval with Modifications' received on August 14, 2015 (NMED 2015). The remedy included removal of the prior placed asphaltic cover and concrete hangar pads, relocation of waste from the far western portion to the remaining footprint within the landfill, placement of a new concrete hangar pad over the western portion where the waste was relocated from, and closure of the landfill with a cover system referred to as an ET Cover. The replacement cover was successfully installed and completed in accordance with the NMED-approved Work Plan (NMED 2015) by July 1, 2016. Final design and completion activities are provided in the 2016 Remedy Completion Report (Dwyer 2016, NMED Approval 2016). Figure 2 shows the replacement cover and associated facilities, along with the remaining 2007 remedy elements. Long term monitoring began in October 2016 after completion of the replacement cover and is continuing under the NMED-approved 2017 Long-Term Monitoring Plan (LTMP) (Dwyer, 2017). This report satisfies the annual long-term reporting requirement specified in the LTMP.



Source: LANL 1998

Figure 1. Airport Landfill and Debris Disposal Area Locations

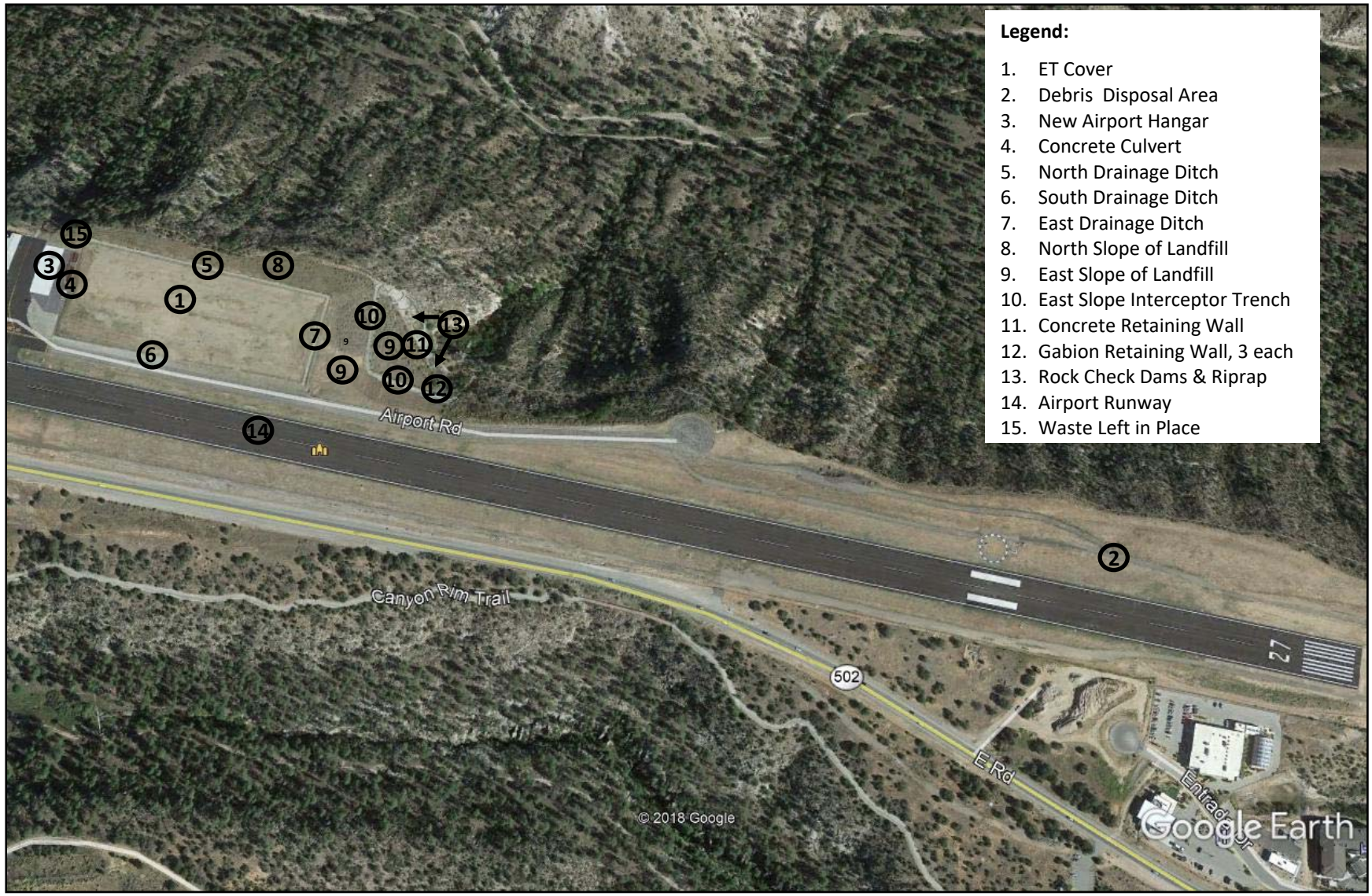


Figure 2. Los Alamos Airport Landfill and Debris Disposal Area Elements

1.2 Purpose

The Los Alamos County Airport Landfill Cover Replacement Project site elements (Figure 2) were inspected consistent with the Long-Term Monitoring Plan (Dwyer 2017, NMED Approval 2017). The purpose of the inspections is to identify any areas of the site closure that may require repair to restore the intended functionality of the closure. The landfill cover as well as erosion and sedimentation control measures are inspected quarterly to assess the general condition of the closure system and identify any maintenance or repair issues. Water balance and methane monitoring of the cover system are included in these quarterly inspections. In addition to quarterly inspections, additional site inspections are conducted following significant precipitation events that exceeds 1 inch in any given hour (the 100-year, 1-hour design storm event is 2.17in/hr.).

The approved LTMP specifies water balance monitoring and cover inspections shall be performed on a quarterly basis for the five-year monitoring period. Should the levels of methane recorded during the initial 2-year monitoring period be below 25% of the lower explosive limit (LEL), then the reported inspections shall be reduced to semi-annual for the next two years. All methane measurements have been 0% of LEL; therefore the monitoring of methane shall be reduced to semi-annual for the next annual reporting period. Finally, should the methane levels for this next year also be below 25% of the LEL, the fifth year reporting inspection will be annual. The NMED shall be provided the results quarterly for the first two years and then reporting periods consistent with the methane monitoring schedule as described above. The moisture measurements are scheduled to be discontinued after the completion of the five-year monitoring period.

An annual Long-Term Monitoring Report covers the annual period from July to June and shall be prepared and submitted to NMED by July 30 of the following year. The annual report shall include all inspection reports and all monitoring performed during that year along with information related to any maintenance and/or repairs performed (if any) and a summary describing the cover performance for the year.

Water balance monitoring is continuous with data downloaded from the data loggers during each quarterly inspection and reported in the respective quarterly inspection reports on the agreed upon schedule. There are two water balance monitoring locations (Figure 3). At each water balance monitoring location there are 5 moisture content probes and 5 matric potential (soil suction) probes buried at intervals between 12-inches below ground surface (BGS) and 3.5-ft BGS (Figure 4). The intent of the probes is to monitor moisture movement within the cover profile.

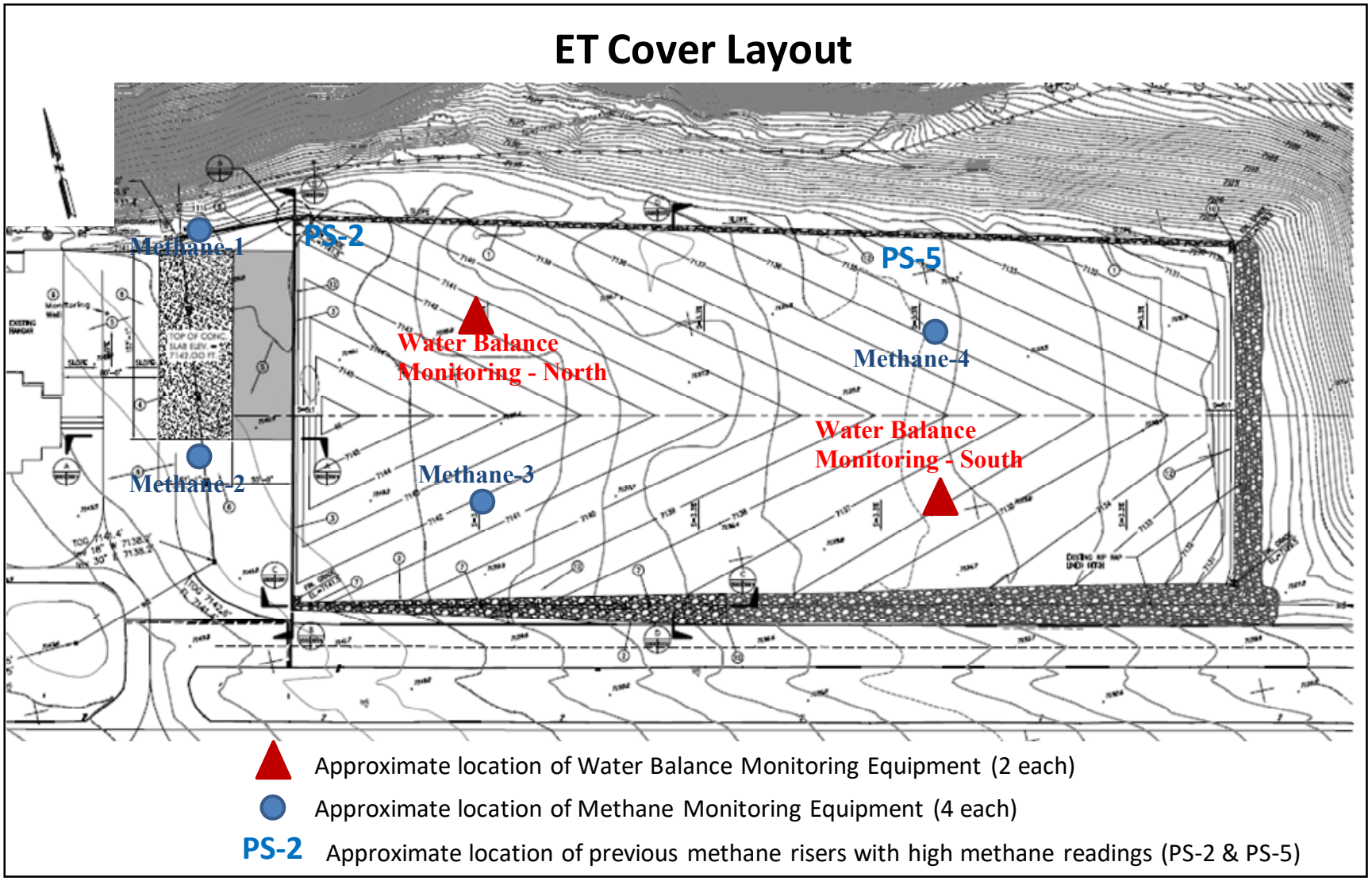


Figure 3. Instrumentation Locations

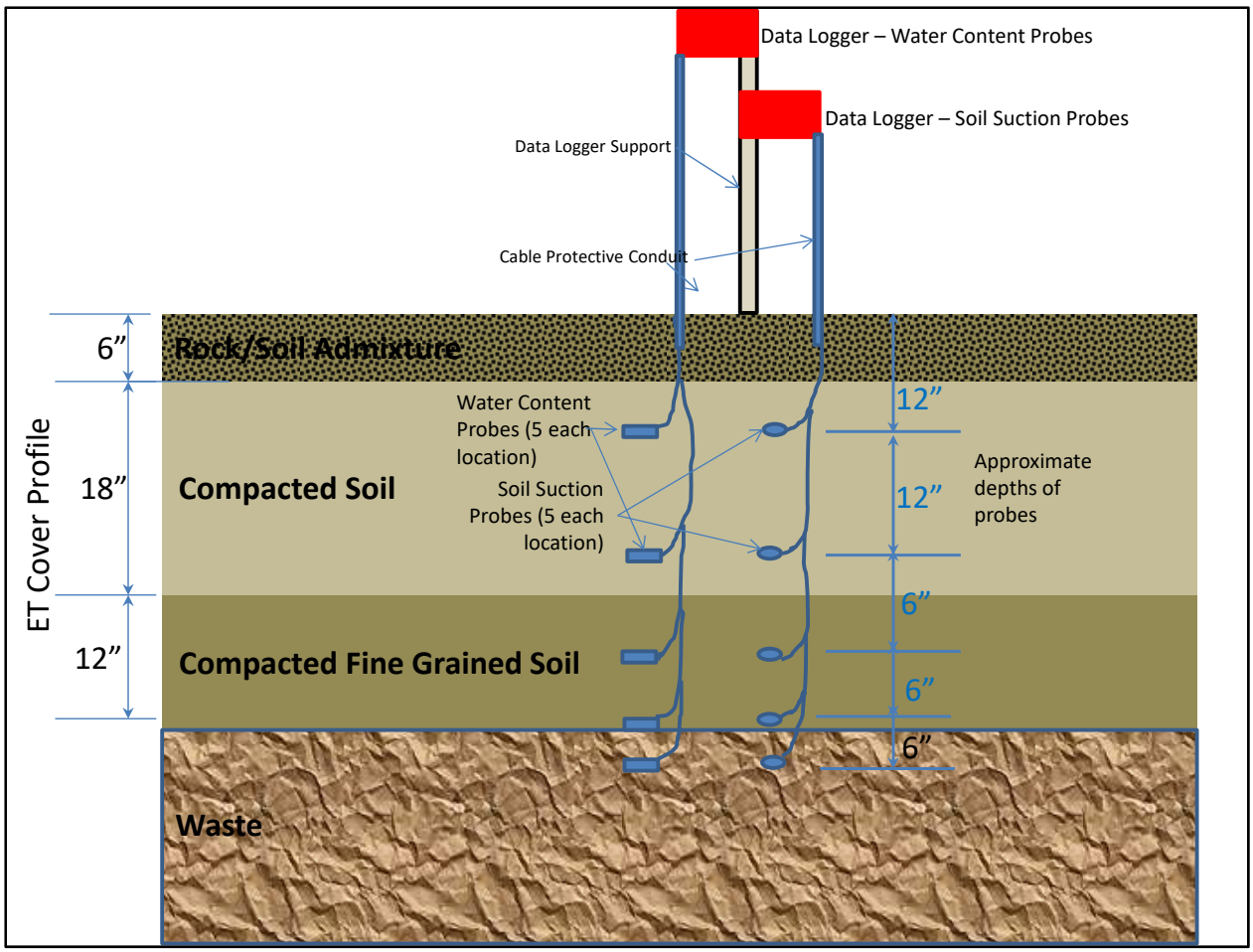


Figure 4. Water Balance Instrumentation

Methane is measured once at each monitoring location for each inspection at the time interval as described above. Refer to Figure 3 for the methane and water balance monitoring locations. Table 1 summarizes the inspections included in this annual report.

Table 1. Cover Inspections Performed

Monitoring Period	Inspection No.	Date
Year 3, Quarter 1 (Jul-Sep)	Inspection 9	October 1, 2018
Year 3, Quarter 2 (Oct-Dec)	Inspection 10	December 1, 2018
Year 3, Quarter 3 (Jan-Mar)	Inspection 11	March 20, 2019
Year 3, Quarter 4 (Apr-Jun)	Inspection 12	June 14, 2019
***Quarterly inspections generally performed in March, June, September and December of each year		

2.0 SCOPE OF ACTIVITIES

In accordance with the LTMP requirements, this report summarizes the inspection of the following elements of the Closure at the Airport Landfill:

- Evapotranspiration Cover System including water balance, methane, biointrusion and differential settlement monitoring;
- Storm water control system;
- Airport Fencing;
- Retaining walls;
- Erosion and Sedimentation Control Measures;
- Site access;
- Site after significant precipitation event inspections; and
- Debris Disposal Area Cover System

The results of the 2018/2019 monitoring and inspections are summarized in this report. The completed inspection checklists along with applicable photos are provided in Attachment A. A summary of the water balance monitoring performed to date is provided in Attachment B. Methane monitoring is provided in Attachment C. Reports after post-high intensity storm events (if any) are provided in Attachment D.

2.1 Evapotranspiration Cover and Debris Disposal Area Monitoring

The installed ET Cover system is inspected quarterly as described in Section 4.1 of the LTMP. The monitoring activities are intended to verify the continued acceptable performance and identity any problems. Additionally, the formerly closed debris disposal area (DDA) cover system is also monitored visually to identify any potential issues that may arise. Details of the DDA closure are summarized in the Remedy Completion Report (North Wind and Weston 2007). Refer to Figure 2 for the location of inspected elements.

3.0 SUMMARY OF PERFORMANCE MONITORING RESULTS

The following subsections describe the specific elements inspected.

3.1 Evapotranspiration Cover

The general integrity of the ET Cover system was inspected during each quarterly inspection. The top slope and side slopes of the landfill were examined for degradation of the cover system, such as erosion (as evidenced by rilling or gullying), quality and quantity of vegetation establishment, areas of subsidence, biointrusion, cracking, slope instability, and wet areas. The cover system was found to be in excellent condition with no signs of degradation. There was no erosion, differential settlement resulting in ponding, biointrusion, or other issues identified. There was some minor rill erosion noted at the base of the eastern side slope of the landfill (Attachment A – Inspections 11 and 12). It has been recommended to address this localized erosion to mitigate any subsequent erosion in the area. These repairs will be completed as soon as possible and reported on in the next annual report.

Vegetation in seeded areas including the cover system was inspected for success based on type of vegetation, approximate surface coverage based on visual observation and size of native vegetation seeded during the cover installation. Vegetation has uniformly emerged across the

entire landfill. The growth of the vegetation is good although there is some unevenness in size. Existing subsurface moisture appears to be the dominant variable related to vegetation height at this time; this unevenness should diminish with time. The emerging grasses vary from a couple of inches high to over 2.5-ft (prior to mowing). Grasses are taller in areas that were wetter, while the grass in the drier areas has relied predominantly on precipitation for its growth to date. Because parts of the landfill were very wet as a result of concentrated infiltration due to flaws with the prior cover system, this variance in vegetation height is expected to last until the vegetation matures and the landfill contents dry out. The vegetation was visually monitored for continued robustness and unintended stresses on it such as oxygen deprivation due to excessive landfill gas. No unusual plant distress was identified. Should future problems with vegetation be identified during the inspections, the problem will be noted along with a recommended repair or further evaluation recommendations.

3.1.1 Water Balance Monitoring

Water balance monitoring data of the ET Cover was downloaded on a quarterly basis. This data is continually collected and stored on data loggers located at the monitoring locations until it is manually downloaded during each quarterly inspection. This monitoring includes water content and soil suction within the cover profile at varied depths. Matric potential probes (soil suction) were replaced on May 19, 2017 with the most advanced sensors available via Decagon Inc. The first set of sensors were less accurate, the second generation sensor was designed to be more accurate in drier soils such as those expected at the site. The multiple probes within each location allows for monitoring of moisture movement within the cover profile. There are two locations within the cover system instrumented (Figure 3). The two locations provide south and north slope differences as well as duplication in case of instrumentation or software errors. Each set of probes are connected to on-site data loggers that compiles the data to be downloaded. The summary and analysis of the data is submitted with this report (Attachment B).

Monitoring Equipment at each location (2 locations) includes:

- 5 each – 5TM water content probes by Decagon Devices Inc.
- 5 each – MPS-2 water potential probes by Decagon Devices, Inc.
- 2 each – EM50 data loggers by Decagon Devices Inc.

The water content probes allow for examination of water movement within the cover profile. The soil suction probes measure the matric potential in the soil and also relate it to wetting fronts. The water balance monitoring to date shows infiltration immediately following precipitation events within the cover profile and subsequent drying of the cover soon after.

3.1.2 Methane Monitoring

Methane monitoring is performed at four locations (Figure 3). The methane monitoring consists of a single instantaneous measurement via a single read calibrated instrument at each monitoring location for each inspection. The measurement units are reported in % of LEL. Methane #1 was placed within an area where waste was removed. Waste from the footprint of the newly constructed concrete hangar pad was removed and relocated within the landfill prior to its installation. Waste was left in place (Figure 2) located west of the northern edge of the concrete hangar pad. Methane #1 is located to detect the potential migration of methane gas produced

from this remaining waste into the removal area near the hangar that could potentially pose a hazard.

There was a vertical polyethylene liner placed between the landfill waste and removal area where the new hangar pad was installed. This liner is intended to stop the potential lateral migration of methane gas from the landfill toward the airport hangars. Methane #2 is located in a clean area intended to identify methane migration from the landfill towards the hangars

Methane #3 is located on the landfill within the measurement zone for the prior methane measuring location (PS2) which consistently received high methane measurements. Methane # 4 is also located on the landfill within the measurement zone for the prior methane measuring location (PS5) which also consistently received high methane measurements. Methane #3 and #4 each include a vertical riser installed into the underlying waste that rises above ground level where measurements are made. The methane was measured at the exit point of each methane riser on the established periodic basis to quantify methane release from the landfill.

