

Rosebud Power Plant Annual Engineer's Inspection Report



Prepared for Rosebud Operating Services, Inc.
by Allied Engineering Services, Inc.
2018 Report
Posted: January 18, 2019



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INTRODUCTION

This annual engineer's report presents Allied Engineering's inspection of the CCR landfill and assessment of the landfill operations for the Rosebud Power Plant in Rosebud County, Montana in order to fulfill the requirements of the CCR rule as published in the Federal Register on April 17, 2015 and July 2, 2015 and its effective date of October 19, 2015. The applicable rule section is 40 CFR Parts 257 and 261. The landfill in this report holds inert hydrated fly ash, which is solid and nearly impermeable to water, similar to concrete. This report follows the same format as the previous Engineer's Annual Inspection Reports.

The project site is located approximately seven miles north of the town of Colstrip, Montana in the southwest quarter of Section 29 and the northwest quarter of Section 32 Township 3 North, Range 41 East (Latitude 45.978859°, Longitude -106.663772° (WGS 84)). Maps of current existing conditions are included in Appendix A. The landfill serves an on-site Power Plant owned by Colstrip Energy Limited Partnership (CELP). The Power Plant and the landfill are operated by Rosebud Operating Services, Inc.

The landfill area covered by this report is an active landfill located on the subject property. There is also a closed landfill, last used in October 2005, that has since been reclaimed in general accordance with permits and regulations at the time. This closed landfill is not subject to regulation by the above referenced rules and is not the subject of this report. The active landfill includes Phase I and Phase II of a contiguous landfill permitted in 1996 and placed in service in October 2005. This active landfill is subject to regulation by the above referenced CCR rules.

The information contained herein is based on an investigation and analysis of the property's topographical and subsurface conditions, a review of existing permits, regulatory requirements, maps and literature for the project area as related to the landfilling operations of combusted coal residuals (CCR), more familiarly referred to as fly ash. The purpose of this report is to assess existing conditions, fulfill the Engineer's Annual Inspection requirements of the CCR rule, and provide recommendations for the ongoing landfilling operations.

BACKGROUND

Rosebud Power Plant is a waste coal burning facility using a fluidized bed reactor. During the burning process of the coal, fly ash or combusted coal residuals (CCR) are produced. The CCR are either sold for commercial/industrial purposes or landfilled on-site near the power plant. The active landfill, consisting of two phases, is located northwest of the power plant. Construction of Phase 1 was completed and began receiving ash when the now retired landfill was closed. Construction of Phase 2 was initiated in the first week of September 2015, completed in December 2015, and has been receiving Ash since the spring of 2016. Ash has continued to be deposited in both phases but is currently placed primarily in Phase 2. Once the ash surface in Phase 2 reaches the ash surface elevation of Phase 1, the two phases will be operated as one continuous surface.

In 1996, Chandler Geotechnical, Inc. (a predecessor to Allied Engineering Services, Inc.) was hired as a sub-consultant to JSM, Inc. to provide engineering analysis and design of the current active landfill (Phases 1 and 2). During the initial construction of Phase 1, the planned landfill footprint/area was reduced. Over the course of operations at the plant, fly ash was sold in certain years; thus, the amount of fly ash placed in the Phase 1 area was less than anticipated with the original design and has not yet reached its maximum storage capacity. These changes resulted in the need for minor modifications of

the original design of the landfill area. Phase 2 modifications began in September of 2015 and were completed in December of 2015. Construction was completed for Phase 2 of the active landfill in general conformance with the original 1996 design with modifications undertaken during construction under the direction of Allied Engineering Services, Inc. The active landfill modifications were designed to store the rest of the expected volume of 635,897 CY (at the time of the redesign, late 2015/early 2016) for the remainder of the anticipated lifetime of the power plant. This volume assumed that no fly ash will be sold and was considered a conservative value. This volume is also less than the originally designed and permitted ash quantity. The original design had a final storage volume of approximately 2,200,000 CY and the revised design will have a total storage volume of approximately 1,300,000 CY.

