Rosebud Power Plant
2022 Annual Engineer's Inspection Report

Prepared for Rosebud Operating Services, Inc.
by Allied Engineering Services, Inc.
2022 Report
Posted: January 13, 2023
Project: 15-125

Contents

Appendices

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. 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. 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 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 being placed in Phase 2. In 2022, the Phase 2 ash surface was filled to match the ash surface elevation of Phase 1—approximately 3,160-ft. It is anticipated that the two phases may operate as one continuous surface in 2023 and future years.

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 Air Quality Permit No. MAQP 2035-08
- Title V Air Permit: OP2035-05
- Montana Ground Water Pollution Control System (MGWPCS) Permit No. MTX000052
- Montana Pollutant Discharge Elimination System (MPDES) Permit No. MT0031780
- Multi-Sector General Permit for Storm Water Discharges Associated with Industrial Activity. Permit No. MTR000058

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. During the calendar year of 2022 the power plant had multiple load reductions and scheduled outages that are summarized below:

- Tube Leak – February 27 - March 3 – Plant offline for 4.03 days
- Tube Leak – May 5 - May 8 – Plant offline for 3.44 days
- Load reduction – June 18 - June 20 – Economic Reduction – Plant operating at half load
- Outage – June 21 - June 30 – Economic Outage –Plant offline for 9.31 days
- Outage – July 3 – Offline for transmission line fault – Plant offline for 0.11 days
- Scheduled maintenance outage – Sept 9 - Sept 30 – Plant offline for 21.65 days

At this operating capacity, the power plant produced approximately 75,823 CY of fly ash. The ash volume was placed in the Phase 2 Landfill and approximately 157.11 tons (~149.2I CY) of fly ash was sold and not placed in the Phase 2 Landfill from 11/30/2021 to 11/01/2022. See *Landfill Volumes Table*

for additional volume details. The ash volume was calculated between the 2021 and 2022 site quantity surveys for the annual engineering inspection. Phase 1 continues to operate as a coal storage area and is not actively receiving CCR.

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.**

40 CFR §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. During the removal of the topsoil and subsoil, the operation of the haul trucks provided initial compaction to the subsoil. The base of the Phase 2 area of the active landfill was compacted by a vibratory roller before ash placement. Pozzolanic[1] 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.

[1] Pozzolans are a siliceous or silico-aluminous material that will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds having cementitious properties (there are both natural and artificial pozzolans).

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 High Density Polyethylene (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 2022. A review of the weekly inspection reports reveals no significant issues with the existing CCR landfill. A few of the highlights of 2022 are as follows:

03/25/22 Start of spring vegetation growth.
07/22/22 Pipe sediment removed from outlets. Vegetation turning brown during dry and hot season.
12/28/2022 Last received inspection report.

Copies of the weekly inspection reports are available upon request and are maintained onsite within the environmental records. The landfill continues to be operated in general conformance with the original design. The Phase 2 area has received all the ash for 2022. Containment berms have been constructed on the perimeter of Phase 2 to allow the landfill elevation to continue upward. In 2022, berm construction took place primarily on the north, south, and west ends of Phase 2.

The berm on the north end of Phase 2 was constructed with ash material and increased in height between 0-FT - 8.5-FT from the previous 2021 berm. The average height increase of the northern Phase 2 berm was approximately 5.8-FT with an average elevation of 3,165.25-FT. The berm on the south end of Phase 2 including a portion of the haul road was constructed with ash and was covered with 2 feet of subsoil on the exterior surfaces. The berm was completed shortly after the 2021 inspection and has an average elevation of 3,167.65-FT. The average height increase of the south Phase 2 berm is represented by the added 1.5-FT subsoil cap.

The berm on the west end of Phase 2 was constructed with ash and increased in height between 0-FT – 8.9-FT. The average height increase of the western Phase 2 berm is approximately 4.5-FT from the previous 2021 berm with an average elevation of 3,167.9-FT. During the time of inspection, topsoil had not been placed as a cap for the north or west berm but was planned for 2023 construction. All berm construction was performed by Rosebud Operating Services, Inc. personnel and equipment.

Note, there are presently two areas of Phase 2 that are still contained by the native ground. These two areas comprise approximately 330 linear feet of the Phase 2 landfill edge near the northeast corner and northwest corner. The edge of ash is contained by a cut slope in the native ground and a small amount of exterior run-on from the native ground onto the active ash fill surface occurs. Given the small area involved and the alternative drainage configuration challenges (i.e. an active berm in these areas would direct the sediment laden runoff from the temporary cut slope into natural drainages) and that the insignificant amount of occasional run-on is easily used for ash hydration, we believe this is the most favorable temporary configuration of the containment. There is no runoff from the active ash area.