If combustible gas level measurements exceed 25% of the LEL in any riser near the airport hangar pad, or 100% of the LEL at the risers on the landfill, the owner or operator shall:

- Immediately take all necessary steps to ensure protection of public health, welfare and the environment and notify the NMED;
- Within seven days of detection, record the methane gas levels detected and a description of the steps taken to protect public health, welfare and the environment and report them to NMED.

To date, all measurements have been zero; as a result of the consistent measurements below 25% of the LEL, methane measurement readings will be conducted on a semi-annual basis. Refer to Attachment C.

3.1.3 Biointrusion Monitoring

The ET Cover surface layer is composed of a mixture of 25% rock to 75% soil by volume that discourages burrowing, but does not prevent it. The Federal Aviation Administration (FAA) requires nearby fields including this landfill surface to be mowed to ensure that vegetation is less than one-foot tall. The mowing is to be performed under the direction of the LAC Airport and has multiple advantages for the cover system. Its purpose is to disrupt the landscape required for burrowing animals to effectively survive. The taller vegetation acts as a canopy to hide the smaller animals from predators such as coyotes and birds. The FAA requires the mowing and thus discouragement of smaller burrowing animals because the presence of predators is a safety hazard, by attracting the predators within the airport. A second advantage of the mowing is that it encourages the establishment of thinner and shallower rooting vegetation such as grasses and discourages the establishment of deeper, woody rooted plants including trees. The large woody roots of trees can provide preferential flow paths through soil covers. Significant burrowing will be reported in the attached inspection checklist as well as to the LAC Airport manager. Any animal burrows larger than 3-inches in diameter will be reported. These large burrow holes will also be filled as soon as possible with soil, meeting the cover soil specifications contained in the Technical Specifications, Section 02200 (Earthwork) of the Remedy Completion Report (Dwyer 2016).

As part of each inspection, the ET Cover surface was visually monitored for animal or insect burrowing. To date, no biointrusion has been noted in the ET Cover; however several animal burrows, generally 2-inch diameter or less were noted on the side slopes. These occurrences are within expected tolerances and do not pose significant risk to the performance of the side slope cover system.

3.1.4 Differential Settlement Monitoring

Differential settlement is a concern for the cover system because it is reflective of the subsurface conditions of the landfill including waste biodegradation and settlement. Furthermore, significant differential settlement can produce ponding and thus concentrated infiltration of surface water and potentially produce surface tension cracks that can allow for preferential flow through the cover system.

The surface of the landfill cover is surveyed quarterly. An evenly spaced grid was set up on the landfill cover whereby the elevation of each of 60 points making up this grid is surveyed each quarter. The change in elevation (drop in elevation) of the cover allows for the quantification of differential settlement along with the rate of settlement.

The summary of quarterly surveys during the prior year is contained in Attachment E. The cover settlement has considerably slowed to the point where there was essentially no additional settlement noted during the past two surveys. The settlement of the various point locations surveyed during the reporting period range from no settlement to 1.1-ft. In general, the western portion of the landfill has experienced the least settlement ranging from about 0.1-ft to 0.2-ft. The amount of settlement increases from west to east with the eastern portion settlement ranging from about 0.3-ft to 0.4-ft. This is consistent with waste being shallow on the west and increasing in depth toward the east. There is one location (Point 34 – middle of the landfill about half way down the northern slope) that experienced about 1.1-ft of settlement soon after placement of the ET Cover. However, this settlement has not advanced since. This isolated area still has positive drainage (no ponding). In March 2018, a surface crack was seen in the general area, but this crack was not visible in subsequent inspections. The surface crack was likely due to surface tensile stresses from localized settlement. Small surface cracks can easily disappear due to soil movement and subsequent infill of the crack or expansion of clays within the cover soil after a wetting period. This area will continue to be monitored. There is no current recommendation for maintenance in this area since the drainage is still positive (no ponding) and there are no current significant cracks that could allow for preferential flow paths. Should ponding occur or significant cracking form, a recommended maintenance plan will be immediately submitted.

3.2 Storm Water Control Systems

The storm water control systems, including perimeter ditches and other drainage controls, were noted to be in proper working condition with no degradation observed. The visual inspection looked for evidence of, or the potential for, degradation of and /or pollutants entering the storm water conveyance system.

If any of the issues are observed to be significant by the Inspection Engineer (New Mexico Professional Engineer), they are to be repaired as soon as weather permits. Repairs (if any)

requiring additional material such as riprap or soil shall use locally available materials that meet the design technical specifications contained in the Remedy Completion Report (Dwyer 2016).

The general integrity of the landfill drainage channels and culverts were inspected. No degradation or problems were identified. The channels and the transition of the channels to Pueblo Canyon were inspected for evidence of degradation, erosion, subsidence, sediment accumulation, undercutting, obstructions, slope instability and other disturbances to the channels.

No degradation or problems were identified.

3.3 Fencing

Fencing at the site is composed of perimeter fencing around the airport. The integrity of all fencing adjacent to the landfill and eastern retaining wall structures was inspected. This length of fencing was inspected for any damage, including but not limited to: bent posts, loose posts, broken links or wire, and damaged gates. Any damage noted shall be noted in the inspection report and repaired as soon as weather permits.

There were no deficiencies identified.

3.4 Retaining Walls

Visual inspections to assess for signs of degradation were performed for both the concrete and gabion retaining walls. Inspections include identifying the existence and extent of any cracks that may exist in the concrete wall. Inspections also look for any distortion in the wall due to such things as unexpected settlement or soil piping.

Digital photos shall be taken of any cracking or degradation noted in the concrete wall. Measurements of the location and depth of the crack(s) (if any) shall be determined and documented in the inspection report. Documentation will be submitted of the location (if any) of any issues identified along with digital photos of the extent of damage or movement and included in the inspection report. Any soil erosion or other evidence of water damage in the vicinity of retaining walls shall be documented in the inspection report with recommended repair(s) or maintenance.

No issues or deficiencies were identified in this set of inspections.

3.5 Erosion and Sediment Control

The condition of permanent erosion control measures was inspected. This included the drainage channels, rock check dams, terraces, and rip rap protecting the areas around the retaining structures along the eastern portion of the landfill. If any degradation or damage is noted in future inspections, they shall be noted in the inspection reports along with recommended repair or maintenance for each occurrence. These reports or maintenance items are to be performed as soon as weather permits.

There was no damage or degradation noted to date.

Condition of perimeter drains/berms, culverts, and drop inlets were inspected for presence of sediments, breaches in berms, presence of vegetation or debris, etc. Sediments, vegetation, or debris retarding storm water runoff shall be reported to the appropriate Los Alamos County and DOE personnel and then removed as needed (if identified).

No sediment or issues were identified to date.

3.6 Site Access

A permanent road dedicated to the landfill does not exist. However, access to continued monitoring, maintenance and repairs as necessary is granted by the Los Alamos County. Access to the site through the locked gate is adequate and provides for desired isolation of the site. Prior notice must be given to the Los Alamos County Airport manager before any maintenance or work is performed.

3.7 Site after Significant Precipitation Event Inspections

There were no post-high intensity storm events (storms with intensity greater than 1-in of precipitation per hour) during the 2018/2019 monitoring period. However, due to the above average precipitation during the previous year and the frequency of storms; multiple post-high intensity storm inspections were performed.

3.8 Debris Disposal Area Cover System

The DDA cover system is an earthen cover located east of the ET Cover (Figures 1 and 2). It is approximately 5 acres in size and consists of a 12-inch thick soil cover seeded with native vegetation. This work was completed prior to 2007 and is described in North Wind and Weston (2007).

The cover appeared in good condition with no signs of ponding or vegetation distress. Vegetation is generally mature on the site and is mowed to comply with the maximum height of vegetation allowed per the FAA (about 12-inches). There was minimal biointrusion noted on the DDA cover that included a single ant hill and approximately 2-inch diameter animal burrow hole.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The Los Alamos County Airport Landfill Cover Replacement and associated facilities are in good condition and performing as designed. Methane monitoring recorded zero percent of the lower explosive limit (LEL) to date. The ET Cover is in good condition with no signs of erosion while vegetation is emerging as expected. Differential settlement identified to date is as expected and has not created any ponding. The surface tension crack that was identified in March 2018, was not visible in subsequent inspections. Consequently no maintenance or repair is recommended for this issue. There was not significant biointrusion in the cover systems. The water balance data reveals that moisture infiltrates within the cover profile following precipitation events and quickly dries. Storm water controls are effective at controlling surface runoff from the site and efficiently routing it off site though designated release points. The site access is effectively controlled by the airport fencing and locked access.

Based on two consecutive years of methane monitoring readings of less than 25% of the LEL (recorded 0% of the LEL), methane monitoring readings will be made on a semi-annual basis.

There is one recommended minor maintenance issue at this time. It is recommended to address isolated erosion rills at the base of the eastern side slope of the landfill (Attachment A – Inspection Reports 11 and 12). Measures taken to address the isolated erosion rills will be

reported on in the next annual report. The next annual report will be submitted to NMED by July 30, 2020 and every July thereafter as long as monitoring is required.

5.0 REFERENCES

1. Dwyer Engineering LLC., August 2012. "Los Alamos County Airport Technical and Feasibility Study". US DOE, Los Alamos Site Office, August 2012.
2. Dwyer Engineering LLC. 2015. Work Plan for the Los Alamos County Airport Landfill Cover Replacement submitted August 2016.
3. Dwyer Engineering LLC. 2016. Remedy Completion Report for the Los Alamos County Airport Landfill Cover Replacement submitted October 2016.
4. Dwyer Engineering LLC. 2017. Long-Term Monitoring Plan for the Los Alamos County Airport Landfill Cover Replacement submitted March 2017.
5. LANL. 1998. RFI Report for Potential Release Sites, 73-001 (a,b,c,d) 73-004(a) (Airport Landfill Areas) Volumes 1 to 3, Los Alamos National Laboratory report LA-UR-98-3824, November 1998.
6. NMED Approval; Work Plan. 2015. Approval with Modifications Work Plan for Los Alamos County Airport Landfill Cover Replacement, Los Alamos National Laboratory, EPA ID #NM0890010515, HWB-LANL-16-018. August 14, 2015.
7. NMED Approval RCR. 2016. Approval with Modifications Submittal of the Remedy Completion Report for Los Alamos County Airport Landfill Cover Replacement, Solid Waste Management Unit 73-001 (a) Los Alamos National Laboratory, EPA ID #NM0890010515, HWB-LANL-16-055. December 22, 2016.
8. NMED Approval; Long-Term Monitoring Plan. 2017. Approval Long-Term Monitoring Plan for Los Alamos County Airport Landfill Cover Replacement, Solid Waste Management Units 73-001(a,d) Technical Area 73 Los Alamos National Laboratory, EPA ID #NM0890010515, HWB-LANL-16-018. March 30, 2017.
9. North Wind and Weston. 2007. Remedy Completion Report DOE-LASO TA-73 Airport Landfill SWMUs 73-001(a) and 73-001(d). North Wind Report NWI-4212-001, April 2007.
10. North Wind. 2004. Phase II Work Plan for Los Alamos Site Office TA-73 Airport Landfill. NW-ID-2004-031. April 2004.
11. Remedy Completion Report *replacement pages. 2017.* Remedy Completion Report *replacement pages* for the Los Alamos County Airport Landfill Cover Replacement. Los Alamos, NM. February 2017.

ATTACHMENTS

Attachment A

Inspection Check Lists and Photographs

1.	Year 3, Quarter 1	Inspection 9	October 1, 2018
2.	Year 3, Quarter 2	Inspection 10	December 1, 2018
3.	Year 3, Quarter 3	Inspection 11	March 20, 2019
4.	Year 3, Quarter 4	Inspection 12	June 14, 2019

LONG-TERM MONITORING INSPECTION REPORT

YEAR 3, Quarter 1 ***INSPECTION #9***

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

Inspection Date: *October 1, 2018*
Report Date: *October 22, 2018*

prepared for:
Department of Energy
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos Field Office
Los Alamos, NM 87544

prepared by:
Dwyer Engineering LLC under contract to The Lakeworth Group
Stephen F. Dwyer, PhD, PE
1813 Stagecoach Rd.
Albuquerque, NM 87123
(505) 270-0215

Revision 0

EXECUTIVE SUMMARY

This is the ninth inspection (Year 3, Quarter 1 - inspection date: October 1, 2018) of the Evapotranspiration (ET) Cover and associated project elements for the Los Alamos County Airport Landfill. The inspections are performed in accordance with the Long-Term Monitoring Plan[1]. The construction of the cover system was completed in July 2016.

All features of the closure are currently in good condition. The vegetation has full coverage and is dominated by grasses varying in height from a few inches to about a foot. All drainage systems are in excellent working condition. There are no erosion issues on the cover or side slopes. There is no biointrusion to date on the new ET Cover. There is some localized animal burrowing on the existing side slopes of the older cover system that appears consistent with the prior inspection. There was also some burrowing noted in the Debris Disposal Area (DDA) cover, also consistent with the prior inspection. There were tension cracks identified along the top of the older landfill side slope north of the ET Cover (Picture 29). These cracks extended several feet and were generally a fraction of an inch to an inch in width. These cracks are presumably due to differential settlement in the older side slopes that had a prescriptive cover system inclusive of a composite barrier layer (compacted clay soil overlain by a geomembrane). This area will continue to be monitored in future inspections. No maintenance or repairs are recommended at this time.

Methane monitoring during the reporting period revealed no detectable methane. The water balance monitoring (soil moisture and soil suction) appears to show infiltration in response to precipitation that moves into the cover profile and subsequently is removed via ET. The heat dissipation units were replaced with newer probes in May 2017. Temperature sensitivity of the probes, especially contrasting winter and summer seasons, has contributed to the initial undulation in the data. The soil suction probes indicate a prolonged drying of the cover system. Longer term trends will need to be evaluated to better assess the effectiveness of the cover system water balance data.

The settlement survey grid was performed to quantify differential settlement. The annual differential settlement values will be computed and included in each annual report. The area with the highest differential settlement [Survey point 34 – center of northern half of cover (Figure 8) and Picture 14 and 29] in past surveys did not increase.

[1] Dwyer Engineering. March 2017. Long-Term Monitoring Plan. Los Alamos County Airport Landfill Cover Replacement Solid Waste Management Units 73-001 (a,d) Technical Area 73.

INSPECTION CHECK LIST

Table 1. Long-Term Monitoring Check List for the Los Alamos County Airport Landfill Closure

Site Name: Los Alamos County Airport Landfill Cover Replacement	Date of Inspection: October 1, 2018
City: Los Alamos	Weather: warm, partly cloudy, breezy
State: New Mexico	Temperature: 70s
Agency: Department of Energy	Inspector: Stephen F Dwyer, PhD, PE
Site Element	**Remarks**
ET Cover	
1. Settlement (Low Spots): Yes ( ) No (X) Areal Extent: none Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Visual inspection showed that some differential settlement had previously occurred. There does not appear to be any ponding associated with the settlement to date. The settlement survey grid was performed to quantify differential settlement. The area with the highest differential settlement in past surveys [Survey point 34 – center of northern half of cover Figure 8) and Picture 14 and 29] did not increase. The annual differential settlement values will be computed and included in each annual report.
2. Surface Cracks: Yes ( ) No (X) Length: NA Width: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No surface cracks in the ET Cover were identified. Tension cracks along and parallel to the top of the older side slopes of the prescriptive cover system were identified. They appear to be due to differential settlement (Pictures 28 and 29).
3. Erosion: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No significant erosion noted to date. The gravel/soil top admixture top layer (6-inches thick) referred to as a 'desert pavement' is developing well and appears to be working as designed to minimize erosion.
4. Biointrusion Holes: Yes (X) No ( ) Areal Extent: minimal	No biointrusion noted on the new ET Cover. There was minimal biointrusion (small animal burrow holes) noted on the side slopes of the older prescriptive

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: October 1, 2018**
City: Los Alamos	**Weather: warm, partly cloudy, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Depth: approx. 12-inches Suspected Cause (Rodent or Other): small mammal Repairs Necessary Yes ( ) No (X) If yes, explain	cover system (Picture 19). The biointrusion noted is localized and does not appear to be excessive or growing.
5. Vegetation Condition: General Condition progressing as expected: Yes (X) No ( ) If no, explain Issues Observed: Yes ( ) No (X) If yes, explain Repairs Necessary: Yes ( ) No (X) If yes, explain	Vegetation has full coverage on the cover system. The size/height of the vegetation is uneven across the cover (Pictures 13 to 16). The vegetation is predominantly native grasses that were seeded at the conclusion of the construction of the cover system. The grasses vary in height from a few inches to about a foot. The vegetation on the DDA (Picture 27) appears relatively mature and consists of grasses generally less than a foot in height. This area was recently mowed in to keep the height to within acceptable levels per FAA regulations. The side slopes of the older prescriptive cover (Pictures 17 and 20) appear mature dominated by grasses mixed with forbs. These areas are not mowed due to the steepness of the slope. (Refer to pictures 1, 4, 5, 6, 13, 14, 15, 16, 19, 20 22, 26 and 27).
6. Rill/Gully: Yes ( ) No (X) Areal Extent: NA Depth: NA Suspected Cause: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No erosion noted to date.
7. Wet Areas: Yes ( ) No (X) Ponding: Yes ( ) No (X) Areal Extent: NA	The cover was uniformly dry during the inspection. No unusual wet areas noted to date on the cover.

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: October 1, 2018**
City: Los Alamos	**Weather: warm, partly cloudy, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Seeps: Yes ( ) No (X) Areal Extent: NA Soft Subgrade: Yes ( ) No (X) Areal Extent: NA Repairs Necessary Yes ( ) No (X) If yes, explain	
8. Slope Instability: Yes ( ) No (X) Areal Extent: NA Suspected Cause: NA Exposed Cover Components: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No slope instability noted to date.
9. Water Balance Instrumentation: Functioning Properly: Yes (X) No ( ) Damage: Yes ( ) No (X) Repairs Necessary Yes ( ) No (X) If yes, explain	Moisture content probes are working correctly and are in good condition to date (Picture 6). The heat dissipation units (HDU) were replaced in March 2017.
9. Methane Monitoring Instrumentation: Functioning Properly: Yes (X) No ( ) Damage: Yes ( ) No (X) Repairs Necessary Yes ( ) No (X) If yes, explain	Felicia Aguilar, The Lakeworth Group, performed methane monitoring. No methane was detected. Refer to Figure 7 for methane monitoring locations and Pictures 2, 3, and 4 for methane monitoring ports. The Los Alamos County personnel were excavating near the methane monitoring location west of the landfill and north of the new hangar to connect utilities (Picture 3). The area is to be restored and reseeded after this work is complete in early October 2018.
Rip Rap Lined Drainage Channels	
1. Settlement: Yes ( ) No (X) Areal Extent: NA Depth: NA	Visual inspection revealed no significant differential settlement to date.

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: October 1, 2018**
City: Los Alamos	**Weather: warm, partly cloudy, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Repairs Necessary Yes ( ) No (X) If yes, explain	
2. Material Degradation: Yes ( ) No (X) Material Type: Rock, geotextile, geomembrane (polyethylene) Areal Extent: NA Degree of Degradation: none Repairs Necessary Yes ( ) No (X) If yes, explain	No material degradation noted to date (Pictures 10, 11, and 12).
3. Erosion: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No erosion noted to date.
4. Undercutting: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No undercutting noted to date.
5. Obstructions: Yes ( ) No (X) Type: NA Areal Extent: NA Size: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No obstructions noted to date.
6. Slope Instability: Yes ( ) No (X) Type: NA Areal Extent: NA	No slope instability noted to date.

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: October 1, 2018**
City: Los Alamos	**Weather: warm, partly cloudy, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Repairs Necessary Yes ( ) No (X) If yes, explain	
7. Siltation: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No siltation noted to date.
8. Drop Inlet Structures: Working Properly Yes (X) No ( ) Condition: good Extent of Damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Drop inlet structures are in good condition (Picture 12).
Concrete Culvert	
1. Siltation: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No siltation noted to date (Picture 13).
2. Concrete Condition and Joints General Condition progressing as expected: Yes (X) No ( ) If no, explain Issues Observed: Yes ( ) No (X) If yes, explain Repairs Necessary: Yes ( ) No (X) If yes, explain	Concrete in good condition (Picture 13).
3. Grating Condition: General Condition progressing as expected: Yes (X) No ( ) If no, explain Issues Observed: Yes ( ) No (X) If yes, explain Repairs Necessary: Yes ( ) No (X) If yes, explain	Grating in good condition (Picture 13).

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: October 1, 2018**
City: Los Alamos	**Weather: warm, partly cloudy, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Fencing	
1. Airport Fence Adjacent to Landfill: bent posts: Yes ( ) No (X) loose posts: Yes ( ) No (X) broken links or wire: Yes ( ) No (X) damaged gates: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Airport fencing is in good condition and securing the site (Pictures 9, 21, 23, 25 and 26). This fencing is maintained by the County of Los Alamos.
Retaining Wall	
1.Retaining Wall Condition: General Condition progressing as expected: Yes (X) No ( ) If no, explain	Retaining walls are in good condition. No damage or issues were noted (Pictures 22 to 25).
2. Retaining Wall Damage Description (if any): Issues Observed: Yes ( ) No (X) If yes, explain	None
3.**Repairs Necessary** Repairs Necessary: Yes ( ) No (X) If yes, explain	None
Permanent Erosion & Sedimentation Control Measures	
1. Rip Rap Berm near Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage or degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The Rip Rap drainage on side slope is in good condition (Picture 18).
2. Rock Check Dams near Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage, displaced rock, or other damage: Yes ( ) No (X) Description of damage: NA	The rock check dams are in good condition (Pictures 23 to 26).