REGULATORY SETTING

As of April 17, 2015, new rules for coal combustion residuals (CCR) were published in the Federal Register Volume 80, Number 74, dated Friday April 17, 2015. The applicable sections include 40 CFR Parts 257 and 261. These rules spell out the conditions for existing operating CCR landfills such as the active landfill at the Rosebud Power Plant. The rules provide location restrictions, structural stability assessment requirements, groundwater monitoring requirements, surface water protection, design and operating criteria, along with inspection requirements.

The power plant is currently operating under several permits that include protection criteria for air, surface water, and groundwater quality. Permits include:

- Montana Ground Water Pollution Control System (MGWPCS) Permit No. MTX000052
- Multi-Sector General Permit for Storm Water Discharges Associated with Industrial Activity. Permit No. MTR000058
- Air Quality Permit No. #2035-06

The applicable requirements of the current CCR rule cover active CCR landfills and exclude closed landfills.

EXISTING CONDITIONS

This annual inspection report details the operation efforts of ash placement, landfill construction and maintenance, monitoring of the drainage piping system and groundwater at the Active Landfill's Phase 1 and 2. With the power plant running normally this year, after last year's shut-down, approximately 6,780 tons (~6,439 CY) of fly ash was sold and not placed in the Phase 2 Landfill from 11/14/2017 to 9/19/2018. This time-period is the time between site quantity surveys for the annual inspection (309 days).

An effort was made to complete the design and planning for the Reclamation of some problem areas on the Phase 1 Landfill Slope (see Appendix A). This project was not constructed in 2018.

EXISTING CONDITIONS AND ANNUAL ENGINEER'S INSPECTION REPORT

The following section quotes the requirements of the EPA CCR rule with the findings from the Engineer's Annual Inspection written as a response to each. The EPA CCR rule excerpts are listed in *italics*. Responses are provided in **bold**.

§257.64 Unstable Areas

- a) *An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.*

As demonstrated in the 2015 Annual Engineer's Inspection Report, this CCR landfill is not located in an unstable area.

- b) *The owner or operator must consider all of the following factors, at a minimum, when determining whether an area is unstable.*
 - 1) *On-site or local soil conditions that may result in significant differential settling;*

Differential settlement within the landfill was not observed. The design and construction included the removal of topsoil and 5-feet of subsoil prior to placement of fly ash. The construction sequencing with haul truck traffic provided a compaction effort of the subsoil. The base of the Phase 2 area of the active landfill was compacted by a vibratory roller before ash placement. Pozzolanic characteristics of hydrated fly ash provide a relatively strong mass of material that distributes the load evenly across the landfill footprint. Point load tests of hydrated ash core samples were completed by Ray Womack in 1992 on the retired CCR landfill. The results of the testing indicated compressive strength values comparable to a weak rock or concrete. The shear stresses exerted at depth by the weight of the ash landfill are proportional to the steepness and the height of the finished slope, and to the unit weight of the landfill materials. Due to the gentle overall finished side slopes of 3H:1V (considering the 10' wide benches) and the low density of the ash (about 80 pounds per cubic foot), the ash landfill will exert considerably less stress on the foundation materials than many of the natural slopes in the immediate vicinity of the landfill.

- 2) *On-site or local geologic or geomorphologic features*

The landfill is located in the mapped Lebo member of the Fort Union Formation. As mentioned previously, the relative low-density characteristics of the fly ash distributed over a large area should not exert significant force to the underlying geology. There are no observed or mapped faults in the immediate vicinity of the active landfill. In addition, there is no indication of settlement in the closed landfill located approximately 1,300 feet southeast of the active landfill.

The landfill is characterized as a cross valley fill across two ephemeral swales. The design includes water conveyance under the landfill by way of piping systems with bypass spillways designed to divert water around the perimeter in order to limit oversaturation of vicinity soil. To assure long term drainage stability, the final configuration for closure includes perimeter conveyance of water and abandonment of the piping system under the landfill (See 2016 Annual Engineer's Inspection Report for perimeter conveyance plans).