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. visited the site on November 1, 2022 for the Annual Engineers Inspection. This November inspection of the landfill area and existing piping was most applicable to the 'Annual Engineers Inspection'. During this inspection, traditional survey and aerial mapping was performed across the site. The 2022 survey information is summarized in Appendix A.

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 November 1, 2022. The elevation of the ash placed in Phase 2 has risen an average of 4.6-ft since the last as-built survey on November 30, 2021. The general shape of Phase 2 is a depression which captures precipitation within the ash footprint and surrounding soil berms. The average ash elevation of Phase 1 remains the same as the previous year(s) (2018-2021) at 3160-FT. Phase 1 has been used as a coal storage area since 2018 and currently has about 15.5-FT of coal. Phase 2 has an average ash elevation of 3160.67-FT. A total of 75,823-CY of ash was placed in Phase 2 between as-built surveys. During this same timeframe, approximately 149 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	9.0 Acres
***Areas are approximate and estimated from topographic data taken on 11/1/2022.**	

Ash volume calculations for Phase 2 are based off the 2022 ash surface area including the ash berms. Ash surface statistics including average ash elevation and average ash elevation increase are based off the 2022 ash surface area excluding the ash berms.

Landfill Volumes Table

Description	Volume
Total Ash Stored in Phase 1	344,310 CY
Total Ash Stored in Phase 2	485,709 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 – Top Soil	5,090 CY
Stockpile 4 – Sub Soil	13,782 CY
***Soil volumes are approximate and estimated from topographic data taken on 11/1/2022. Stockpile volumes may have changed since this survey date.**	

All piping installed in 2015, along with the previously existing piping is functioning as designed with in-place trash racks and rock riprap. Upon visual inspection, no sedimentation has been observed at the outlets of the pipes. Some sedimentation has occurred at the inlets of the pipes. This small amount of sediment should be removed during routine site maintenance in the coming year and when detected going forward.

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.*

Acknowledged.

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 appears to be functioning as designed.

See below for a list of recommendations for continued operation and maintenance of the landfill:

1. Grade outward facing slopes on most recent berm construction (2023 and future) to insure a 3:1 side slope or flatter geometry. Any existing or future finished slopes steeper than 3H:1V will require flattening from the bottom (i.e., additional fill placement) during final closure. Avoiding exterior slopes/berms steeper than 3H:1V is efficient with respect to total earthwork and re-vegetation. Existing areas steeper than 3H:1V are shown in red and purple in Sheet 3.
2. Proceed with intended plans to continue placing soil on any outward facing slopes of berms constructed of CCR. The recommended soil cover consists of 1-FT of topsoil and 2-FT of sub soil. The minimum required soil cover is 0.5-FT of topsoil and 1.5-ft of sub soil. Topsoil should be applied at the minimum cover requirement to conserve topsoil volumes until final reclamation.
3. Issues may arise from coal dust depositing onto vegetated areas on the embankment. Enact additional measures to suppress coal dust from stockpile on Phase 1 from blowing onto existing vegetation. Suppression can include water or chemical applications.
4. Continue periodic maintenance grading to flatten all slopes steeper than 3H:1V (See Slope Figure).
5. Continue periodic maintenance grading to fix erosion that may be occurring on finished areas to prevent ash from being exposed.
6. Continue seeding of all disturbed areas in the fall or spring to promote vegetation growth on bare ground.
7. For Subsoil Stockpile 2 continue periodic maintenance grading to fix erosion and continue seeding eroded areas in the fall or spring to promote vegetation growth on bare ground.
8. Perform routine cleaning and maintenance of the installed piping under the landfill, including inlet and outlet areas. Specifically remove sediment that has collected at the inlet to Pipe 3 and Pipe 2.
9. Strip and stockpile all topsoil to a minimum depth of 12 inches from all proposed disturbance areas and maintain a 10-foot buffer strip around landfill perimeter. Topsoil and sub soil to be stored separately for final reclamation or ongoing berm construction.

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

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4. 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/
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6. Natural Resource Conservation Service, Web Soil Survey. http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm Accessed 12/23/15.
7. Rosebud Power Plant Ash Disposal Site Engineering Design and Construction Specifications by Chandler Geotechnical. Chandler, D.S. dated July 16, 1996.