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: October 1, 2018**
City: Los Alamos	**Weather: warm, partly cloudy, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Repairs Necessary Yes ( ) No (X) If yes, explain	
3. Landfill Terrace above Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage, adjunct erosion, slope problem, or other damage/degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (NA) If yes, explain	The landfill terraces above the retaining walls are in good condition (Pictures 22 to 24).
4. Drainage Channels adjacent to Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage, adjunct erosion, slope problem, or other damage/degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The drainage channels adjacent to the retaining wall appear in good condition (Pictures 23 to 26). Drainage channels appear to be working properly.
5. Gabion above Drainage Channels adjacent to Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage or degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The gabions above drainage channels adjacent to the retaining walls are in good condition (Picture 22 and 23).
Site Access	
1. Access Restrictions: Yes (X) No ( ) Description: Secured fence with keyed lock Repairs Necessary Yes ( ) No (X) If yes, explain	The site has controlled access with a security fence and locked gates.
Debris Disposal Area (DDA)	
Debris Disposal Area Condition Good Condition (X) Poor Condition ( )	The surface of the DDA cover system is in good condition. There is no observed degradation of the site. The vegetation on the site is in good condition (Picture

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: October 1, 2018**
City: Los Alamos	**Weather: warm, partly cloudy, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
	27). Vegetation is in good condition and varies in height from a few inches to about a foot. This area is mowed during the summer months by the airport personnel to remain compliant with FAA regulations (vegetation mowed to be less than a foot in height). There was some small mammal burrowing noted on the cover. The amount of burrowing does not appear to be excessive at this time.
General	
1. Vandalism: Yes ( ) No (X) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	No vandalism noted.
2. Land Use Change: Yes ( ) No (X) Description: Repairs Necessary Yes ( ) No ( ) If yes, explain	No land use changes.
Summary of Recommended Maintenance and/or Repairs	
1.Maintenance / Repairs Necessary Yes ( ) No (X) If yes, explain	None at this time.
Other	

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: October 1, 2018**
City: Los Alamos	**Weather: warm, partly cloudy, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
1. Construction of the new LA County Airport Hangar continues. This is west of the footprint of the landfill. The seeded areas adjacent to this work in the waste removal areas have been disturbed. This area is scheduled to be reseeded by the Los Alamos County upon completion of the hangar and utility work (Pictures 3, 7 and 8).	1. This work is west of the landfill and does not affect the performance of the cover or related facilities.

Picture 1. Cover Northeast View

Picture 2. Methane Monitoring Port - West of Landfill, South of New Hangar

Picture 3. Methane Monitoring Port - West of Landfill, North of New Hangar

Picture 4. Methane Monitoring Port - South Slope of Landfill

Picture 5. West Slope End of Landfill

Picture 6. Water Balance Monitoring Nest - South Slope of Landfill

Picture 7. Ongoing Utility Work for New Hangar by Los Alamos County, West of Landfill

Picture 8. New Asphalt and Hangar Under Construction - West of Landfill

Picture 9. New Drop Inlet Structure Installed by Los Alamos County North of New Hangar Pad

Picture 10. Drainage Channel - North Perimeter of ET Cover

Picture 11. Drainage Channel - East Perimeter of ET Cover

Picture 12. Drainage Channel - South Perimeter of ET Cover

Picture 13. Concrete Culvert - West Perimeter of ET Cover

Picture 14. ET Cover - Southeast View

Picture 15. ET Cover - West View

Picture 16. ET Cover - Northwest View

Picture 17. Older Cover Side Slope, North of ET Cover

Picture 18. Eastern Berm on Sideslope East of Landfill

Picture 19. Biointrusion in Older Landfill Side Slope, East of ET Cover

Picture 20. Eastern Side Slope of Landfill

Picture 21. Concrete Drainage - East End of SE Berm

Picture 22. Gabion Retaining Structure - East End of Landfill

Picture 23. Large Rip Rap Slope and Gabion Retainment Wall - East End of Landfill Site

Picture 24. Concrete Retaining Wall - East End of Landfill

Picture 25. Erosion Control below Concrete Retaining Wall - NE End of Landfill

Picture 26. Side Slopes and Erosion Control, East End of Landfill

Picture 27. Debris Disposal Area

Picture 28. Tension Cracking near Top of Side Slope of Older Landfill Cover, North of ET Cover

Picture 29. Aerial View of Airport Landfill (Google Earth)

LONG-TERM MONITORING INSPECTION REPORT

YEAR 3, Quarter 2 ***INSPECTION #10***

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

Inspection Date: *December 1, 2018*
Report Date: December *10, 2018*

prepared for:
Department of Energy
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos Field Office
Los Alamos, NM 87544

prepared by:
Dwyer Engineering LLC under contract to The Lakeworth Group
Stephen F. Dwyer, PhD, PE
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(505) 270-0215

Revision 0

EXECUTIVE SUMMARY

This is the tenth inspection (Year 3, Quarter 2 - inspection date: December 1, 2018) of the Evapotranspiration (ET) Cover and associated project elements for the Los Alamos County Airport Landfill. The inspections are performed in accordance with the Long-Term Monitoring Plan[1]. The construction of the cover system was completed in July 2016.

All features of the closure are currently in good condition. The vegetation has full coverage and is dominated by grasses varying in height from a few inches to about a foot. All drainage systems are in excellent working condition. There are no erosion issues on the cover or side slopes. There is no biointrusion to date on the new ET Cover. There is some localized animal burrowing and ant hills on the existing side slopes of the older cover system that appears consistent with the prior inspection. There was also some burrowing noted in the Debris Disposal Area (DDA) cover, also consistent with the prior inspection. There were tension cracks identified along the top of the older landfill side slope north of the ET Cover, consistent with the prior inspection (Picture 29). No maintenance or repairs are recommended at this time.

Methane monitoring during the reporting period revealed no detectable methane. The water balance monitoring (soil moisture and soil suction) appears to show infiltration in response to precipitation that moves into the cover profile and subsequently is removed via ET. The heat dissipation units were replaced with newer probes in May 2017. Temperature sensitivity of the probes, especially contrasting winter and summer seasons, has contributed to the initial undulation in the data. Longer term trends will need to be evaluated to better assess the effectiveness of the cover system water balance data.

The settlement survey grid was performed to quantify differential settlement. The annual differential settlement values will be computed and included in each annual report. In general, it appears there was no significant increase in differential settlement across the ET Cover from the prior inspection survey.

[1] Dwyer Engineering. March 2017. Long-Term Monitoring Plan. Los Alamos County Airport Landfill Cover Replacement Solid Waste Management Units 73-001 (a,d) Technical Area 73.

INSPECTION CHECK LIST

Table 1. Long-Term Monitoring Check List for the Los Alamos County Airport Landfill Closure

Site Name: Los Alamos County Airport Landfill Cover Replacement	Date of Inspection: December 1, 2018
City: Los Alamos	Weather: cold, partly cloudy, breezy
State: New Mexico	Temperature: 30s
Agency: Department of Energy	Inspector: Stephen F Dwyer, PhD, PE
Site Element	**Remarks**
ET Cover	
1. Settlement (Low Spots): Yes ( ) No (X) Areal Extent: none Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Visual inspection showed that some differential settlement had previously occurred. There does not appear to be any ponding associated with the settlement to date. The settlement survey grid was performed to quantify differential settlement. The area with the highest differential settlement in past surveys [Survey point 34 – center of northern half of cover Figure 8) and Pictures 16 and 30] did not increase. The annual differential settlement values will be computed and included in each annual report.
2. Surface Cracks or Stains: Yes ( ) No (X) none in new ET cover Length: NA Width: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No surface cracks in the ET Cover were identified. Tension cracks along and parallel to the top of the older side slopes of the prescriptive cover system were identified. They appear to be due to differential settlement (Pictures 29 and 30). They are consistent with the prior inspection observations – no new cracking or change in size was noted. Light colored precipitate was noted in the northeast corner of the cover (Picture 28). It was localized - about a 20 square foot area. It appears to be gypsum, likely present in the cover soil and moved to the surface as the cover dried and precipitated when the moisture evaporated.
3. Erosion: Yes ( ) No (X)	No significant erosion noted to date. The gravel/soil admixture top layer (6-inches thick) referred to as a 'desert pavement' is developing well and appears to be

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: December 1, 2018**
City: Los Alamos	**Weather: cold, partly cloudy, breezy**
State: New Mexico	**Temperature: 30s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	working as designed to minimize erosion.
4. Biointrusion Holes: Yes (X) No ( ) Areal Extent: minimal Depth: approx. 12-inches Suspected Cause (Rodent or Other): small mammal and ants Repairs Necessary Yes ( ) No (X) If yes, explain	No biointrusion noted on the new ET Cover. There was minimal biointrusion (small animal burrow holes and ant hill) noted on the side slopes of the older prescriptive cover system (Picture 19). The biointrusion noted is localized. The amount of burrowing was consistent with that observed in the prior inspection.
5. Vegetation Condition: General Condition progressing as expected: Yes (X) No ( ) If no, explain Issues Observed: Yes ( ) No (X) If yes, explain Repairs Necessary: Yes ( ) No (X) If yes, explain	All vegetation was dormant during this inspection. Vegetation has full coverage on the cover system. The size/height of the vegetation is uneven across the cover (Pictures 1, 4, 6, 14, 15, and 16). The vegetation is predominantly native grasses that were seeded at the conclusion of the construction of the cover system. The grasses vary in height from a few inches to about a foot. The vegetation on the debris disposal area (DDA) (Picture 27) appears relatively mature and consists of grasses generally less than a foot in height. This vegetation was dormant during this inspection. The side slopes of the older prescriptive cover (Pictures 17 and 20) appear mature dominated by grass mixed with forbs. These areas are not mowed due to the steepness of the slope.
6. Rill/Gully: Yes ( ) No (X) Areal Extent: NA Depth: NA Suspected Cause: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No erosion noted to date.

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: December 1, 2018**
City: Los Alamos	**Weather: cold, partly cloudy, breezy**
State: New Mexico	**Temperature: 30s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
7. Wet Areas: Yes ( ) No (X) Ponding: Yes ( ) No (X) Areal Extent: NA Seeps: Yes ( ) No (X) Areal Extent: NA Soft Subgrade: Yes ( ) No (X) Areal Extent: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The cover was uniformly dry during the inspection. No unusual wet areas noted to date on the cover.
8. Slope Instability: Yes ( ) No (X) Areal Extent: NA Suspected Cause: NA Exposed Cover Components: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No slope instability noted to date.
9. Water Balance Instrumentation: Functioning Properly: Yes (X) No ( ) Damage: Yes ( ) No (X) Repairs Necessary Yes ( ) No (X) If yes, explain	Moisture content probes are working and are in good condition to date (Picture 6). The heat dissipation units (HDU) were replaced in March 2017. The instrumentation is showing significant sensitivity to soil temperature variations (summer vs. winter).
9. Methane Monitoring Instrumentation: Functioning Properly: Yes (X) No ( ) Damage: Yes ( ) No (X) Repairs Necessary Yes ( ) No (X) If yes, explain	Felicia Aguilar, The Lakeworth Group, performed methane monitoring. No methane was detected. Refer to Figure 7 for methane monitoring locations and Pictures 2, 3, and 4 for methane monitoring ports. Methane station 2 accidentally had the top damaged (Picture 2). This will be replaced. The area directly north of the new airport hangar pad was restored and reseeded after the completion of the recent utility work (Pictures 3 and 7).
Rip Rap Lined Drainage Channels	

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: December 1, 2018**
City: Los Alamos	**Weather: cold, partly cloudy, breezy**
State: New Mexico	**Temperature: 30s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
1. Settlement: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Visual inspection revealed no significant differential settlement to date.
2. Material Degradation: Yes ( ) No (X) Material Type: Rock, geotextile, geomembrane (polyethylene) Areal Extent: NA Degree of Degradation: none Repairs Necessary Yes ( ) No (X) If yes, explain	No material degradation noted to date (Pictures 10, 11, and 12).
3. Erosion: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No erosion noted to date.
4. Undercutting: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No undercutting noted to date.
5. Obstructions: Yes ( ) No (X) Type: NA Areal Extent: NA Size: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No obstructions noted to date.

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: December 1, 2018**
City: Los Alamos	**Weather: cold, partly cloudy, breezy**
State: New Mexico	**Temperature: 30s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
6. Slope Instability: Yes ( ) No (X) Type: NA Areal Extent: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No slope instability noted to date.
7. Siltation: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No siltation noted to date.
8. Drop Inlet Structures: Working Properly Yes (X) No ( ) Condition: good Extent of Damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Drop inlet structures are in good condition (Picture 12).
Concrete Culvert	
1. Siltation: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No siltation noted to date (Picture 13).
2. Concrete Condition and Joints General Condition progressing as expected: Yes (X) No ( ) If no, explain Issues Observed: Yes ( ) No (X) If yes, explain Repairs Necessary: Yes ( ) No (X) If yes, explain	Concrete in good condition (Picture 13).

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: December 1, 2018**
City: Los Alamos	**Weather: cold, partly cloudy, breezy**
State: New Mexico	**Temperature: 30s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
3. Grating Condition: General Condition progressing as expected: Yes (X) No ( ) If no, explain Issues Observed: Yes ( ) No (X) If yes, explain Repairs Necessary: Yes ( ) No (X) If yes, explain	Grating in good condition (Picture 13).
Fencing	
1. Airport Fence Adjacent to Landfill: bent posts: Yes ( ) No (X) loose posts: Yes ( ) No (X) broken links or wire: Yes ( ) No (X) damaged gates: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Airport fencing is in good condition and securing the site (Pictures 20, 21, 23, 25 and 26). This fencing is maintained by the County of Los Alamos. Some of the perimeter fencing along the highway and airport entrance is currently being replaced with a more robust fence (Picture 9).
Retaining Wall	
1.Retaining Wall Condition: General Condition progressing as expected: Yes (X) No ( ) If no, explain	Retaining walls are in good condition. No significant damage or issues were noted (Pictures 22 to 26). A single small crack was noted on the concrete retaining wall with precipitate along it (Picture 24). It appears to be typical concrete cracking and does not likely reflect any degradation of strength at this point.
2. Retaining Wall Damage Description (if any): Issues Observed: Yes ( ) No (X) If yes, explain	None
3.**Repairs Necessary** Repairs Necessary: Yes ( ) No (X) If yes, explain	None
Permanent Erosion & Sedimentation Control Measures	
1. Rip Rap Berm near Retaining Wall: Functional Yes (X) No ( ) if no, describe locations	The Rip Rap drainage on the side slopes is in good condition (Picture 18).

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: December 1, 2018**
City: Los Alamos	**Weather: cold, partly cloudy, breezy**
State: New Mexico	**Temperature: 30s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Damage or degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	
2. Rock Check Dams near Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage, displaced rock, or other damage: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The rock check dams are in good condition (Picture 25).
3. Landfill Terrace above Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage, adjunct erosion, slope problem, or other damage/degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (NA) If yes, explain	The landfill terraces above the retaining walls are in good condition (Pictures 25 and 26).
4. Drainage Channels adjacent to Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage, adjunct erosion, slope problem, or other damage/degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The drainage channels adjacent to the retaining wall appear in good condition (Pictures 23, 25 and 26). Drainage channels appear to be working properly.
5. Gabion above Drainage Channels adjacent to Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage or degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The gabions above drainage channels adjacent to the retaining walls are in good condition (Picture 22, 23 and 25).
Site Access	
1. Access Restrictions:	The site has controlled access with a security fence and

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: December 1, 2018**
City: Los Alamos	**Weather: cold, partly cloudy, breezy**
State: New Mexico	**Temperature: 30s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Yes (X) No ( ) Description: Secured fence with keyed lock Repairs Necessary Yes ( ) No (X) If yes, explain	locked gates. Some of the perimeter fencing is currently being replaced with a more robust fence (Picture 9).
Debris Disposal Area (DDA)	
1. Debris Disposal Area Condition Good Condition (X) Poor Condition ( )	The surface of the DDA cover system is in good condition. There is no observed degradation of the site. The vegetation was dormant during this inspection (Picture 27). Vegetation is in good condition and varies in height from a few inches to about a foot. This area is mowed during the summer months by the airport personnel to remain compliant with FAA regulations (vegetation mowed to be less than a foot in height). There was some small mammal burrowing noted on the older cover side slopes. The amount of burrowing is consistent with the prior inspection.
General	
1. Vandalism: Yes ( ) No (X) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	No vandalism noted. The methane port south of the new airport hangar pad had the upper vent damaged and knocked off (Picture 2). This will be replaced.
2. Land Use Change: Yes ( ) No (X) Description: Repairs Necessary Yes ( ) No ( ) If yes, explain	No land use changes.
Summary of Recommended Maintenance and/or Repairs	
1.Maintenance / Repairs Necessary Yes ( ) No (X) If yes, explain	None at this time.

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: December 1, 2018**
City: Los Alamos	**Weather: cold, partly cloudy, breezy**
State: New Mexico	**Temperature: 30s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Other	
1. Construction of the new LA County Airport Hangar continues. This is west of the footprint of the landfill. The areas adjacent to this work in the waste removal areas has been reseeded (Pictures 3and 7).	1. This work is west of the landfill and does not affect the performance of the cover or related facilities.

Picture 1. Cover Northeast View

Picture 2. Methane Monitoring Port - West of Landfill, South of New Hangar

Picture 3. Methane Monitoring Port - West of Landfill, North of New Hangar

Picture 4. Methane Monitoring Port - North Slope of Landfill

Picture 5. West Slope End of Landfill

Picture 6. Water Balance Monitoring Nest - South Slope of Landfill

Picture 7. Completed Utility Work for New Hangar by Los Alamos County, West of Landfill

Picture 8. New Asphalt and New Airport Hangar - West of Landfill

Picture 9. Installation of New Perimeter Fencing Around Airport

Picture 10. Drainage Channel - North Perimeter of ET Cover

Picture 11. Drainage Channel - East Perimeter of ET Cover

Picture 12. Drainage Channel - South Perimeter of ET Cover

Picture 13. Concrete Culvert - West Perimeter of ET Cover

Picture 14. ET Cover - West View

Picture 15. ET Cover - Northwest View

Picture 16. ET Cover - East View

Picture 17. Older Cover Side Slope, North of ET Cover

Picture 18. Eastern Berm on Sideslope East of Landfill

Picture 19. Biointrusion in Older Landfill Side Slope, North of ET Cover

Picture 20. Eastern Side Slope of Landfill

Picture 21. Concrete Drainage - East End of SE Berm

Picture 22. Gabion Retaining Structure - East End of Landfill

Picture 23. Large Rip Rap Slope and Gabion Retainment Wall - East End of Landfill Site

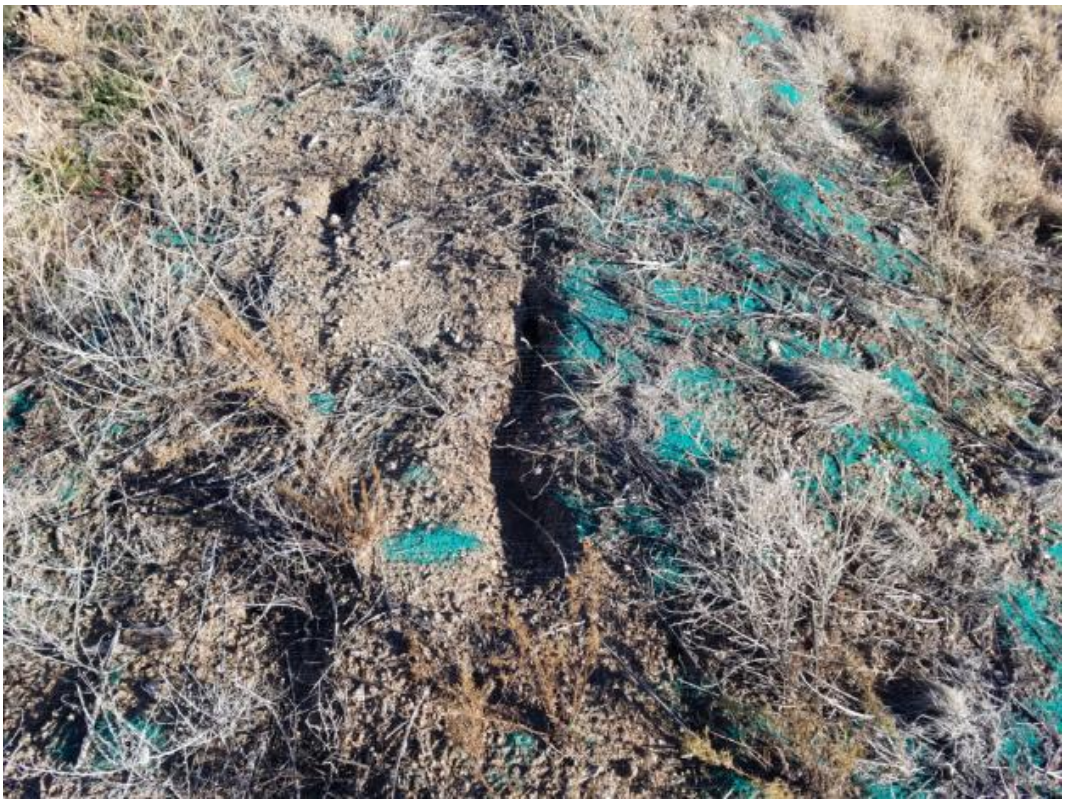
Picture 24. Small Crack in Concrete Retaining Wall - East End of Landfill

Picture 25. Erosion Control below Concrete Retaining Wall - NE End of Landfill

Picture 26. Side Slopes and Erosion Control, East End of Landfill

Picture 27. Debris Disposal Area

Picture 28. Light Colored Precipitate on Cover Surface (NE Corner)



Picture 29. Tension Cracking near Top of Side Slope of Older Landfill Cover, North of ET Cover

Picture 30. Aerial View of Airport Landfill (Google Earth)

LONG-TERM MONITORING INSPECTION REPORT

YEAR 3, Quarter 3 ***INSPECTION #11***

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

Inspection Date: March 20, 2019
Report Date: May 9, 2019

prepared for:
Department of Energy
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos Field Office
Los Alamos, NM 87544

prepared by:
Dwyer Engineering LLC under contract to The Lakeworth Group
Stephen F. Dwyer, PhD, PE
1813 Stagecoach Rd.
Albuquerque, NM 87123
(505) 270-0215

Revision 0

EXECUTIVE SUMMARY

This is the eleventh inspection (Year 3, Quarter 3 - inspection date: March 20, 2019) of the Evapotranspiration (ET) Cover and associated project elements for the Los Alamos County Airport Landfill. The inspections are performed in accordance with the Long-Term Monitoring Plan[1]. The construction of the cover system was completed in July 2016.