- 3) *On-site or local human-made features or events (both surface and subsurface).*

The design of the landfill accounted for appropriate side-slopes to limit the likelihood of instabilities. The original design as well as the 2015 design update utilized 3H:1V side slopes for the man-made berms surrounding the landfill area. This side slope is a common and conservative reclamation slope throughout the country, and specifically in the local Colstrip area which includes extensive coal mines.

The active landfill is located across two ephemeral drainages. The original design called for three pipes that convey the natural drainage of the active landfill site. The main drainage covers an area of 103 acres with a secondary drainage covering an area of 16 acres. The original design utilized a HDPE dual wall corrugated pipe. The reason for the selection of this pipe was for its flexibility which would cause bridging of the soil in a deep bury situation. The 2015 design update continued the use of an HDPE pipe, but selected a steel-reinforced HDPE pipe for added stability. The storm water conveyance pipes themselves are likely the most vulnerable element in the landfill system in terms of long term stability (in the event of a pipe failure). As stated previously, a surface conveyance system will replace the current piping system around the time of landfill closure.

- c) *The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.*

The landfill area was designed by a professional engineer. Additionally, this report serves as Allied Engineering Services, Inc.'s certification that the landfill is not situated in an unstable area.

- d) *The owner or operator of the CCR unit must complete the demonstration required by paragraph (a) of this section by the date specified in either paragraph (d)(1) or (2) of this section.*
- 1) *For an existing CCR landfill or existing CCR surface impoundment, the owner or operator must complete the demonstration no later than October 17, 2018.*

This requirement was met prior to the first annual Engineer's Inspection Report (dated January 19, 2016) which was before the deadline, and was provided to the facility for placement in their operating record.

- 2) *For a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit, the owner or operator must complete the demonstration no later than the date of initial receipt of CCR in the CCR unit.*

Not applicable, the active CCR landfill area has been in use prior to the regulatory timeframe of October 19, 2015.

- 3) *The owner or operator has completed the demonstration required by paragraph (a) of this section when the demonstration is placed in the facility's operating record as required by § 257.105(e)*

Reporting requirements as outlined in § 257.105(e) will be followed. CELP maintains operational requirements on their webpage (<http://www.celpccr.com>)

- 4) *An owner or operator of an existing CCR surface impoundment or existing CCR landfill who fails to demonstrate compliance with the requirements of paragraph (a) of this section by the date specified in paragraph (d)(1) of this section is subject to the requirements of § 257.101(b)(1) or (d)(1), respectively.*

Acknowledged.

- 5) *An owner or operator of a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit who fails to make the demonstration showing compliance with the requirements of paragraph (a) of this section is prohibited from placing CCR in the CCR unit.*

Not applicable to existing landfills and the requirements of paragraph (a) were met with the first annual Engineer's Inspection Report (dated January 19, 2016).

- e) *The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(e), the notification requirements specified in § 257.106(e), and the Internet requirements specified in § 257.107(e)*

Acknowledged.

§257.84 Inspection requirements for CCR Landfills

- b) *Annual inspections by a qualified professional engineer.*
 - 1) *Existing and new CCR landfills and any lateral expansion of a CCR landfill must be inspected on a periodic basis by a qualified professional engineer to ensure that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering standards. The inspection must, at a minimum, include:*
 - i. *A review of available information regarding the status and condition of the CCR unit, including, but not limited to, files available in the operating record (e.g., the results of inspections by a qualified person, and results of previous annual inspections); and*

Weekly inspections have been undertaken by facility personnel during the calendar year of 2018. A review of the weekly inspection reports reveals no significant issues with the existing CCR landfill. A few of the highlights of 2018 are:

3/16/18	Spring thaw started.
4/20/18	Vegetation starting to turn green.
5/18/18	Grass growing.
6/15/18	Good vegetation growth from spring rains.
7/27/18	Site drying out and end of rain season.
11/19/18	First snow cover of season.