Appendix A: Existing Conditions Survey, Orthomosaic, & Slopes Figures

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 & 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
11/13/19 BY CONNER SWITZER OF AESI
11/05/20 BY CONNER SWITZER OF AESI
11/30/21 BY CONNER SWITZER OF AESI
11/01/22 BY CONNER SWITZER OF AESI

LEGEND

- APPROXIMATE 2022 ASH BOUNDARY
- APPROXIMATE 2022 COAL BOUNDARY

CENTERLINE TWO-TRACK
PROPERTY BOUNDARY
INLET ROCK RIPRAP
SURVEY BASE POINT PT# 402 ELEV: 3182.13
NORTH BERM 2022 ASH BERM CONSTRUCTION AVERAGE ELEV=3165.25'
APPROXIMATE BOUNDARY OF ASH PLACEMENT
PHASE 1 AVERAGE ASH ELEV=3160.0'. AREA CONTINUES TO BE USED FOR COAL STORAGE CONTOURS REFLECT THE ELEVATION OF THE COAL STOCKPILE ON 11/1/2022
STOCKPILE 3
STOCKPILE 2
ROCK RIP-RAP STORAGE
PIPE 3
WEST BERM 2022 ASH BERM CONSTRUCTION AVERAGE ELEV=3167.9'
PHASE 2 AVERAGE ASH ELEV: 3160.67'
INLET ROCK RIPRAP
PIPE 2
EXISTING 48-IN DUAL WALL HDPE LENGTH: 989FT SLOPE: 1.89%
OUTLET ROCK RIPRAP
MONITORING WELL OMW-7
BOREHOLE BH-11
MONITORING WELL OMW-10
MONITORING WELL OMW-9
SURVEY BASE POINT PT# 1
NOTE: DESTROYED BY GRADING OPERATIONS 2019
SOUTH BERM CONSTRUCTION COMPLETED IN 2021. AVERAGE ASH ELEV=3167.65'
APPROXIMATE BOUNDARY OF COAL PLACEMENT
BOREHOLE BH-12
MONITORING WELL OMW-8
STOCKPILE 1
HAUL ROAD 1
ABANDONED DEEP WELL
DEEP SOURCE WELL
ABANDONED SHALLOW WELL
EXISTING LANDFILL ASH BOUNDARY
STOCKPILE 4 NOTE: ADDITIONAL MATERIAL HAS BEEN REMOVED FROM STOCKPILE 4 SINCE 2021 FOR BERM CONSTRUCTION

BASE POINT COORDINATES #402:
ELEV: 3182.13'
LAT: 45.980278
LONG: 106.665509

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NO.	REVISIONS	DRAWN BY	DATE

0 80 160 240
SCALE (FEET)

PROJECT ENGINEER: DSC	DRAWN BY: CCS
DESIGNED BY: CCS	REVIEWED BY: ASG

ROSEBUD SURVEY FIGURE
2022 ACTIVE LANDFILL (AS-BUILT)
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

ALLIED ENGINEERING SERVICES, INC.
Diverse Projects

PROJECT #: 15-125	SHEET 1
DATE: 1/9/2023	

ACTIVE LANDFILL

LEGEND

- APPROXIMATE 2022 ASH BOUNDARY
- APPROXIMATE 2022 COAL BOUNDARY

CENTERLINE TWO-TRACK

PROPERTY BOUNDARY

INLET ROCK RIPRAP

SURVEY BASE POINT
PT# 402
ELEV: 3182.13

NORTH BERM 2022 ASH BERM CONSTRUCTION AVERAGE ELEV=3165.25'

APPROXIMATE BOUNDARY OF ASH PLACEMENT

PHASE 1 AVERAGE ASH ELEV=3160.0'. AREA CONTINUES TO BE USED FOR COAL STORAGE CONTOURS REFLECT THE ELEVATION OF THE COAL STOCKPILE ON 11/1/2022

STOCKPILE 3

STOCKPILE 2

ROCK RIP-RAP STORAGE

PIPE 3

WEST BERM 2022 ASH BERM CONSTRUCTION AVERAGE ELEV=3167.9'

PHASE 2 AVERAGE ASH ELEV: 3160.67'

INLET ROCK RIPRAP

PIPE 2

EXISTING 48-IN DUAL WALL HDPE
LENGTH: 989FT
SLOPE: 1.89%

OUTLET ROCK RIPRAP

MONITORING WELL OMW-7

BOREHOLE BH-11

MONITORING WELL OMW-10

MONITORING WELL OMW-9

BOREHOLE BH-12

MONITORING WELL OMW-8

APPROXIMATE BOUNDARY OF COAL PLACEMENT

SURVEY BASE POINT PT# 1

NOTE: DESTROYED BY GRADING OPERATIONS 2019

SOUTH BERM CONSTRUCTION COMPLETED IN 2021. AVERAGE ASH ELEV=3167.65'