All features of the closure are currently in good condition. The vegetation has full coverage although it was dormant during this most recent inspection. All drainage systems are in excellent working condition. There are no erosion issues on the cover or side slopes. There is no biointrusion to date on the new ET Cover. There is localized animal burrowing and a few ant hills on the existing side slopes of the older cover system (north and east of new ET Cover). There was also some burrowing noted in the Debris Disposal Area (DDA) cover. The tension cracks identified along the top of the older landfill side slope north of the ET Cover in the prior inspection was still visible although it had some sediment infill as well as animal burrowing activity within it (Picture 29). No maintenance or repairs are recommended at this time.

Methane monitoring during the reporting period revealed no detectable methane. The water balance monitoring (soil moisture and soil suction) shows infiltration in response to precipitation that moves into the cover profile and subsequently is removed via ET. The infiltrated water in the cover beginning December 27, 2018 into March 2019 has accumulated due to significant snow in addition to snow coverage of the landfill during this period. The snow depth peaked at 28-inches on January 1, 2109 and due to the below average temperatures much of it remained into February 2019. Temperature sensitivity of the probes, especially contrasting winter and summer seasons, has contributed to the initial undulation in the data. Longer term trends will need to be evaluated to better assess the effectiveness of the cover system water balance data.

The settlement survey grid was performed to quantify differential settlement. The annual differential settlement values will be computed and included in each annual report. In general, it appears there was no significant increase in differential settlement across the ET Cover from the prior inspection survey.

[1] Dwyer Engineering. March 2017. Long-Term Monitoring Plan. Los Alamos County Airport Landfill Cover Replacement Solid Waste Management Units 73-001 (a,d) Technical Area 73.

INSPECTION CHECK LIST

Table 1. Long-Term Monitoring Check List for the Los Alamos County Airport Landfill Closure

Site Name: Los Alamos County Airport Landfill Cover Replacement	Date of Inspection: March 20, 2019
City: Los Alamos	Weather: cool, partly cloudy, breezy
State: New Mexico	Temperature: 40s
Agency: Department of Energy	Inspector: Stephen F Dwyer, PhD, PE
Site Element	**Remarks**
ET Cover	
1. Settlement (Low Spots): Yes (X) No ( ) Areal Extent: new ET Cover Depth: varies Repairs Necessary Yes ( ) No (X) If yes, explain	Visual inspection showed that some differential settlement occurred, predominantly soon after placement of the cover. Continued surveying of the site shows that settlement has slowed significantly. There does not appear to be any ponding associated with the settlement to date. The settlement survey grid was performed to quantify differential settlement. The area with the highest differential settlement in past surveys is survey point 34 – center of northern half of cover (Figure 9). The annual differential settlement values will be computed and included in each annual report.
2. Surface Cracks or Stains: Yes (X) No ( ) Length: varies Width: about 1/8-inch Depth: less than an inch Repairs Necessary Yes ( ) No (X) If yes, explain	There was shallow block shaped desiccation cracking in the cover surface due to drying of recent moisture (Picture 28). The cracking is very shallow (less than an inch) and is typical of this soil texture. The cracking is expected to self-heal. Tension cracks along and parallel to the top of the older side slopes of the prescriptive cover system were identified. They appear to be due to prior differential settlement (Pictures 29 and 30). Sediment infill of the cracking was noted with some burrowing activity within the crack. They are consistent with the prior inspection observations – no new cracking or change in size was noted.
3. Erosion: Yes ( ) No (X)	No significant erosion noted to date. The gravel/soil admixture top layer (6-inches thick) referred to as a 'desert pavement' is developing well and appears to be

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: March 20, 2019**
City: Los Alamos	**Weather: cool, partly cloudy, breezy**
State: New Mexico	**Temperature: 40s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	working as designed to minimize erosion. There was some sediment transport along the base of the older side slopes east of the ET Cover (Picture 18). Evidence of surface water runoff in the form of sheet flow was apparent after a significant precipitation inspection performed on March 12, 2019. There were no rills or gullies formed in the area. This area will be watched closely in subsequent inspections. There is no recommended maintenance or repairs required at this time.
4. Biointrusion Holes: Yes (X) No ( ) Areal Extent: minimal Depth: approx. 12-inches Suspected Cause (Rodent or Other): small mammal and ants Repairs Necessary Yes ( ) No (X) If yes, explain	No biointrusion noted on the new ET Cover. There was minimal biointrusion (small animal burrow holes and ant hill) noted on the side slopes of the older prescriptive cover system (Pictures 19 and 29). The biointrusion noted is localized. The amount of burrowing was consistent with that observed in the prior inspection.
5. Vegetation Condition: General Condition progressing as expected: Yes (X) No ( ) If no, explain Issues Observed: Yes ( ) No (X) If yes, explain Repairs Necessary: Yes ( ) No (X) If yes, explain	All vegetation was dormant during this inspection. Vegetation has full coverage on the cover system. The size/height of the vegetation is uneven across the cover (Pictures 1, 2, 4, 5, 6, 14, 15, and 16). The vegetation is predominantly native grasses that were seeded at the conclusion of the construction of the cover system. The grasses vary in height from a few inches to about a foot. The vegetation on the debris disposal area (DDA) (Picture 27) appears relatively mature and consists of grasses generally less than a foot in height. This vegetation was dormant during this inspection. The side slopes of the older prescriptive cover (Pictures 17, 18 and 20) appear mature dominated by grass mixed with forbs. These areas are not mowed due to the steepness of the slope.

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: March 20, 2019**
City: Los Alamos	**Weather: cool, partly cloudy, breezy**
State: New Mexico	**Temperature: 40s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
6. Rill/Gully: Yes ( ) No (X) Areal Extent: NA Depth: NA Suspected Cause: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No erosion noted to date.
7. Wet Areas: Yes (X) No ( ) cover uniformly moist due to precipitation Ponding: Yes ( ) No (X) Areal Extent: full Seeps: Yes ( ) No (X) Areal Extent: NA Soft Subgrade: Yes ( ) No (X) Areal Extent: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The cover was uniformly moist during the inspection due to recent precipitation. No unusual wet areas noted to date on the cover.
8. Slope Instability: Yes ( ) No (X) Areal Extent: NA Suspected Cause: NA Exposed Cover Components: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No slope instability noted to date.
9. Water Balance Instrumentation: Functioning Properly: Yes (X) No ( ) Damage: Yes ( ) No (X) Repairs Necessary Yes ( ) No (X) If yes, explain	Moisture content probes are working and are in good condition to date (Picture 6). The heat dissipation units (HDU) were replaced in March 2017. The instrumentation is showing significant sensitivity to soil temperature variations (summer vs. winter).

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: March 20, 2019**
City: Los Alamos	**Weather: cool, partly cloudy, breezy**
State: New Mexico	**Temperature: 40s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
9. Methane Monitoring Instrumentation: Functioning Properly: Yes (X) No ( ) Damage: Yes ( ) No (X) Repairs Necessary Yes ( ) No (X) If yes, explain	Methane was monitored on March 20, 2019. No methane was detected. Refer to Figure 8 for methane monitoring locations and Pictures 4 and 5 for methane monitoring ports. Methane station 2 that had accidentally been damaged was repaired and in good condition. The area directly north of the new airport hangar pad was restored and reseeded after the completion of the recent utility work (Pictures 3 and 7).
Rip Rap Lined Drainage Channels	
1. Settlement: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Visual inspection revealed no differential settlement to date.
2. Material Degradation: Yes ( ) No (X) Material Type: Rock, geotextile, geomembrane (polyethylene) Areal Extent: NA Degree of Degradation: none Repairs Necessary Yes ( ) No (X) If yes, explain	No material degradation noted to date (Pictures 10, 11, and 12).
3. Erosion: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No erosion noted to date.
4. Undercutting: Yes ( ) No (X) Areal Extent: NA	No undercutting noted to date.

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: March 20, 2019**
City: Los Alamos	**Weather: cool, partly cloudy, breezy**
State: New Mexico	**Temperature: 40s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	
5. Obstructions: Yes ( ) No (X) Type: NA Areal Extent: NA Size: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No obstructions noted to date.
6. Slope Instability: Yes ( ) No (X) Type: NA Areal Extent: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No slope instability noted to date.
7. Siltation: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No siltation noted to date.
8. Drop Inlet Structures: Working Properly Yes (X) No ( ) Condition: good Extent of Damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Drop inlet structures are in good condition.
Concrete Culvert	

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: March 20, 2019**
City: Los Alamos	**Weather: cool, partly cloudy, breezy**
State: New Mexico	**Temperature: 40s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
1. Siltation: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No siltation noted to date (Picture 13).
2. Concrete Condition and Joints General Condition progressing as expected: Yes (X) No ( ) If no, explain Issues Observed: Yes ( ) No (X) If yes, explain Repairs Necessary: Yes ( ) No (X) If yes, explain	Concrete in good condition (Picture 13).
3. Grating Condition: General Condition progressing as expected: Yes (X) No ( ) If no, explain Issues Observed: Yes ( ) No (X) If yes, explain Repairs Necessary: Yes ( ) No (X) If yes, explain	Grating in good condition (Picture 13).
Fencing	
1. Airport Fence Adjacent to Landfill: bent posts: Yes ( ) No (X) loose posts: Yes ( ) No (X) broken links or wire: Yes ( ) No (X) damaged gates: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Airport fencing is in good condition and securing the site (Pictures 9, 23 and 25). This fencing is maintained by the County of Los Alamos. Some of the perimeter fencing along the highway and airport entrance was replaced with a more robust fence (Picture 9).
Retaining Wall	
1.Retaining Wall Condition: General Condition progressing as expected: Yes (X) No ( ) If no, explain	Retaining walls are in good condition. No significant damage or issues were noted (Pictures 22 to 26).

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: March 20, 2019**
City: Los Alamos	**Weather: cool, partly cloudy, breezy**
State: New Mexico	**Temperature: 40s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
2. Retaining Wall Damage Description (if any): Issues Observed: Yes ( ) No (X) If yes, explain	None
3.**Repairs Necessary** Repairs Necessary: Yes ( ) No (X) If yes, explain	None
Permanent Erosion & Sedimentation Control Measures	
1. Rip Rap Berm near Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage or degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The Rip Rap drainage on the side slopes is in good condition (Pictures 18, 20 and 21).
2. Rock Check Dams near Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage, displaced rock, or other damage: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The rock check dams are in good condition (Pictures 23 and 25).
3. Landfill Terrace above Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage, adjunct erosion, slope problem, or other damage/degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (NA) If yes, explain	The landfill terraces above the retaining walls are in good condition (Picture 22).
4. Drainage Channels adjacent to Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage, adjunct erosion, slope problem, or other damage/degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The drainage channels adjacent to the retaining wall appear in good condition (Pictures 23 and 25). Drainage channels appear to be working properly.
5. Gabion above Drainage Channels adjacent to	The gabions above drainage channels adjacent to the

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: March 20, 2019**
City: Los Alamos	**Weather: cool, partly cloudy, breezy**
State: New Mexico	**Temperature: 40s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage or degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	retaining walls are in good condition (Picture 22, 23 and 25).
Site Access	
1. Access Restrictions: Yes (X) No ( ) Description: Secured fence with keyed lock Repairs Necessary Yes ( ) No (X) If yes, explain	The site has controlled access with a security fence and locked gates. Some of the perimeter fencing was replaced with a more robust fence (Picture 9).
Debris Disposal Area (DDA)	
1. Debris Disposal Area Condition Good Condition (X) Poor Condition ( )	The surface of the DDA cover system is in good condition. There is no observed degradation of the site. The vegetation was dormant during this inspection (Picture 27). Vegetation is in good condition and varies in height from a few inches to about a foot. This area is mowed during the summer months by the airport personnel to remain compliant with FAA regulations (vegetation mowed to be less than a foot in height). There was some small mammal burrowing noted on the older cover side slopes. The amount of burrowing is consistent with the prior inspection.
General	
1. Vandalism: Yes ( ) No (X) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	No vandalism noted.
2. Land Use Change:	No land use changes.

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: March 20, 2019**
City: Los Alamos	**Weather: cool, partly cloudy, breezy**
State: New Mexico	**Temperature: 40s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Yes ( ) No (X) Description: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Summary of Recommended Maintenance and/or Repairs	
1. Maintenance / Repairs Necessary Yes ( ) No (X) If yes, explain	Methane port south of new airport hangar (west of landfill) was repaired and is in good condition.
Other	
1. Construction of the new LA County Airport Hangar continues. This is west of the footprint of the landfill. The areas adjacent to this work in the waste removal areas has been reseeded (Pictures 3and 7).	1. This work is west of the landfill and does not affect the performance of the cover or related facilities. 2. There were some tire depressions along the western perimeter of the landfill made by construction equipment during work on the Hangar. These depressions should be filled in with soil meeting cover soil specifications.

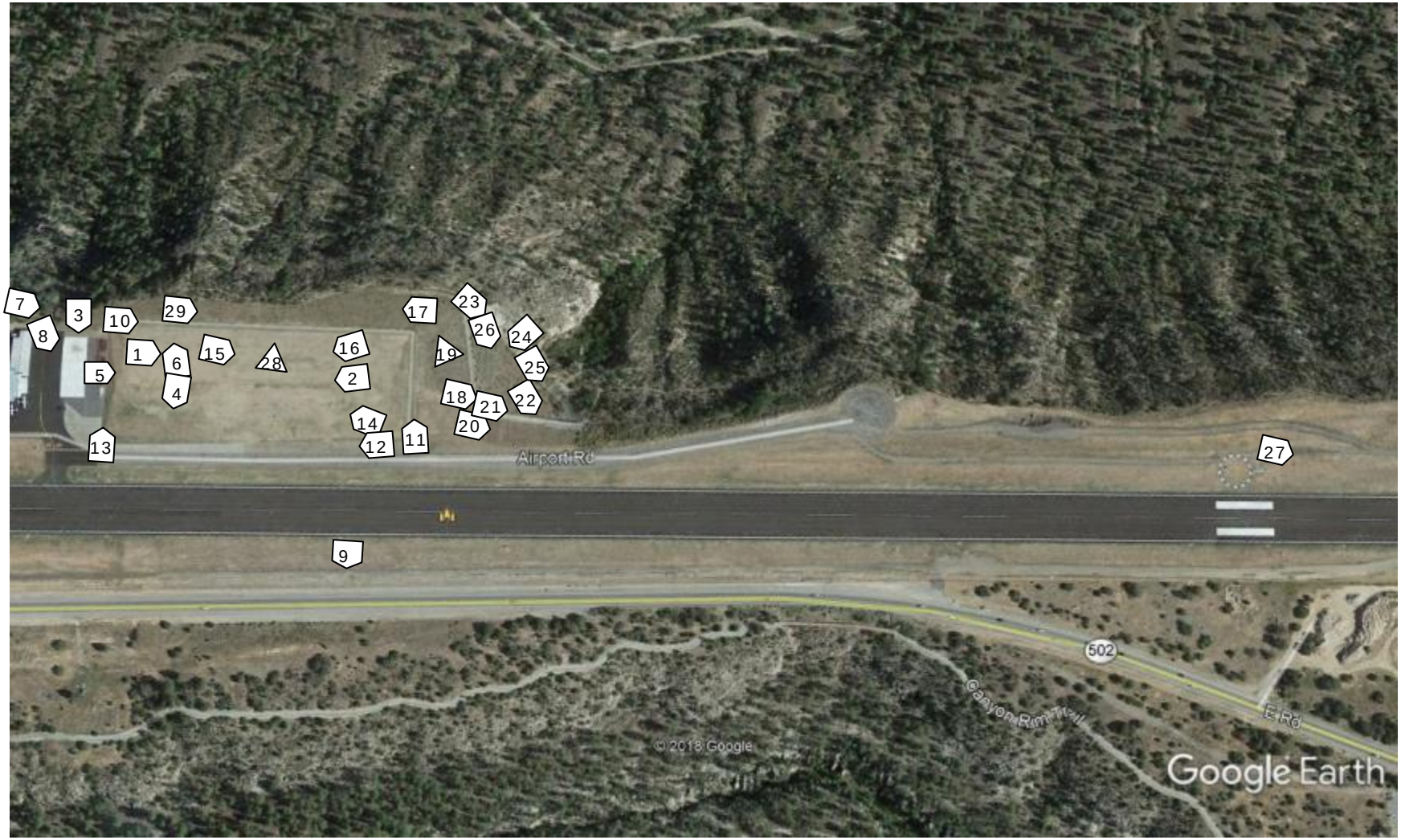


Figure 1. Photo Locations and Direction of Shot

Picture 1. Cover East View

Picture 2. Cover West View

Picture 3. Methane Monitoring Port - West of Landfill, North of New Hangar

Picture 4. Methane Monitoring Port - South Slope of Landfill

Picture 5. West Slope End of Landfill

Picture 6. Water Balance Monitoring Nest - North Slope of Landfill

Picture 7. Completed Utility Work North of New Hangar by Los Alamos County, West of Landfill

Picture 8. New Asphalt and New Airport Hangar - West of Landfill

Picture 9. New Perimeter Fencing Around Airport

Picture 10. Drainage Channel - North Perimeter of ET Cover

Picture 11. Drainage Channel - East Perimeter of ET Cover

Picture 12. Drainage Channel - South Perimeter of ET Cover

Picture 13. Concrete Culvert - West Perimeter of ET Cover

Picture 14. ET Cover - West View

Picture 15. ET Cover – Southeast View

Picture 16. ET Cover - Southwest View

Picture 17. Older Cover Side Slope, North of ET Cover

Picture 18. Side slope East of Landfill

Picture 19. Biointrusion in Older Landfill Side Slope, North of ET Cover

Picture 20. North-facing Side Slope East of Landfill

Picture 21. Sideslope Berm East of Landfill

Picture 22. Gabion Retaining Structure - East End of Landfill

Picture 23. Large Rip Rap Slope and Gabion Retainment Wall - East End of Landfill Site

Picture 24. Concrete Retaining Wall - East End of Landfill

Picture 25. Erosion Control below Concrete Retaining Wall - NE End of Landfill

Picture 26. Side Slopes and Erosion Control, East End of Landfill

Picture 27. Debris Disposal Area

Picture 28. Tension Cracking in Surface of ET Cover

Picture 29. Crack near Top of Side Slope of Older Landfill Cover, North of ET Cover

Picture 30. Aerial View of Airport Landfill (Google Earth)

LONG-TERM MONITORING INSPECTION REPORT

YEAR 3, Quarter 4 ***INSPECTION #12***

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

Inspection Date: June 14, 2019
Report Date: July 22, 2019

prepared for:
Department of Energy
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos Field Office
Los Alamos, NM 87544

prepared by:
Dwyer Engineering LLC under contract to The Lakeworth Group
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Revision 0

EXECUTIVE SUMMARY

This is the twelfth inspection (Year 3, Quarter 4 - inspection dates: June 13 and 14, 2019) of the Evapotranspiration (ET) Cover and associated project elements for the Los Alamos County Airport Landfill. The inspections are performed in accordance with the Long-Term Monitoring Plan[1]. The construction of the cover system was completed in July 2016.