Copies of the weekly inspection reports are available upon request and have been placed in the operating record of the plant. The landfill continues to be operated in general conformance with the original design. The Phase 2 area has received all the ash for 2018. Soil containment berms will not be needed until the ash reaches an elevation of about 3150 FT (Current elevation is about 3141 FT). At this elevation, soil containment berms will be constructed on the perimeter of the ash as the landfill elevation continues upward.

- ii. *A visual inspection of the CCR unit to identify signs of distress or malfunction of the CCR unit.*

Personnel from Allied Engineering Services, Inc. have visited the site on multiple occasions. Recent site visit dates are as follows:

- May 5, 2018 Ron Orton visited the site to retrieve groundwater elevation data from pressure transducers and met with Ken McFarland to go over well purging procedures. General vegetation establishment was observed, and photo documented. Observed maintenance of sediment traps and piping outlet structures with physical sediment removal resulting from spring run-off completed.
- September 19, 2018*

The date indicated with the * was the primary inspection of the landfill area and existing piping and was most applicable to the 'Annual Engineers Inspection'. The other site visit included some inspection in support of the Engineers Report but also focused on the existing landfill and groundwater monitoring requirements.

During the primary inspection, traditional survey and aerial mapping was performed across the site. The 2018 survey information is summarized in Appendix B.

- 2) *Inspection report. The qualified professional engineer must prepare a report following each inspection that addresses the following:*
 - i. *Any changes in geometry of the structure since the previous annual inspection;*
 - ii. *The approximate volume of CCR contained in the unit at the time of the inspection;*
 - iii. *Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are*

- disrupting or have the potential to disrupt the operation and safety of the CCR unit; and*
- iv. *Any other change(s) which may have affected the stability or operation of the CCR unit since the previous annual inspection.*

The geometry of the landfill is actively changing as CCR is placed in lifts and hydrated. The attached as-built survey sheets depict the topography of the ash surface as of September 19, 2018. The elevation of the ash placed in Phase 2 has risen an average of 3.7-ft since the last as-built survey on November 14, 2017. The general shape of Phase 2 is concave which captures precipitation within the ash footprint. The average elevation of Phase 1 and 2 is now 3160-FT and 3140.7-FT respectively. A total of 52,701 CY of ash was placed in both Phases 1 & 2 during the time between as-built surveys. During this same time-frame, approximately 6,439 CY of ash was sold and not placed in the landfill area.

Landfill Surface Area Table

Description	Surface Area*
Phase 1 Open Ash Area	3.4 Acres
Phase 2 Open Ash Area	8.8 Acres
*Areas are approximate and estimated from topographic data taken on 9/19/2018.	

Routine cleaning and maintenance in the installed piping under the landfill has been observed. All piping installed in 2015, along with the previously existing piping is functioning as designed with in-place trash racks and rock riprap.

Landfill Volumes Table

Description	Volume
Total Ash Stored in Phase 1	344,310 CY
Total Ash Stored in Phase 2	177,167 CY
Estimated Closed Landfill Ash Storage	836,000 CY
Stockpile 1 – Top Soil	6,000 CY
Stockpile 2 – Sub Soil	82,460 CY
Stockpile 3 – Sub Soil	5,090 CY
Stockpile 4 – Sub Soil	27,430 CY
*Soil volumes are approximate and estimated from topographic data taken on 9/19/2018. Stockpile volumes may have changed since this survey date.	

CONCLUSION

The landfill inspection at the Rosebud Power Plant revealed that there is currently no significant or damaging active settlement or significant stability issues related to landfilling of CCR. All existing piping is functioning as designed, and all disturbed areas have been hydro-seeded. As stated above, the reclamation plans for the Phase 1 slopes have been completed but never constructed.