STOCKPILE 1

HAUL ROAD 1

ABANDONED DEEP WELL

DEEP SOURCE WELL

ABANDONED SHALLOW WELL

STOCKPILE 4 NOTE: ADDITIONAL MATERIAL HAS BEEN REMOVED FROM STOCKPILE 4 SINCE 2021 FOR BERM CONSTRUCTION

EXISTING LANDFILL ASH BOUNDARY

BASE POINT COORDINATES #402:
ELEV: 3182.13'
LAT: 45.980278
LONG: 106.665509

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NO.	REVISIONS	DRAWN BY	DATE

0 80 160 240
SCALE (FEET)

PROJECT ENGINEER: DSC	DRAWN BY: CCS
DESIGNED BY: CCS	REVIEWED BY: ASG

ROSEBUD SURVEY FIGURE
2022 ACTIVE LANDFILL ORTHOMOASIC
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

ALLIED ENGINEERING SERVICES, INC.

PROJECT #: 15-125	SHEET 2
DATE: 1/9/2023	

ACTIVE LANDFILL

LEGEND

APPROXIMATE 2022 ASH BOUNDARY

APPROXIMATE 2022 COAL BOUNDARY

CENTERLINE TWO-TRACK

PROPERTY BOUNDARY

INLET ROCK RIPRAP

SURVEY BASE POINT
PT# 402
ELEV: 3182.13

NORTH BERM 2022 ASH BERM
CONSTRUCTION AVERAGE
ELEV=3165.25'

APPROXIMATE BOUNDARY
OF ASH PLACEMENT

PHASE 1 AVERAGE ASH ELEV=3160.0'. AREA CONTINUES TO BE USED FOR COAL STORAGE CONTOURS REFLECT THE ELEVATION OF THE COAL STOCKPILE ON 11/1/2022

STOCKPILE 3

STOCKPILE 2

ROCK RIP-RAP STORAGE

PIPE 3

WEST BERM 2022 ASH
BERM CONSTRUCTION
AVERAGE ELEV=3167.9'

PHASE 2 AVERAGE ASH ELEV: 3160.67'

INLET ROCK RIPRAP

EXISTING 48-IN DUAL WALL HDPE
LENGTH: 989FT
SLOPE: 1.89%

PIPE 2

OUTLET ROCK RIPRAP

MONITORING WELL OMW-7

BOREHOLE BH-11

MONITORING WELL OMW-10

MONITORING WELL OMW-9

BOREHOLE BH-12

MONITORING WELL OMW-8

APPROXIMATE BOUNDARY
OF COAL PLACEMENT

SURVEY BASE POINT PT# 1

NOTE: DESTROYED BY
GRADING OPERATIONS 2019

SOUTH BERM CONSTRUCTION
COMPLETED IN 2021. AVERAGE ASH
ELEV=3167.65'

STOCKPILE 1

HAUL ROAD 1

ABANDONED DEEP WELL

DEEP SOURCE WELL

ABANDONED SHALLOW WELL

EXISTING LANDFILL ASH
BOUNDARY

STOCKPILE 4 NOTE: ADDITIONAL MATERIAL
HAS BEEN REMOVED FROM STOCKPILE 4
SINCE 2021 FOR BERM CONSTRUCTION

BASE POINT COORDINATES #402:
ELEV: 3182.13'
LAT: 45.980278
LONG: 106.665509

SLOPES TABLE

ID No.	MINIMUM SLOPE	MAXIMUM SLOPE	AREA [AC.]	COLOR
1	Horizontal	5.0:1	75.52	
2	5.0:1	3.0:1	22.09	
3	3.0:1	2.5:1	6.10	
4	2.5:1	0.0:1	6.08	

NO.	REVISIONS	DRAWN BY	DATE

0 80 160 240
SCALE (FEET)

PROJECT ENGINEER: DSC | DRAWN BY: CCS
DESIGNED BY: CCS | REVIEWED BY: ASG

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

32 DISCOVERY DRIVE
BOZEMAN, MT 59718
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Civil Engineering
Geotechnical Engineering
Land Surveying

ALLIED ENGINEERING SERVICES, INC.
Diverse Projects

PROJECT #: 15-125
DATE: 1/9/2023
SHEET 3

ACTIVE LANDFILL SLOPES

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