All features of the ET Cover are currently in good condition. The vegetation has full coverage and ranges in height from a few inches to about 2.5-ft. All drainage systems are in excellent working condition. There are no erosion issues on the cover. There is no biointrusion to date on the new ET Cover. There is localized animal burrowing and a few ant hills on the existing side slopes of the older cover system (north and east of new ET Cover). There was also some burrowing noted in the Debris Disposal Area (DDA) cover. The tension cracking identified along the top of the older landfill side slope north of the ET Cover in the prior inspection was still visible although it had some sediment infill as well as animal burrowing activity within it. The small amount of rill erosion at the base of the eastern slope has increased slightly and is recommended to be repaired at this time (Pictures 26 and 27). The rilling is due to concentrated flow created by the geometry of the side slopes.

Methane monitoring during the reporting period revealed no detectable methane. The water balance monitoring (soil moisture and soil suction) shows infiltration in response to precipitation that moves into the cover profile and subsequently is removed via ET. The infiltrated water in the cover beginning December 27, 2018 into March 2019 has accumulated due to significant snow in addition to snow coverage of the landfill during this period. The snow depth peaked at 28-inches on January 1, 2109 and due to the below average temperatures much of it remained through the Spring 2019. Temperature sensitivity of the probes, especially contrasting winter and summer seasons, has contributed to the initial undulation in the data. Longer term trends will need to be evaluated to better assess the effectiveness of the cover system water balance data.

The settlement survey grid was performed to quantify differential settlement. The annual differential settlement values will be computed and included in the annual report. In general, it appears there was no significant increase in differential settlement across the ET Cover from the prior inspection survey.

[1] Dwyer Engineering. March 2017. Long-Term Monitoring Plan. Los Alamos County Airport Landfill Cover Replacement Solid Waste Management Units 73-001 (a,d) Technical Area 73.

INSPECTION CHECK LIST

Table 1. Long-Term Monitoring Check List for the Los Alamos County Airport Landfill Closure

Site Name: Los Alamos County Airport Landfill Cover Replacement	Date of Inspection: June 13 and 14, 2019
City: Los Alamos	Weather: warm, breezy
State: New Mexico	Temperature: 70s
Agency: Department of Energy	Inspector: Stephen F Dwyer, PhD, PE
Site Element	**Remarks**
ET Cover	
1. Settlement (Low Spots): Yes (X) No ( ) Areal Extent: new ET Cover Depth: varies Repairs Necessary Yes ( ) No (X) If yes, explain	Visual inspection showed that some differential settlement occurred, predominantly soon after placement of the cover. Continued surveying of the site shows that settlement has slowed significantly. There is no identified ponding associated with the settlement to date. The settlement survey grid was performed to quantify differential settlement. The area with the highest differential settlement in past surveys is survey point 34 – center of northern half of cover (Figure 9). The annual differential settlement values will be computed and included in each annual report.
2. Surface Cracks or Stains: Yes (X) No ( ) Length: varies Width: about 1/8-inch Depth: less than an inch Repairs Necessary Yes ( ) No (X) If yes, explain	There was some shallow block shaped desiccation cracking in the cover surface due to drying of recent moisture (Picture 28). The cracking is very shallow (less than an inch) and is typical of this soil texture. The cracking is expected to self-heal. Tension cracks along and parallel to the top of the older side slopes of the prescriptive cover system were identified, although much harder to see this inspection. It is presumed to be due to prior differential settlement. Sediment infill of the cracking was noted with some burrowing activity within the crack. They are consistent with the prior inspection observations – no new cracking or change in size was noted.
3. Erosion: ET Cover Yes ( ) No (X)	No significant erosion noted to date. The gravel/soil admixture top layer (6-inches thick) referred to as a 'desert pavement' is developing well and appears to be

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City: Los Alamos	**Weather: warm, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	working as designed to minimize erosion.
Side Slopes of Older Resistive Cover Yes (X) No ( ) Areal Extent: Isolated (Picture 30) Depth: 2-inches Repairs Necessary Yes (X) No ( ) If yes, explain A small set of rills have begun to form in the concentrated flow area of the side slopes east of the ET cover (Picture 30). Because the rills are likely to continue to grow into a gully that could possibly reach the depth of the buried geomembrane in that area (about 2-ft deep); it is recommended that at least two rock check dams be constructed along the concentrated flow line to reduce the water runoff velocity and thus mitigate the potential for future erosion.	The majority of the side slopes are in excellent condition with no signs of erosion. There was some isolated sediment transport along the base of the older side slope east of the ET Cover (Pictures 26 and 27) where flows are concentrated (Picture 30). The rills in this area should be repaired with preventive measures taken to slow the runoff water velocities in this concentration area.
4. Biointrusion Holes: Yes (X) No ( ) Areal Extent: minimal Depth: approx. 12-inches Suspected Cause (Rodent or Other): small mammal and ants Repairs Necessary Yes ( ) No (X) If yes, explain	No biointrusion noted on the new ET Cover. There was minimal biointrusion (small animal burrow holes and ant hills) noted on the side slopes of the older prescriptive cover system (Picture 19). The biointrusion identified is localized. The amount of burrowing was consistent with that observed in the prior inspection.
5. Vegetation Condition: General Condition progressing as expected: Yes (X) No ( ) If no, explain Issues Observed: Yes ( ) No (X) If yes, explain Repairs Necessary: Yes ( ) No (X) If yes, explain	The vegetation has increased in size from the prior inspection. Vegetation has full coverage on the cover system. The size/height of the vegetation is uneven across the cover (Pictures 1, 2, 4, 5, 9, 14, 15, and 16). The vegetation is predominantly native grasses that were seeded at the conclusion of the construction of the cover system. The grasses vary in height from a few inches to about 2.5-ft. Some clover and alfalfa have emerged on

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: June 13 and 14, 2019**
City: Los Alamos	**Weather: warm, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
	the cover (Picture 9). The vegetation on the debris disposal area (DDA) (Picture 29) appears relatively mature and consists of grasses generally less than a foot in height – due to consistent mowing. This vegetation was dormant during this inspection. The side slopes of the older prescriptive cover (Pictures 17, 18 and 20) appear mature dominated by grass mixed with forbs. These areas are not mowed due to the steepness of the slope.
6. Rill/Gully: **ET Cover** Yes ( ) No (X) Areal Extent: NA Depth: NA Suspected Cause: NA Repairs Necessary Yes ( ) No (X) If yes, explain **Side Slopes of Older Resistive Cover** Yes (X) No ( ) Areal Extent: Isolated (Picture 30) Depth: 2-inches Repairs Necessary Yes (X) No ( ) If yes, explain A small set of rills have begun to form in the concentrated flow area of the side slopes east of the ET cover (Picture 30). Because the rills are likely to continue to grow into a gully that could possibly reach the depth of the buried geomembrane in that area (about 2-ft deep); it is recommended that at least two rock check dams be constructed along the concentrated flow line to reduce the water runoff velocity and thus mitigate the potential for	None The majority of the side slopes are in excellent condition with no signs of rills or gullies. There was some isolated sediment transport along the base of the older side slope east of the ET Cover (Pictures 26 and 27) where flows are concentrated (Picture 30). The rills in this area should be repaired with preventive measures taken to slow the runoff water velocities in this concentration area.

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: June 13 and 14, 2019**
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State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
future erosion.	
7. Wet Areas: Yes ( ) No (X) Ponding: Yes ( ) No (X) Areal Extent: NA Seeps: Yes ( ) No (X) Areal Extent: NA Soft Subgrade: Yes ( ) No (X) Areal Extent: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The cover was uniformly dry during the inspection. No unusual wet areas noted to date on the cover.
8. Slope Instability: Yes ( ) No (X) Areal Extent: NA Suspected Cause: NA Exposed Cover Components: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No slope instability noted to date.
9. Water Balance Instrumentation: Functioning Properly: Yes (X) No ( ) Damage: Yes ( ) No (X) Repairs Necessary Yes ( ) No (X) If yes, explain	Moisture content probes are working and are in good condition to date (Picture 6). The heat dissipation units (HDU) were replaced in March 2017. The instrumentation is showing significant sensitivity to soil temperature variations (summer vs. winter).
9. Methane Monitoring Instrumentation: Functioning Properly: Yes (X) No ( ) Damage: Yes ( ) No (X) Repairs Necessary Yes ( ) No (X) If yes, explain	Methane monitoring was performed on June 14, 2019. No methane was detected. Refer to Figure 8 for methane monitoring locations and Pictures 3 and 4 for methane monitoring ports. The area directly north of the new airport hangar pad was restored and reseeded after the completion of the recent utility work (Pictures 3 and 7).
Rip Rap Lined Drainage Channels	

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City: Los Alamos	**Weather: warm, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
1. Settlement: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Visual inspection revealed no differential settlement to date.
2. Material Degradation: Yes ( ) No (X) Material Type: Rock, geotextile, geomembrane (polyethylene) Areal Extent: NA Degree of Degradation: none Repairs Necessary Yes ( ) No (X) If yes, explain	No material degradation noted to date (Pictures 10, 11, and 12).
3. Erosion: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No erosion noted to date.
4. Undercutting: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No undercutting noted to date.
5. Obstructions: Yes ( ) No (X) Type: NA Areal Extent: NA Size: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No obstructions noted to date.

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: June 13 and 14, 2019**
City: Los Alamos	**Weather: warm, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
6. Slope Instability: Yes ( ) No (X) Type: NA Areal Extent: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No slope instability noted to date.
7. Siltation: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No siltation noted to date.
8. Drop Inlet Structures: Working Properly Yes (X) No ( ) Condition: good Extent of Damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Drop inlet structures located within the drainage channel adjacent to the south side of the ET Cover are in good condition.
Concrete Culvert	
1. Siltation: Yes ( ) No (X) Areal Extent: NA Depth: NA Repairs Necessary Yes ( ) No (X) If yes, explain	No siltation noted to date (Picture 13).
2. Concrete Condition and Joints General Condition progressing as expected: Yes (X) No ( ) If no, explain Issues Observed: Yes ( ) No (X) If yes, explain Repairs Necessary: Yes ( ) No (X) If yes, explain	Concrete in good condition (Picture 13).

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Site Element	**Remarks**
3. Grating Condition: General Condition progressing as expected: Yes (X) No ( ) If no, explain Issues Observed: Yes ( ) No (X) If yes, explain Repairs Necessary: Yes ( ) No (X) If yes, explain	Grating in good condition (Picture 13).
Fencing	
1. Airport Fence Adjacent to Landfill: bent posts: Yes ( ) No (X) loose posts: Yes ( ) No (X) broken links or wire: Yes ( ) No (X) damaged gates: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	Airport fencing is in good condition and securing the site (Picture 23). This fencing is maintained by the County of Los Alamos. Some of the perimeter fencing along the highway and airport entrance was replaced with a more robust fence.
Retaining Wall	
1.Retaining Wall Condition: General Condition progressing as expected: Yes (X) No ( ) If no, explain	Retaining walls are in good condition. No significant damage or issues were noted (Pictures 22 to 25).
2. Retaining Wall Damage Description (if any): Issues Observed: Yes ( ) No (X) If yes, explain	None
3.**Repairs Necessary** Repairs Necessary: Yes ( ) No (X) If yes, explain	None
Permanent Erosion & Sedimentation Control Measures	
1. Rip Rap Berm near Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage or degradation: Yes ( ) No (X) Description of damage: NA	The Rip Rap drainage on the side slopes is in good condition (Pictures 18and 20).

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Site Element	**Remarks**
Repairs Necessary Yes ( ) No (X) If yes, explain	
2. Rock Check Dams near Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage, displaced rock, or other damage: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The rock check dams are in good condition (Pictures 23 and 25).
3. Landfill Terrace above Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage, adjunct erosion, slope problem, or other damage/degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (NA) If yes, explain	The landfill terraces above the retaining walls are in good condition (Picture 22).
4. Drainage Channels adjacent to Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage, adjunct erosion, slope problem, or other damage/degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The drainage channels adjacent to the retaining wall appear in good condition (Pictures 23 and 25). Drainage channels appear to be working properly.
5. Gabion above Drainage Channels adjacent to Retaining Wall: Functional Yes (X) No ( ) if no, describe locations Damage or degradation: Yes ( ) No (X) Description of damage: NA Repairs Necessary Yes ( ) No (X) If yes, explain	The gabions above drainage channels adjacent to the retaining walls are in good condition (Picture 23 and 25).
Site Access	
1. Access Restrictions: Yes (X) No ( ) Description: Secured fence with keyed lock	The site has controlled access with a security fence and locked gates. Some of the perimeter fencing was replaced with a more robust fence.

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: June 13 and 14, 2019**
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State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Repairs Necessary Yes ( ) No (X) If yes, explain	
Debris Disposal Area (DDA)	
1. Debris Disposal Area Condition Good Condition (X) Poor Condition ( )	The surface of the DDA cover system is in good condition. There is no observed degradation of the site. The vegetation was in very good condition during this inspection (Picture 29). Vegetation is in good condition and varies in height from a few inches to about one foot. This area is mowed during the summer months by the airport personnel to remain compliant with FAA regulations (vegetation mowed to be less than a foot in height). There was some small mammal burrowing noted on the older cover side slopes. The amount of burrowing is consistent with the prior inspection.
General	
1. Vandalism: Yes ( ) No (X) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	No vandalism noted.
2. Land Use Change: Yes ( ) No (X) Description: Repairs Necessary Yes ( ) No ( ) If yes, explain	No land use changes.
Summary of Recommended Maintenance and/or Repairs	
1. Maintenance / Repairs Necessary Yes (X) No ( ) If yes, explain	The isolated rill erosion at the base of the eastern side slope – east of the landfill should be repaired (Pictures 25 and 26). Recommend preventive measures be taken to slow the runoff velocity of water in this area (Picture 30).

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Inspection: June 13 and 14, 2019**
City: Los Alamos	**Weather: warm, breezy**
State: New Mexico	**Temperature: 70s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
Site Element	**Remarks**
Other	
1. Construction of the new LA County Airport Hangar was completed. This is west of the footprint of the landfill. The areas adjacent to this work in the waste removal areas has been reseeded (Pictures 3and 7).	1. This work is west of the landfill and does not affect the performance of the cover or related facilities. 2. There were some tire depressions along the western perimeter of the landfill made by construction equipment during work on the Hangar. . Picture 5 shows the area with the tire depressions – the western slope of the ET Cover adjacent to the concrete culvert. These depressions should be filled in with soil meeting cover soil specifications.

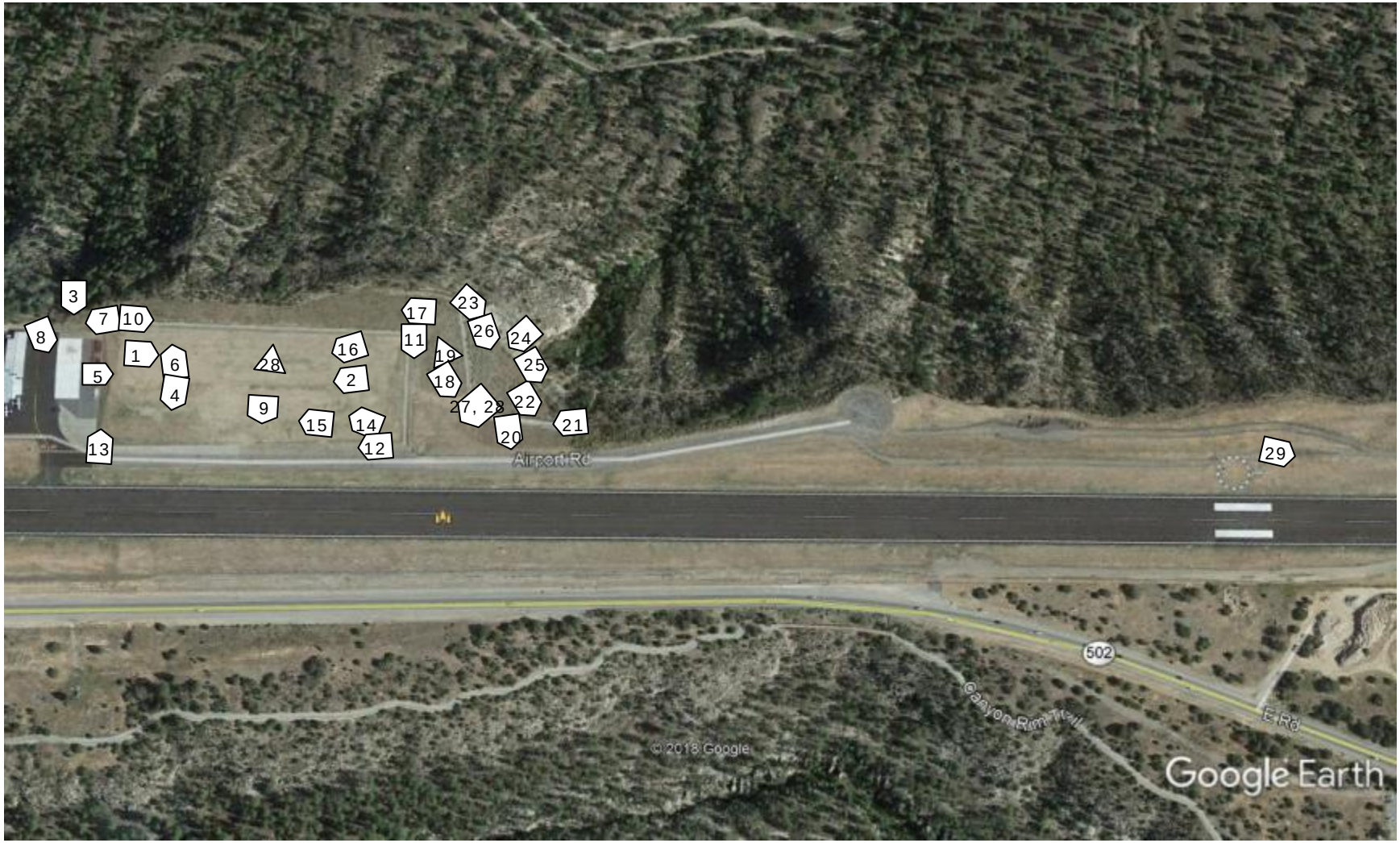


Figure 1. Photo Locations and Direction of Shot

Picture 1. Cover East View

Picture 2. Cover West View

Picture 3. Methane Monitoring Port - West of Landfill, North of New Hangar

Picture 4. Methane Monitoring Port - South Slope of Landfill

Picture 5. West Slope End of Landfill

Picture 6. Water Balance Monitoring Nest - North Slope of Landfill

Picture 7. Completed Utility Work North of New Hangar by Los Alamos County, West of Landfill

Picture 8. New Asphalt and New Airport Hangar - West of Landfill

Picture 9. Clover and Alfalfa Vegetation Emergence

Picture 10. Drainage Channel - North Perimeter of ET Cover

Picture 11. Drainage Channel - East Perimeter of ET Cover

Picture 12. Drainage Channel - South Perimeter of ET Cover

Picture 13. Concrete Culvert - West Perimeter of ET Cover

Picture 14. ET Cover - Northwest View

Picture 15. ET Cover – West View

Picture 16. ET Cover - Southwest View

Picture 17. Older Cover Side Slope, North of ET Cover

Picture 18. Side slopes East of Landfill

Picture 19. Biointrusion (Ant Hill) in Older Landfill Side Slope, North of ET Cover

Picture 20. North-facing Side Slope East of Landfill

Picture 21. Sideslope Berm East of Landfill

Picture 22. Gabion Retaining Structure - East End of Landfill

Picture 23. Large Rip Rap Slope and Concrete Retainment Wall - East End of Landfill Site