- 3) *Timeframes for conducting the initial inspection -*
- i. *Existing CCR landfills. The owner or operator of the CCR unit must complete the initial inspection required by paragraphs (b)(1) and (2) of this section no later than January 18, 2016.*

The first Annual Inspection report was completed prior to the stated deadline and has therefore addressed this requirement.

- ii. New CCR landfills and any lateral expansion of a CCR landfill. The owner or operator of the CCR unit must complete the initial annual inspection required by paragraphs (b)(1) and (2) of this section no later than 14 months following the date of initial receipt of CCR in the CCR unit.*

Not applicable to the existing landfill.

- 4) Frequency of inspections. The owner or operator of the CCR unit must conduct the inspection required by paragraphs (b)(1) and (2) of this section on an annual basis. The date of completing the initial inspection report is the basis for establishing the deadline to complete the first subsequent inspection. Any required inspection may be conducted prior to the required deadline provided the owner or operator places the completed inspection report into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing subsequent inspection reports is based on the date of completing the previous inspection report. For purposes of this section, the owner or operator has completed an inspection when the inspection report has been placed in the facility's operating record as required by § 257.105(g)(9).*

The Engineer's Inspection Report will be completed annually with the potential to complete them more frequently if a deficiency or release is identified in the facility weekly inspections.

- 5) If a deficiency or release is identified during an inspection, the owner or operator must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.*

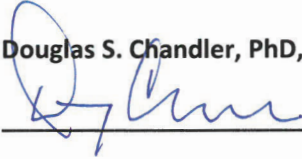
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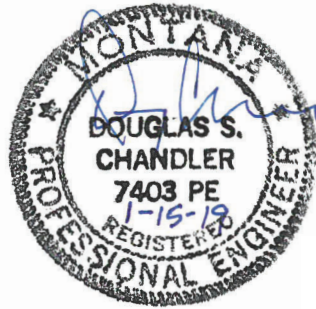
CERTIFICATION

This report was prepared by Allied Engineering Services, Inc., under the direction of Douglas S. Chandler, PhD, PE, with assistance from Andrew Graham, PE, and QC review by Brock Athman, PE.