Picture 24. Concrete Retaining Wall - East End of Landfill

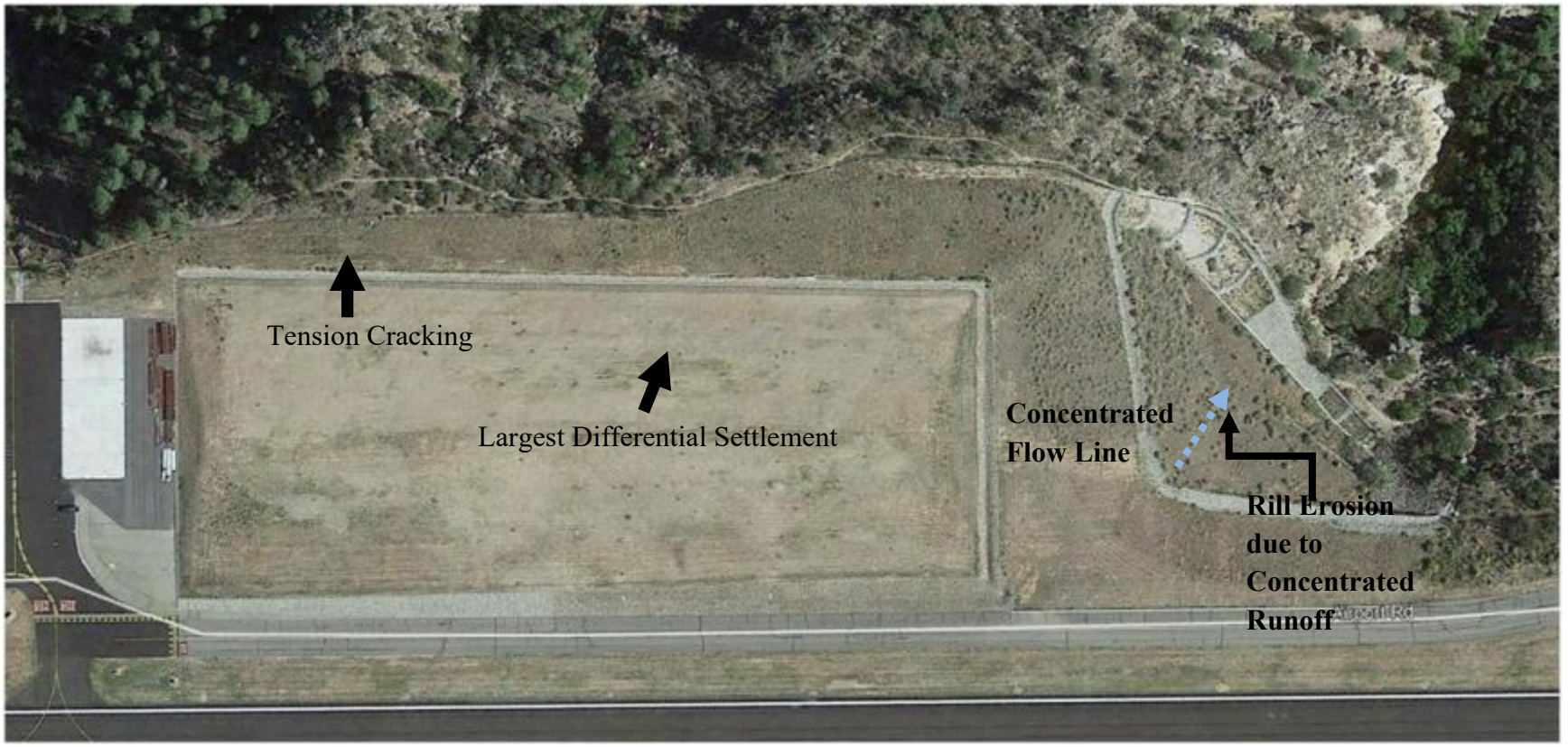
Picture 25. Erosion Control below Concrete Retaining Wall - NE End of Landfill

Picture 26. Rill Erosion, Base of East Slope @ End of Landfill

Picture 27. Rilling at Base of Eastern Slope – East of Landfill

Picture 28. Tension Cracking in Surface of ET Cover

Picture 29. Debris Disposal Area



Picture 30. Aerial View of Airport Landfill (Google Earth)

Attachment B

Water Balance Data

WATER BALANCE MONITORING SUMMARY

The moisture content probes data was collected and summarized in this report (Figures 1 and 2). The probes were installed on August 29, August 30, and September 4, 2016. Figure 7 shows the monitoring point locations. Figure 3 contains the available daily precipitation events for comparison of the response to infiltration reflected in the moisture probe data.

The moisture content probes reveal that infiltrated moisture due to precipitation quickly dries shortly after (Figures 1 and 2). There also appears to be some sensitivity of the moisture content measurements to soil temperature (especially noted in variation of winter and summer months). This data will take multiple seasons to analyze and better understand the water balance trends in the cover system.

Heat dissipation units (HDU) were replaced on May 18, 2017. These probes measure the matric potential or soil suction in the soil cover system at various depths. Collected data to date is shown in Figures 4 and 5. Figure 6 contains the available daily precipitation events for comparison to response of the soil suction data. Figure 7 shows the monitoring point locations.

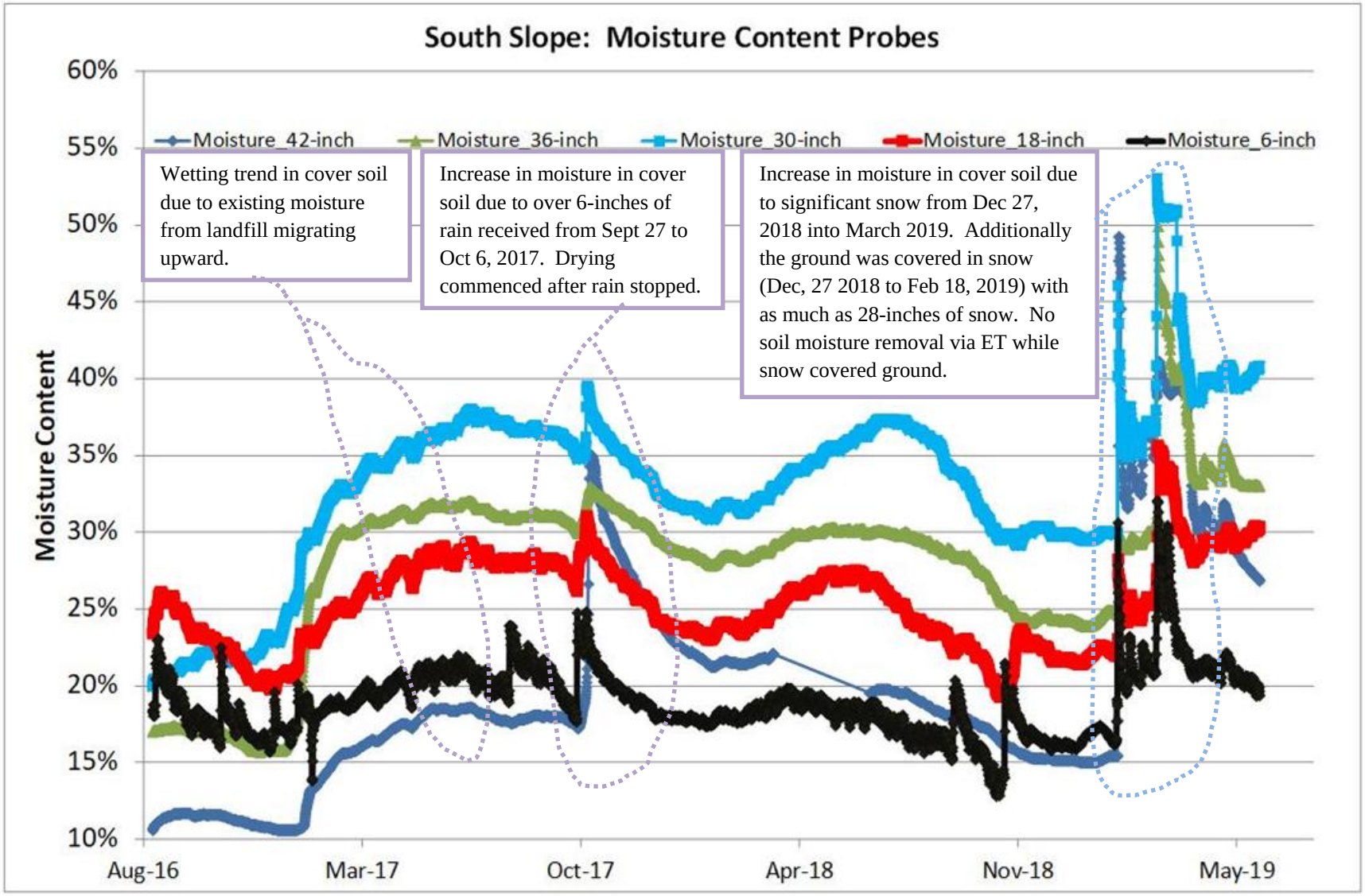


Figure 1. Moisture Probe Data (September 2016 to June 2019) - ET Cover South Slope

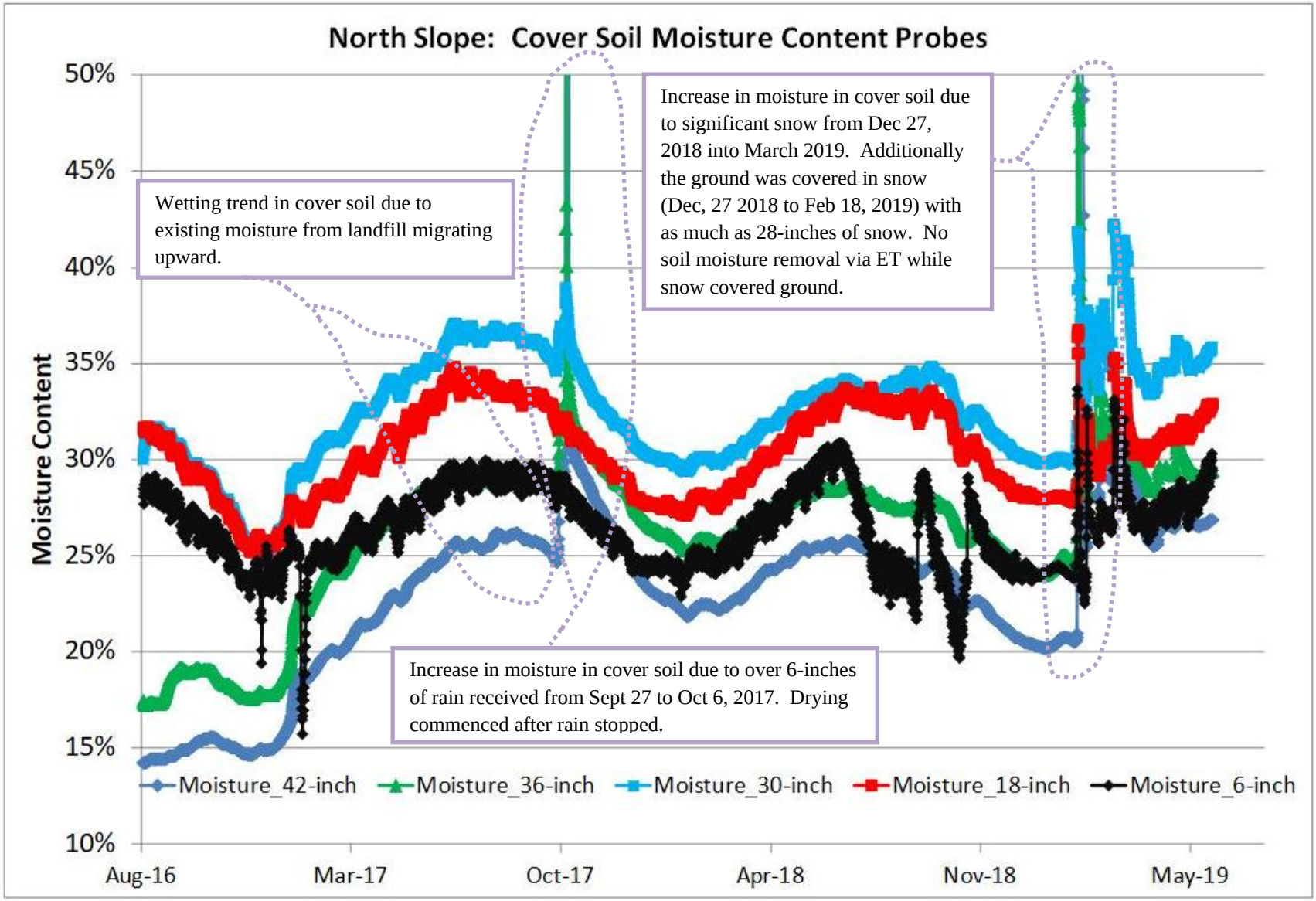


Figure 2. Moisture Probe Data (September 2016 to June 2019) - ET Cover North Slope

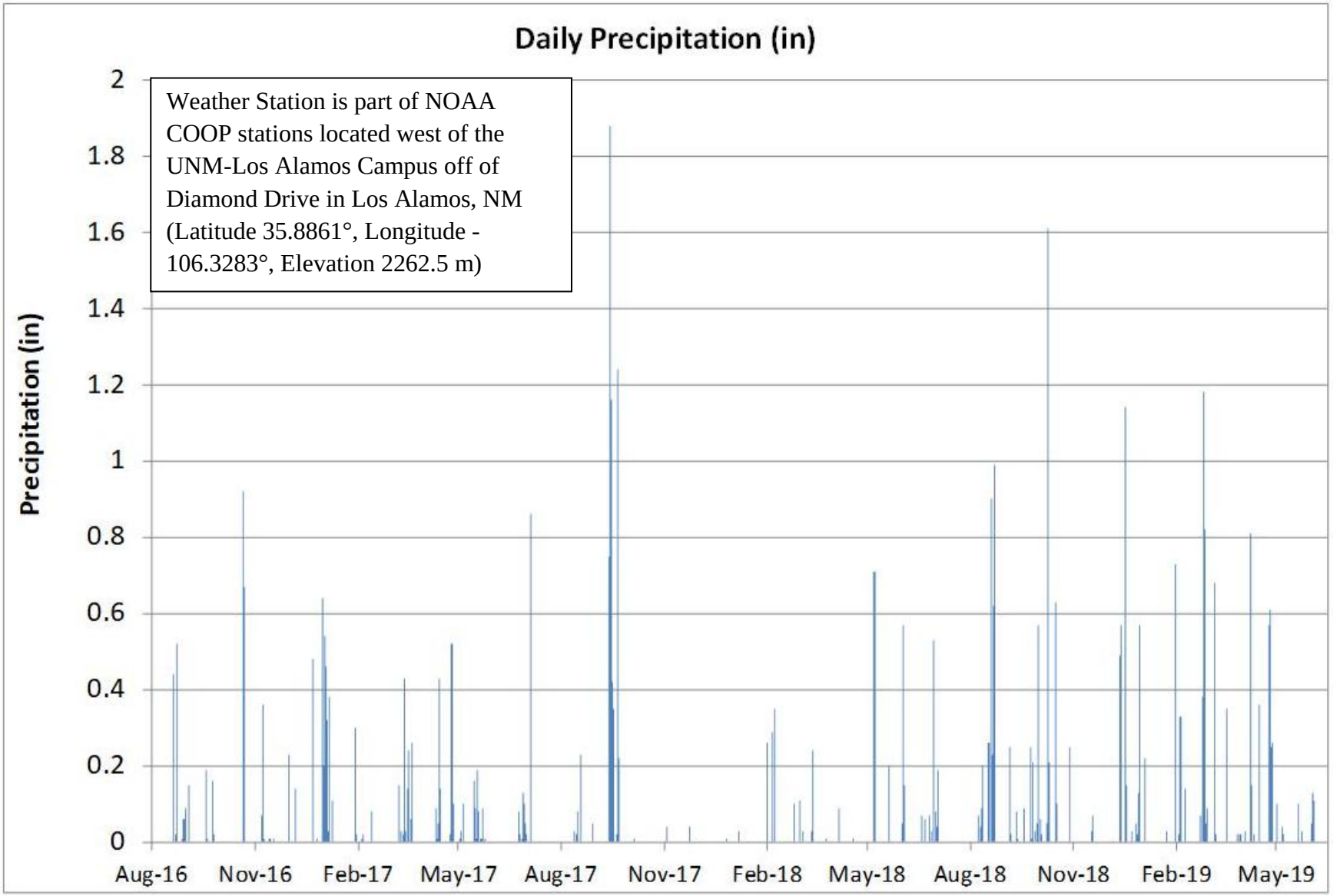


Figure 3. Daily Precipitation (Sept 2016 to June 2019)

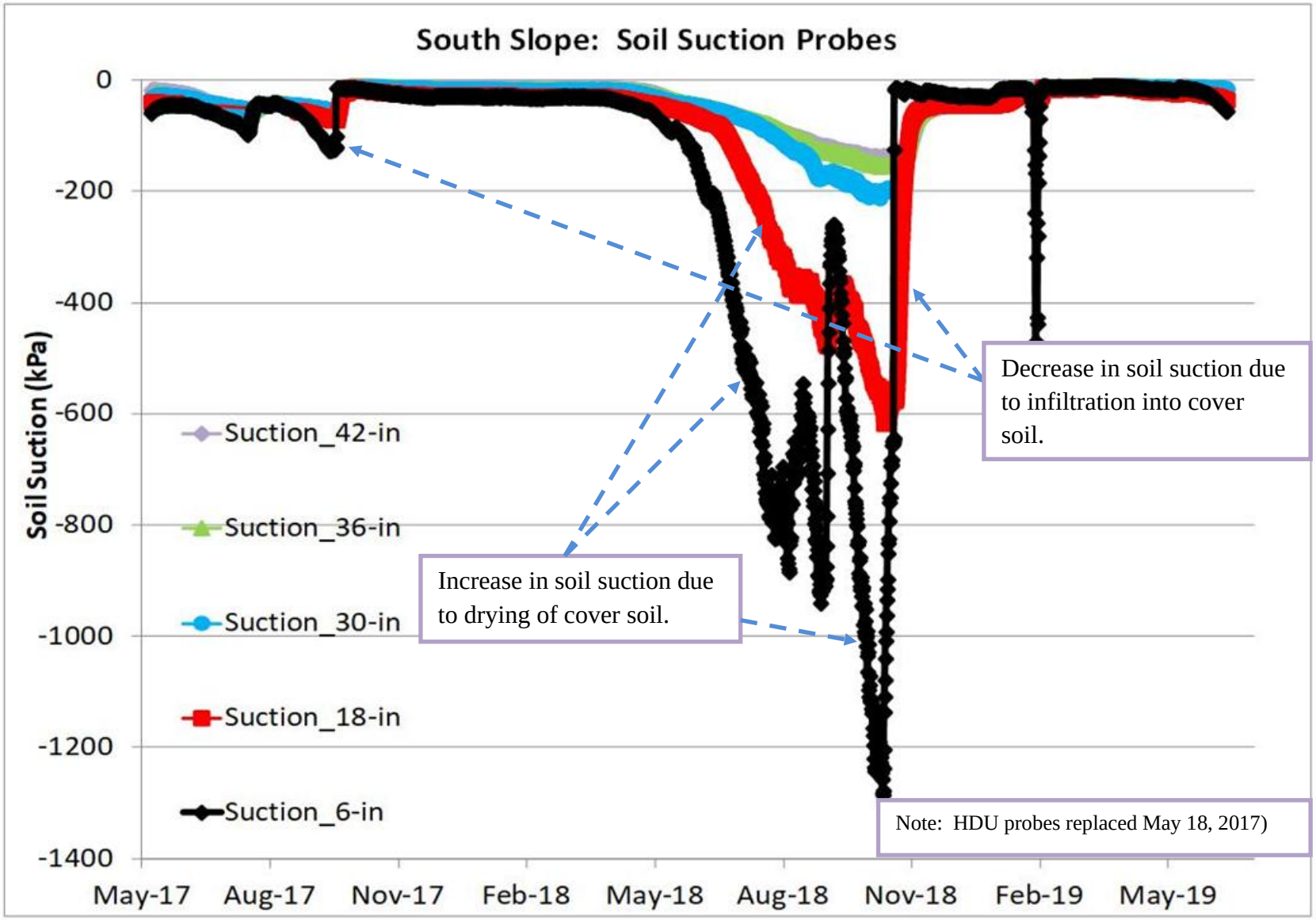


Figure 4. HDU Data (May 2017 to June 2019) - ET Cover South Slope

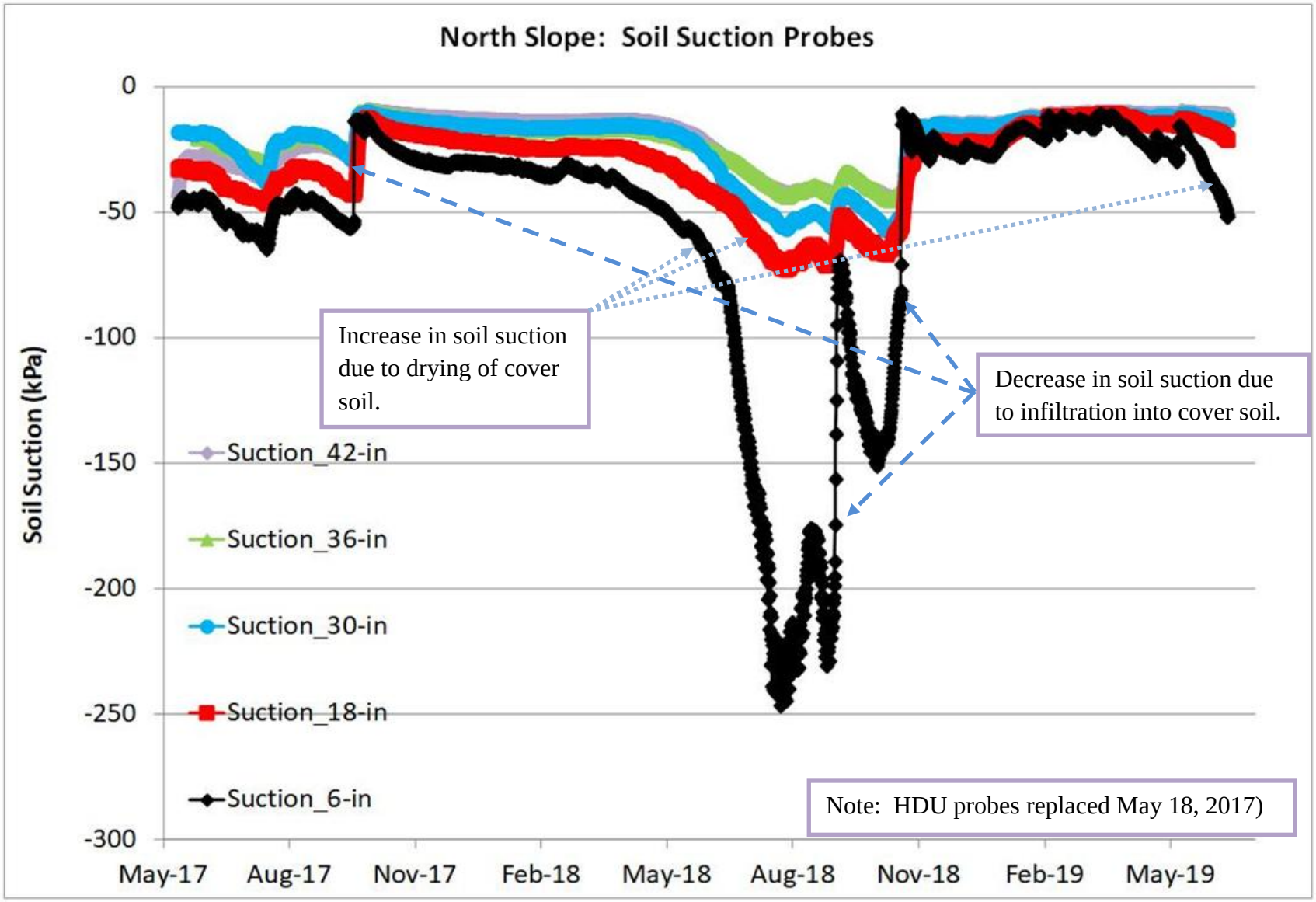


Figure 5. HDU Data (May 2017 to June 2019) - ET Cover North Slope

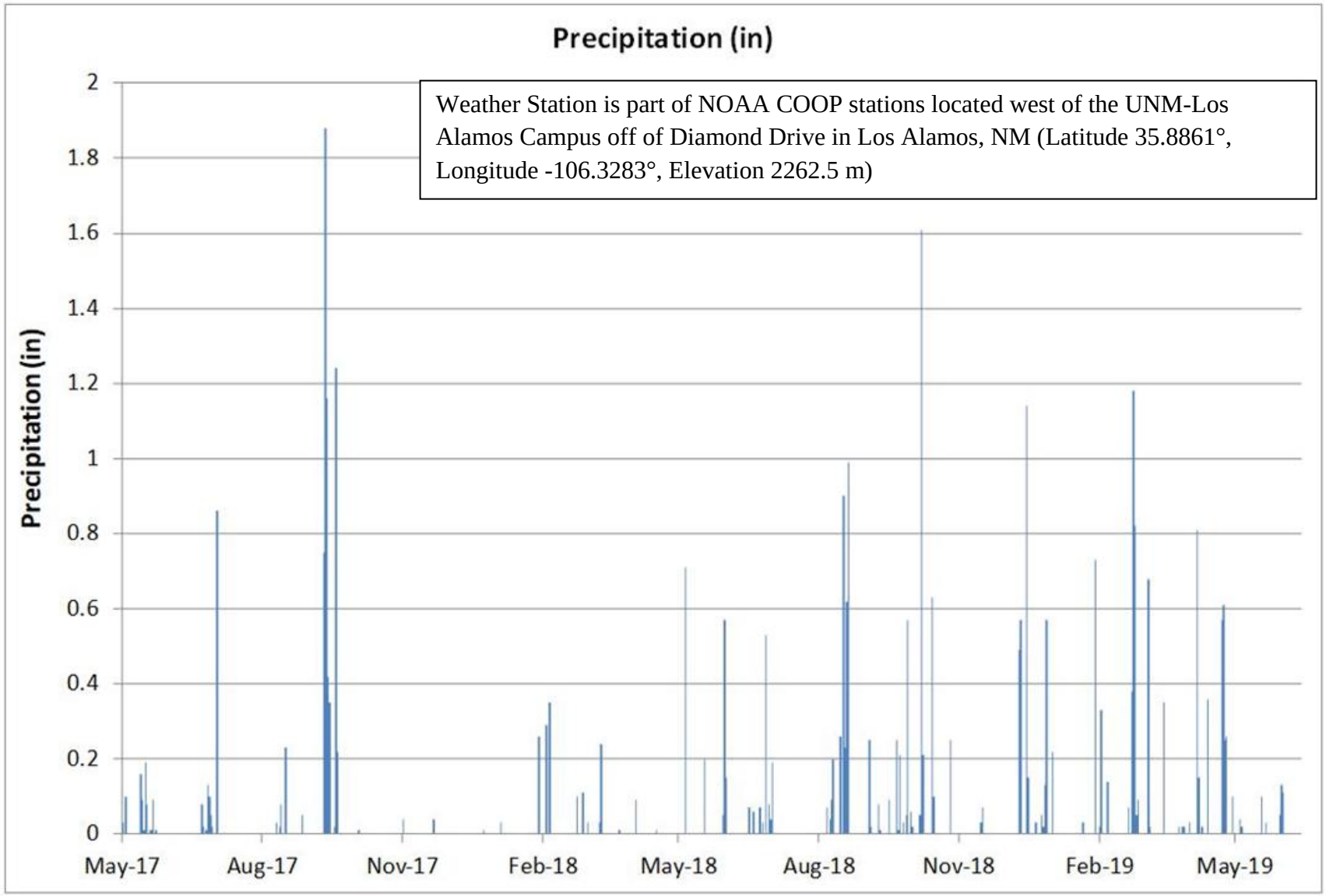


Figure 6. Precipitation (May 2017 to June 2019)

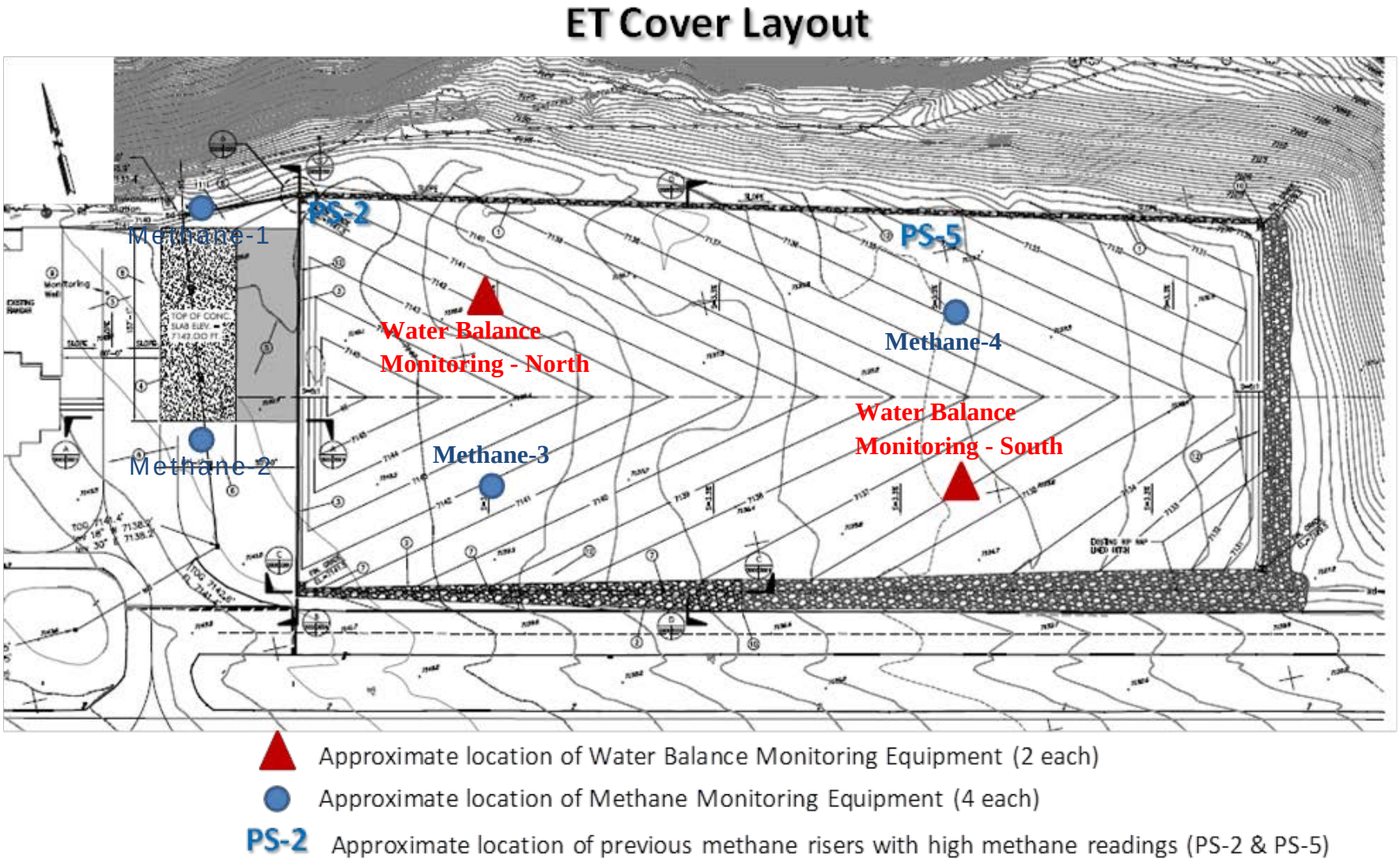


Figure 7. Methane and Water Balance Probe Monitoring Locations

Attachment C

Methane Monitoring Data

1. Methane Monitoring Summary Table
2. Methane Monitoring Field Notes

METHANE MONITORING

Table 1. Methane Monitoring Readings

Site Name: Los Alamos County Airport Landfill Cover Replacement				
City: Los Alamos	State: New Mexico			
Agency: Department of Energy	Inspector: Stephen F Dwyer			
Date	Methane Monitoring Station (units are % of lower explosive limit)			
	Methane-1	Methane-2	Methane-3	Methane-4
September 27, 2018	0	0	0	0
December 2, 2018	0	0	0	0
March 20, 2019	0	0	0	0
June 14, 2019	0	0	0	0

July 13, 2018
- 8:30 am
- Wind N @ 3 mph
- 30.37 pressure (in)
- 66°F clear
0% LEL @ all methane locations

September 27, 2018
- 9:15 am
- Wind Calm
- 30.30 pressure (in)
- 53°F clear
0% LEL @ all methane locations

December 02, 2018
- 4:15 pm
- Wind N 5 mph
- 30.11 pressure (in)
- 30°F Partly Cloudy
0% LEL @ all methane locations

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March 20, 2019 SAD 3/20/19
- 12:15 pm
- Wind E @ 5 mph
- 30.34 pressure (in)
- 46°F - clear to partly cloudy
0% LEL @ all methane locations

June 14, 2019 SAD 6/14/19
~ 10:10 am
~ Wind calm
~ 30.31 pressure (in)
~ 71°F ~ clear
0% LEL @ all methane locations

Attachment D

Inspection Reports after Significant Precipitation Events

There were no exceedances of the established 1 in/hr precipitation intensity criterion during this monitoring period. However, there were above average precipitation and multiple precipitation events that followed one another during the monitoring period and thus the site was inspected after each of these occurrences.

Inspection dates:

1. August 26, 2018
2. March 15, 2019
3. April 29, 2019
4. July 17, 2019

Los Alamos County Airport Cover Replacement Inspection Report after a Significant Precipitation Event

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Event: August 19, 2018** **Date of Inspection: August 26, 2018**
City: Los Alamos	**Weather during Inspection: sunny, clear**
State: New Mexico	**Temperature during Inspection: 80s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**

Event: The weather station at the airport is still not working. Precipitation on August 19, 2018 per the Weather Underground available online for Los Alamos, NM stated that between 12:30pm to 1:30 pm 4.3-inches of rainfall was measured. This large amount is likely inaccurate given that the 100-year, 1-hour precipitation event is only 2.17 in/hr. The airport manager was contacted and asked if a large rainfall event occurred. He said it did rain, but estimated it was much less than 4.3-inches.

Subsequent review of all stations available though NOAA for the Los Alamos area, the largest reading on August 19, 2018 was 0.1 inches of rainfall for the entire day.

Element	Inspection Remarks
1. ET Cover	No erosion or damage noted
2. Cover Side Slopes directly adjacent to the ET Cover	No erosion or damage noted
3. Surface Water Drainage Ditches	No erosion or damage noted
4. Debris Disposal Area	No erosion or damage noted
5. Eastern Side Slopes near Concrete Retaining Walls	No erosion or damage noted
6. Retaining Walls	No erosion or damage noted
7. Surface Water Control Features below and adjacent to Retaining Wall	No erosion or damage noted

Pictures

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Event: August 19, 2018** **Date of Inspection: August 26, 2018**
City: Los Alamos	**Weather during Inspection: sunny, clear**
State: New Mexico	**Temperature during Inspection: 80s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**

Figure 1. Cover - East View

Figure 2. Cover – West View

Figure 3. Eastern Slope of ET Cover

Figure 4. Side Slope of Older Cover adjacent to Taxiway

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Event: August 19, 2018** **Date of Inspection: August 26, 2018**
City: Los Alamos	**Weather during Inspection: sunny, clear**
State: New Mexico	**Temperature during Inspection: 80s**
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Figure 5. Side Slope of Older Cover – East of ET Cover	Figure 6. Retaining Walls & Lower Erosion Control Measures

Los Alamos County Airport Cover Replacement Inspection Report after a Significant Precipitation Event

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Event: March 12, 2019** **Date of Inspection: March 15, 2019**
City: Los Alamos	**Weather during Inspection: sunny, clear**
State: New Mexico	**Temperature during Inspection: 40s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**

Event: Precipitation recorded near the site on March 12, 2019 exceeded 0.25-inch in less than half an hour. There have been multiple significant precipitation events during the prior couple of months in the form of snow that did not exceed the intensity criteria.

Maintenance or Repairs Required: none

Element	Inspection Remarks
1. ET Cover	No erosion or damage noted. Soil was very wet due to the recent rain and snow (melted prior to inspection).
2. Cover Side Slopes directly adjacent to the ET Cover	No erosion or damage noted
3. Surface Water Drainage Ditches	No erosion or damage noted
4. Debris Disposal Area	No erosion or damage noted
5. Eastern Side Slopes above Concrete Retaining Walls	The older eastern side slope just above the interceptor trench that directs the water toward the north had some sediment movement due to sheet flow. There were no rills or gullies formed. The sediment is evident above and adjacent to the interceptor trench (Figure 4). This is in an area where the vegetation is not as mature as the adjacent area directly to the north. The amount of sediment is not considered significant and does not require maintenance at this time.
6. Retaining Walls	No erosion or damage noted
7. Surface Water Control Features below and adjacent to Retaining Wall	No erosion or damage noted
Pictures	

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Event: March 12, 2019** **Date of Inspection: March 15, 2019**
City: Los Alamos	**Weather during Inspection: sunny, clear**
State: New Mexico	**Temperature during Inspection: 40s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**

Figure 1. South Drainage Trench Adjacent to ET Cover

Figure 2. North Drainage Trench Adjacent to ET Cover

Figure 3. Older Eastern Slope of ET Cover

Figure 4. Base Eastern Side Slope of Older Cover above North Interceptor Trench

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Event: March 12, 2019** **Date of Inspection: March 15, 2019**
City: Los Alamos	**Weather during Inspection: sunny, clear**
State: New Mexico	**Temperature during Inspection: 40s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**
	
Figure 5. ET Cover and Adjacent Drainage trenches – NW View	Figure 6. Eastern Side Slopes

Storm Water Tracking System Precipitation Report

Precipitation Report (Filtered Results)										
Measurement date between 03/12/2019 and 03/12/2019										
Rain Gage	Measurement Date	Total Precipitation (inches)	Qualifier Code	Qualifier Reason Code	Thirty Minute Max Intensity	Days Since Last Rain	Duration (hours)	Duration Qualifier	Duration Qualifier Reason	Comments
RG-NCOM	03/12/2019	0.78	A		0.27	1	5.25	A		"ImpWM. 30Max 0.27 began 13:45 on 03/12/2019. Rain, hail, and snow mix."
RG-TA-06	03/12/2019	0.77	A		0.27	1	5.5	A		"ImpWM. 30Max 0.27 began 13:30 on 03/12/2019. Rain, hail, and snow mix."
RG-TA-49	03/12/2019	0.88	A		0.27	1	6.0	A		"ImpWM. 30Max 0.27 began 15:00 on 03/12/2019. Rain, hail, and snow mix."
RG-TA-53	03/12/2019	0.62	A		0.16	1	4.5	A		"ImpWM. 30Max 0.16 began 15:00 on 03/12/2019. Rain, hail, and snow mix."
RG-TA-54	03/12/2019	0.49	A		0.23	1	4.25	A		"ImpWM. 30Max 0.23 began 14:00 on 03/12/2019. Rain, hail, and snow mix."

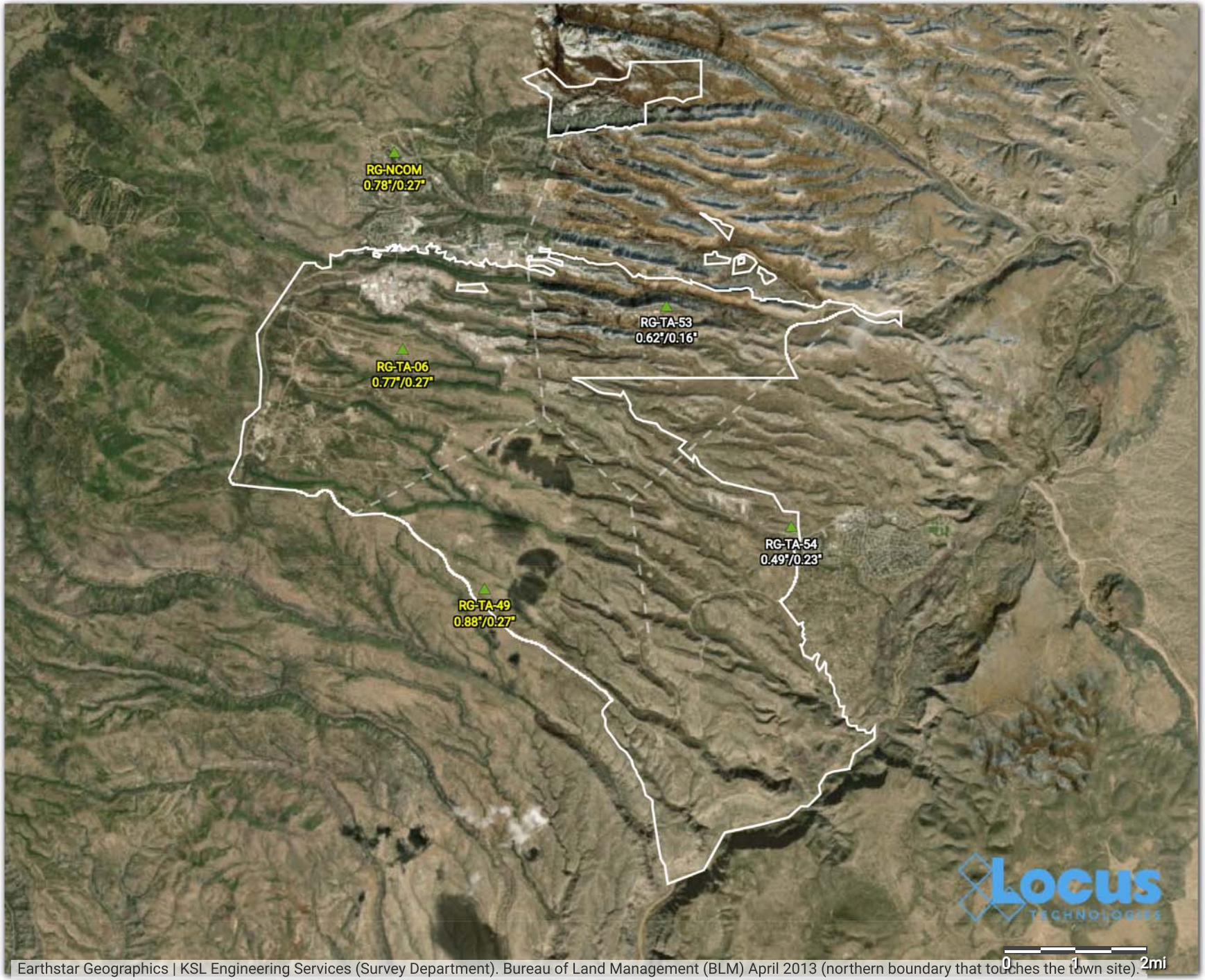
Los Alamos NATIONAL LABORATORY EST.1943

Water Quality Database
Storm Water Tracking System
Precipitation Report

sw_precip_rpt_MAR_13_2019.pdf

03/12/2019

MAR 12, 06:05 to MAR 13, 06:00



Legend

Laboratory Boundary

Meteorological Tower

Values =
Total/Max 30 Min. Intensity

Values in **YELLOW** indicate
Max 30 Min. Intensity >= 0.25"

ND = No data available

All precipitation units are in inches

Earthstar Geographics | KSL Engineering Services (Survey Department). Bureau of Land Management (BLM) April 2013 (northern boundary that touches the town site).