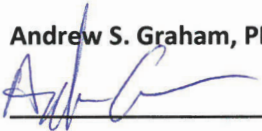
ALLIED ENGINEERING SERVICES, INC

Douglas S. Chandler, PhD, PE



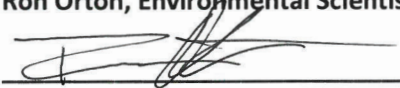


Andrew S. Graham, PE



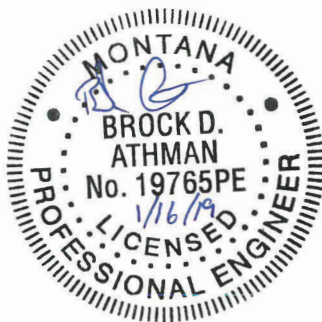


Ron Orton, Environmental Scientist



QC Approval: Brock D. Athman, PE

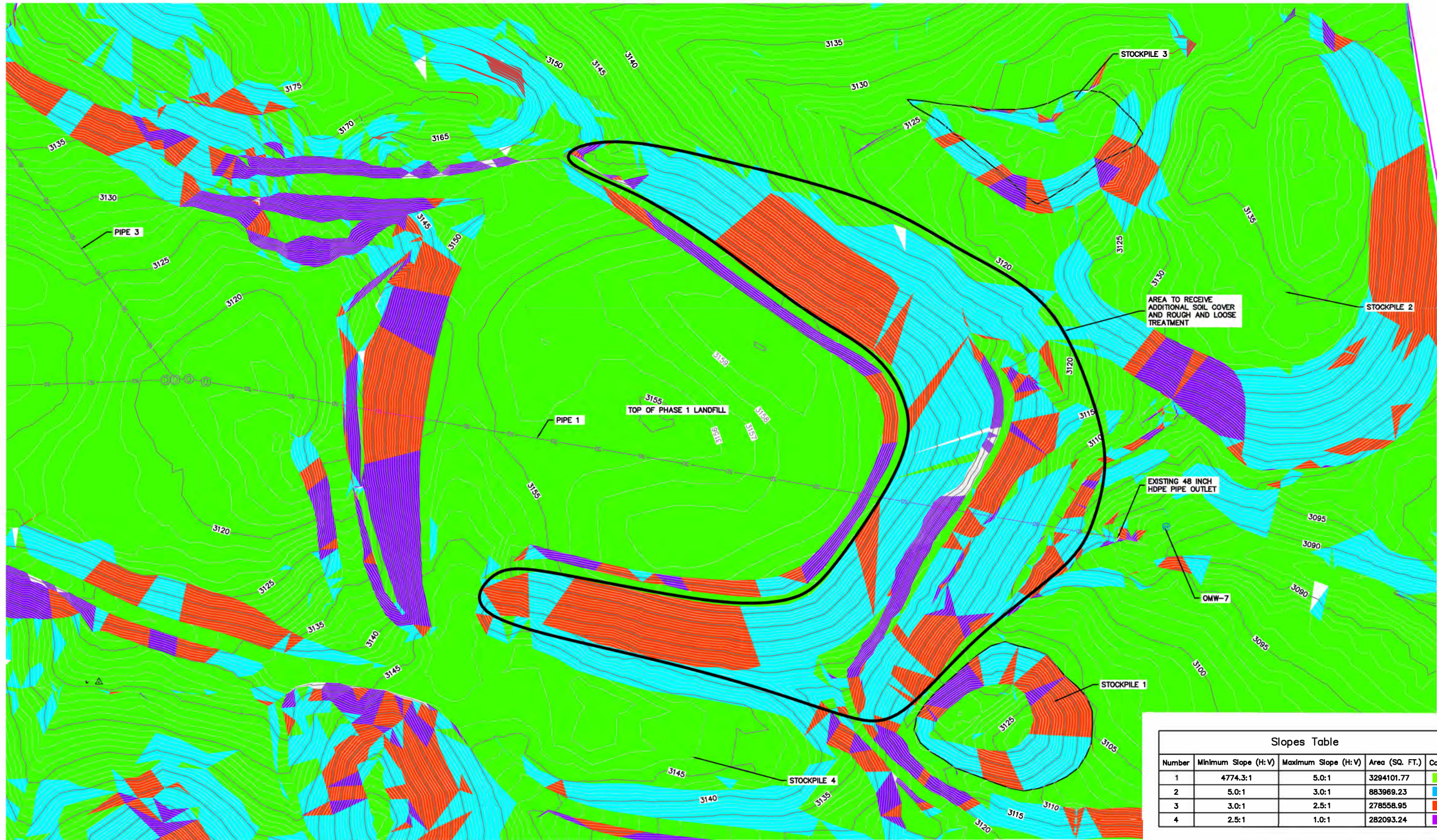




REFERENCES

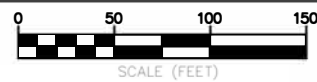
1. Environmental Protection Agency, 2015. "Federal Register", Vol. 80, No. 74, Part 257.
2. Hydrologic Analysis and Design, Third Edition. McCuen, Richard. 2005
3. Montana Bureau of Mines and Geology, 2007. Geologic Map of the Lame Deer 30' x 60' quadrangle, eastern Montana. Vuke, S.M., Heffern, E.L., Bergantino, R.N., and Colton, R.B. Accessed via the USGS National Geologic Map Database Map View. Accessed 12/23/15
<http://ngmdb.usgs.gov/maps/mapview/>
4. Montana Bureau of Mines and Geology, Groundwater Information Center, Well log data website, <http://mbmaggwic.mtech.edu/sqlserver/v11/menus/menuData.asp>. Accessed 1/6/15
5. Natural Resource Conservation Service, Web Soil Survey. <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm> Accessed 12/23/15.
6. Rosebud Power Plant Ash Disposal Site Engineering Design and Construction Specifications by Chandler Geotechnical. Chandler, D.S. dated July 16, 1996.