Los Alamos County Airport Cover Replacement Inspection Report after a Significant Precipitation Event (4-22-19)

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Event: April 22, 2019** **Date of Inspection: April 29, 2019**
City: Los Alamos	**Weather during Inspection: partly cloudy, light rain**
State: New Mexico	**Temperature during Inspection: 60s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**

Event: Precipitation recorded near the site on April 22, 2019 recorded 0.84-inches of precipitation for the day although the intensity was below the established threshold.

Maintenance or Repairs Required: none

Element	Inspection Remarks
1. ET Cover	No erosion or damage noted. Soil was moist due to the recent rain.
2. Cover Side Slopes directly adjacent to the ET Cover	No erosion or damage noted
3. Surface Water Drainage Ditches	No erosion or damage noted
4. Debris Disposal Area	No erosion or damage noted
5. Eastern Side Slopes above Concrete Retaining Walls	The older eastern landfill side slope just above the interceptor trench that directs the water toward the north had some sediment movement due to sheet flow ((Picture 5, Figure 1). A small rill has begun to form in this area where it appears the sheet flow concentrates due to the topography (Picture 6, Figure 1). The rill is very small and not an issue at this time – no immediate maintenance or repairs recommended at this time. The vegetation is beginning to grow and spread in this area. The area will continue to be monitored in subsequent inspections, if the maturation of vegetation does not slow the runoff velocities and mitigate soil loss in this area, an engineered fix will be recommended.
6. Retaining Walls	No erosion or damage noted
7. Surface Water Control Features below and adjacent to Retaining Wall	No erosion or damage noted

Pictures

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Event: April 22, 2019** **Date of Inspection: April 29, 2019**
City: Los Alamos	**Weather during Inspection: partly cloudy, light rain**
State: New Mexico	**Temperature during Inspection: 60s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**

Picture 1. South Drainage Trench Adjacent to ET Cover

Picture 2. North Drainage Trench Adjacent to ET Cover

Picture 3. Older Northern Side Slope of Landfill

Picture 4. Erosion Control Features East of Landfill

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Event: April 22, 2019** **Date of Inspection: April 29, 2019**
City: Los Alamos	**Weather during Inspection: partly cloudy, light rain**
State: New Mexico	**Temperature during Inspection: 60s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**

Picture 5. Evidence of Soil Loss on Eastern Landfill Side Slope

Picture 6. Small Rill Forming at Base of Eastern Landfill Side Slope

Figure 1. Aerial View of Los Alamos Airport Landfill

Storm Water Tracking System Precipitation Report

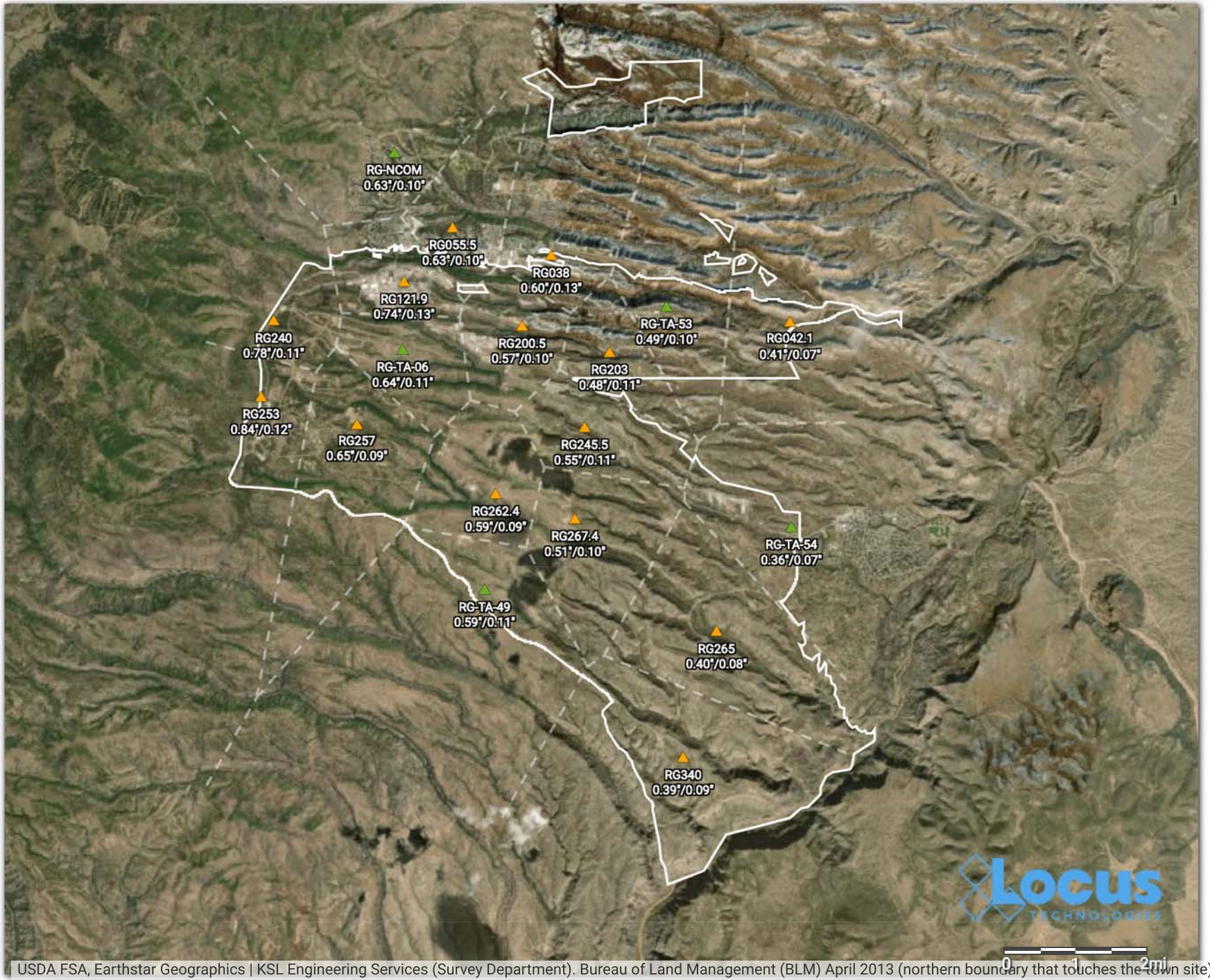
Precipitation Report (Filtered Results)										
Measurement date between 04/22/2019 and 04/22/2019										
Rain Gage	Measurement Date	Total Precipitation (inches)	Qualifier Code	Qualifier Reason Code	Thirty Minute Max Intensity	Days Since Last Rain	Duration (hours)	Duration Qualifier	Duration Qualifier Reason	Comments
RG-NCOM	04/22/2019	0.63	A		0.1	5	8.5	A		ImpWM. 30Max 0.10 began 23:15 on 04/22/2019.
RG-TA-06	04/22/2019	0.64	A		0.11	5	8.0	A		ImpWM. 30Max 0.11 began 23:00 on 04/22/2019.
RG-TA-49	04/22/2019	0.59	A		0.11	5	7.5	A		ImpWM. 30Max 0.11 began 22:45 on 04/22/2019.
RG-TA-53	04/22/2019	0.49	A		0.1	5	6.75	A		ImpWM. 30Max 0.10 began 23:00 on 04/22/2019.
RG-TA-54	04/22/2019	0.36	A		0.07	9	5.75	A		ImpWM. 30Max 0.07 began 23:00 on 04/22/2019.
RG038	04/22/2019	0.6	A		0.13	5	4.16	A		ImpHYD. 30Max 0.13 began 22:55 on 04/22/2019.
RG042.1	04/22/2019	0.41	A		0.07	5	3.33	A		ImpHYD. 30Max 0.07 began 22:40 on 04/22/2019.
RG055.5	04/22/2019	0.63	A		0.1	5	4.58	A		ImpHYD. 30Max 0.1 began 22:55 on 04/22/2019.
RG121.9	04/22/2019	0.74	A		0.13	5	5.33	A		ImpHYD. 30Max 0.13 began 22:50 on 04/22/2019.
RG200.5	04/22/2019	0.57	A		0.1	5	3.91	A		ImpHYD. 30Max 0.1 began 20:10 on 04/22/2019.
RG203	04/22/2019	0.48	A		0.11	5	3.41	A		ImpHYD. 30Max 0.11 began 22:50 on 04/22/2019.
RG240	04/22/2019	0.78	A		0.11	5	5.41	A		ImpHYD. 30Max 0.11 began 22:45 on 04/22/2019.
RG245.5	04/22/2019	0.55	A		0.11	5	3.66	A		ImpHYD. 30Max 0.11 began 20:05 on 04/22/2019.
RG253	04/22/2019	0.84	A		0.12	5	5.33	A		ImpHYD. 30Max 0.12 began 22:15 on 04/22/2019.
RG257	04/22/2019	0.65	A		0.09	4	4.5	A		ImpHYD. 30Max 0.09 began 22:50 on 04/22/2019.
RG262.4	04/22/2019	0.59	A		0.09	5	4.16	A		ImpHYD. 30Max 0.09 began 22:55 on 04/22/2019.
RG265	04/22/2019	0.4	A		0.08	5	3.0	A		ImpHYD. 30Max 0.08 began 22:35 on 04/22/2019.
RG267.4	04/22/2019	0.51	A		0.1	5	3.5	A		ImpHYD. 30Max 0.1 began 20:00 on 04/22/2019.
RG340	04/22/2019	0.39	A		0.09	5	2.75	A		ImpHYD. 30Max 0.09 began 22:35 on 04/22/2019.

Water Quality Database
Storm Water Tracking System
Precipitation Report

sw_precip_rpt_APR_23_2019.pdf

04/22/2019

APR 22, 06:05 to APR 23, 06:00



USDA FSA, Earthstar Geographics | KSL Engineering Services (Survey Department). Bureau of Land Management (BLM) April 2013 (northern boundary that touches the town site).

Legend

- Laboratory Boundary
- Watercourse
- Meteorological Tower

Values =
Total/Max 30 Min. Intensity

Values in **YELLOW** indicate
Max 30 Min. Intensity >= 0.25"

ND = No data available

All precipitation units are in inches

Los Alamos County Airport Cover Replacement Inspection Report after a Significant Precipitation Event (7-17-19)

Site Name: Los Alamos County Airport Landfill Cover Replacement	**Date of Event: July 7 to 15, 2019** **Date of Inspection: July 17, 2019**
City: Los Alamos	**Weather during Inspection: sunny, warm**
State: New Mexico	**Temperature during Inspection: 80s**
Agency: Department of Energy	**Inspector: Stephen F Dwyer, PhD, PE**

Event: Multiple thunderstorms recorded near the site from July 7 to July 15, 2019 were well below the 1 in/hr intensity value required to inspect the site. However, the site was inspected to investigate the condition of the rill erosion area previously identified (April 22, 2019 Significant Precipitation Report) at the base of the eastern slope of the landfill.

Maintenance or Repairs Required: It is advised at this time that the immediate area affected be reinforced against future erosion.

Element	Inspection Remarks
1. ET Cover	No erosion or damage noted. Soil was dry during inspection.
2. Cover Side Slopes directly adjacent to the ET Cover	No erosion or damage noted
3. Surface Water Drainage Ditches	No erosion or damage noted
4. Debris Disposal Area	No erosion or damage noted
5. Eastern Side Slopes above Concrete Retaining Walls	A second rill has formed in the area near where the original rill formed (Picture 1 to 3, Figure 1). Refer to Significant Precipitation Event Report dated April 22, 2019. The older eastern landfill side slope just above the interceptor trench that directs the water toward the north had some sediment movement due to sheet flow ((Picture 3, Figure 1). It is recommended an erosion control measure be installed to mitigate future erosion.
6. Retaining Walls	No erosion or damage noted
7. Surface Water Control Features below and adjacent to Retaining Wall	No erosion or damage noted

Picture 1. New Rill Erosion noted at Base of Eastern Landfill Slope

Picture 2. Close-up of Rill Erosion

Picture 3. Sediment in Riprap at Base of Slope

Figure 1. Aerial View of Los Alamos Airport Landfill

Attachment E

Differential Settlement Monitoring

Survey Dates corresponding to Quarterly Inspections:

1.	Year 3, Quarter 1	Inspection 9	October 1, 2018
2.	Year 3, Quarter 2	Inspection 10	December 1, 2018
3.	Year 3, Quarter 3	Inspection 11	March 20, 2019
4.	Year 3, Quarter 4	Inspection 12	June 14, 2019

Survey Data Summary[1]						
Survey Point	Elevation – feet above sea level					Cumulative Settlement (ft)[1]
	10/1/2018	12/1/2018	3/20/2019	6/14/2019		
1	7141.08	7141.39	7141.30	7141.28		0.13
2	7141.39	7141.42	7141.38	7141.41		0.09
3	7141.37	7141.26	7141.27	7141.32		0.12
4	7141.40	7141.22	7141.29	7141.35		0.15
5	7141.34	7142.47	7141.07	7141.09		0.17
6	7140.98	7140.71	7140.65	7140.68		0.11
7	7144.03	7144.00	7144.02	7143.98		0.08
8	7146.26	7146.30	7146.30	7146.32		0.10
9	7143.32	7143.37	7143.36	7143.33		0.07
10	7140.45	7140.47	7140.44	7140.41		0.13
11	7139.47	7139.49	7139.40	7139.33		0.22
12	7142.60	7142.72	7142.66	7142.72		0.01
13	7145.24	7145.29	7145.24	7145.22		0.07
14	7141.83	7141.85	7141.76	7141.76		0.26
15	7139.33	7139.34	7139.27	7139.30		0.12
16	7138.10	7138.07	7138.10	7138.10		0.15
17	7141.26	7141.30	7141.10	7141.23		0.17
18	7143.85	7143.90	7143.86	7143.82		0.17
19	7140.62	7140.65	7140.49	7140.59		0.17
20	7137.45	7137.41	7137.31	7137.29		0.46
21	7137.13	7137.16	7137.13	7137.11		0.10
22	7139.84	7139.88	7139.84	7139.84		0.12
23	7142.90	7142.92	7142.87	7142.83		0.13
24	7139.74	7139.72	7139.65	7139.64		0.26
25	7136.47	7136.49	7136.40	7136.37		0.33
26	7136.30	7136.27	7136.24	7136.23		0.23
27	7138.43	7138.54	7138.48	7138.46		0.23
28	7141.37	7141.40	7141.37	7141.34		0.18
29	7138.67	7138.66	7138.59	7138.61		-0.03
30	7135.13	7135.14	7135.08	7135.09		0.21
31	7134.82	7135.03	7134.75	7135.05		0.15
32	7137.33	7137.41	7137.37	7137.36		0.15
33	7139.99	7140.05	7140.01	7139.98		0.24
34	7136.93	7136.97	7136.92	7136.94		1.12
35	7134.14	7134.18	7134.22	7134.20		0.05
36	7134.13	7134.21	7134.22	7134.17		0.13
37	7136.41	7136.48	7136.43	7136.41		0.18
38	7138.43	7138.49	7138.44	7138.45		0.17
39	7135.75	7135.80	7135.76	7135.77		0.08
40	7132.71	7132.70	7132.67	7132.75		0.03
41	7132.91	7132.86	7132.84	7132.82		0.22

Survey Data Summary[1]					
Survey Point	Elevation – feet above sea level				Cumulative Settlement (ft)[1]
	10/1/2018	12/1/2018	3/20/2019	6/14/2019	
42	7135.01	7135.05	7135.03	7135.08	0.12
43	7137.04	7137.14	7137.14	7137.10	0.18
44	7134.41	7134.44	7134.37	7134.43	0.13
45	7131.85	7131.84	7131.82	7131.86	0.03
46	7131.65	7131.69	7131.68	7131.67	0.24
47	7133.97	7134.05	7134.05	7134.08	0.04
48	7135.94	7135.97	7135.94	7135.99	0.07
49	7133.15	7133.23	7133.15	7133.27	0.02
50	7130.65	7130.70	7130.63	7130.66	0.15
51	7130.31	7130.38	7130.34	7130.38	0.10
52	7132.14	7132.14	7132.18	7132.19	0.08
53	7134.42	7134.50	7134.44	7134.49	0.11
54	7132.24	7132.26	7132.30	7132.25	0.13
55	7129.15	7129.21	7129.25	7129.22	0.15
56	7128.94	7128.95	7128.92	7128.93	0.15
57	7130.27	7130.27	7130.30	7130.26	0.14
58	7129.64	7129.62	7129.81	7129.74	0.01
59	7129.61	7129.50	7129.48	7129.55	0.04
60	7128.75	7128.79	7128.67	7128.72	0.18

[1] There is a small amount of variability in these measurements due to the manual surveys completed. The negative value in the cumulative settlement column is due to this variability. This simply indicates there has been no settlement in this area and the survey rod may have been placed on a small rock or plant adjacent to the survey marker when sited.

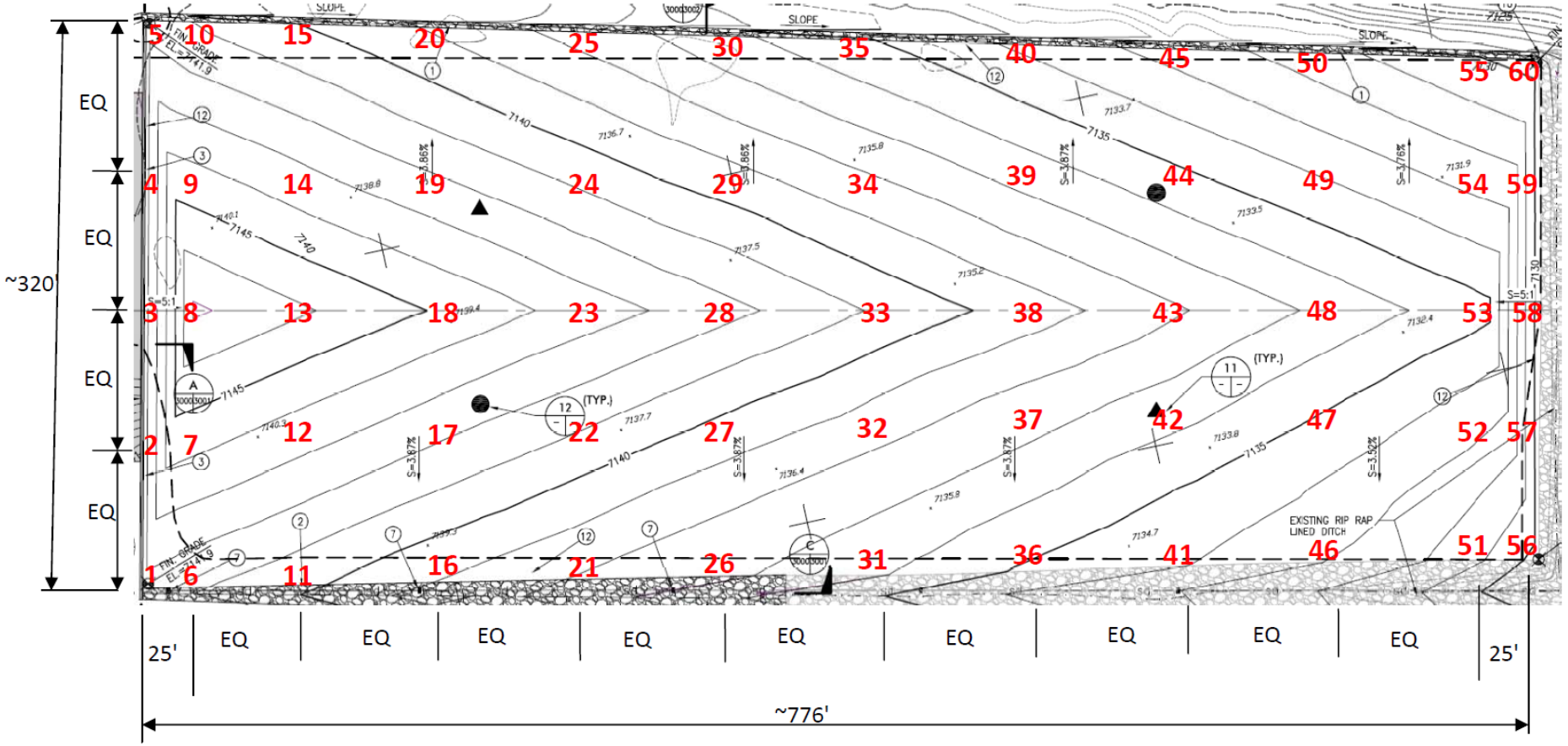


Figure 1. Survey Locations on ET Cover