**Appendix A: Plan Set – Rosebud Active Landfill
– Phase 1 Landfill Slopes
Dated October 5, 2018**



Slopes Table				
Number	Minimum Slope (H:V)	Maximum Slope (H:V)	Area (SQ. FT.)	Color
1	4774.3:1	5.0:1	3294101.77	Green
2	5.0:1	3.0:1	883969.23	Cyan
3	3.0:1	2.5:1	278558.95	Orange
4	2.5:1	1.0:1	282093.24	Purple

NO.	REVISIONS	DRAWN BY	DATE



PROJECT ENGINEER: DSC DRAWN BY: ASG
 DESIGNED BY: ASG REVIEWED BY: DSC, BDA

**ROSEBUD ACTIVE LANDFILL
 PHASE 1 LANDFILL SLOPES
 ROSEBUD COUNTY, MT**

32 DISCOVERY DRIVE
 BOZEMAN, MT 59718
 PHONE (406) 582-0221
 FAX (406) 582-5770
 www.alliedengineering.com

**Civil Engineering
 Geotechnical Engineering
 Land Surveying**



PROJECT # 15-125
 DATE: 10/05/2018

SHEET
S-1

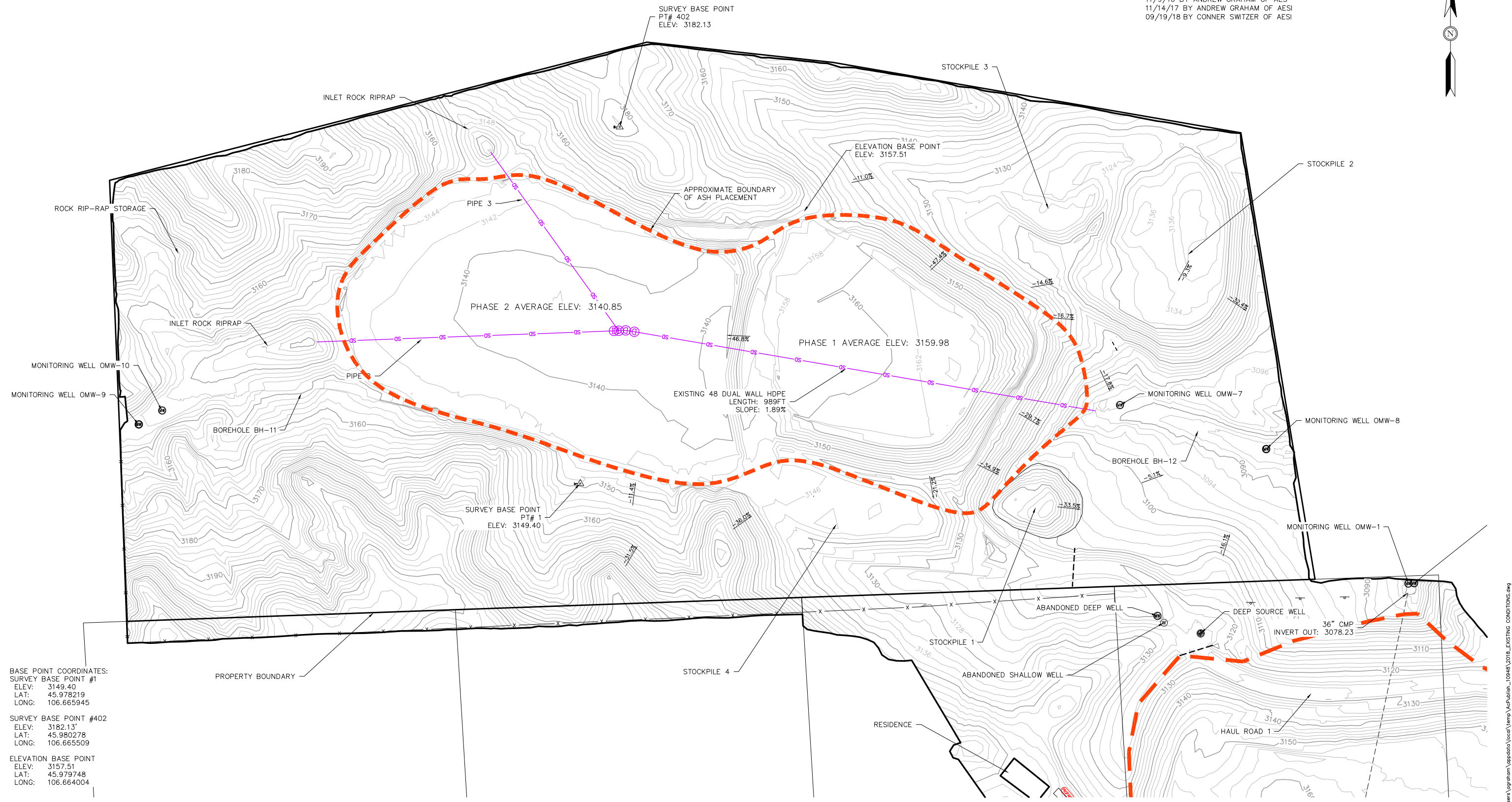
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Appendix B: Existing Conditions Survey & Orthomosaic Figures

LEGEND

--- APPROXIMATE ASH BOUNDARY

SURVEY OF PHASE 1 & 2 LANDFILL AND SURROUNDING AREA BASED ON TOPOGRAPHIC SURVEYS COMPLETED ON:
 9/14/15 BY GREG FINCK OF AESI
 1/27/16 BY GREG FINCK AND KYLE THOMPSON OF AESI
 11/9/16 BY ANDREW GRAHAM OF AESI
 11/14/17 BY ANDREW GRAHAM OF AESI
 09/19/18 BY CONNER SWITZER OF AESI



BASE POINT COORDINATES:
 SURVEY BASE POINT #1
 ELEV: 3149.40
 LAT: 45.978219
 LONG: 106.665945
 SURVEY BASE POINT #402
 ELEV: 3182.13
 LAT: 45.980278
 LONG: 106.665509
 ELEVATION BASE POINT
 ELEV: 3157.51
 LAT: 45.979748
 LONG: 106.664004

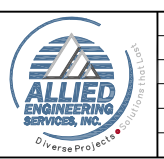
NO.	REVISIONS	DRAWN BY	DATE

<p>SCALE (FEET)</p>	
PROJECT ENGINEER: DSC	DRAWN BY: ASG
DESIGNED BY: ASG	REVIEWED BY: DSC, BDA

**ROSEBUD SURVEY FIGURE
 2018 ACTIVE LANDFILL (AS-BUILT)
 ROSEBUD COUNTY, MT**

32 DISCOVERY DRIVE
 BOZEMAN, MT 59718
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 www.alliedengineering.com

**Civil Engineering
 Geotechnical Engineering
 Land Surveying**



PROJECT # 15-125	SHEET
DATE: 12/28/2018	1
ACTIVE LANDFILL	

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NO.	REVISIONS	DRAWN BY	DATE

<p>SCALE (FEET)</p>	
PROJECT ENGINEER: DSC	DRAWN BY: ASG
DESIGNED BY: ASG	REVIEWED BY: DSC, BDA

ROSEBUD SURVEY FIGURE
2018 ACTIVE LANDFILL ORTHOMOSAIC
ROSEBUD COUNTY, MT

32 DISCOVERY DRIVE
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Civil Engineering
Geotechnical Engineering
Land Surveying



PROJECT #: 15-125	SHEET O-1
DATE: 12/28/2018	
ACTIVE LANDFILL	

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