



Coal Combustion Residuals

Closure Plan for Existing Landfill

Prepared for
Montana-Dakota Utilities Co.
R.M. Heskett Station

October 2016

Coal Combustion Residuals Landfill Closure Plan

October 2016

Contents

1.0	Introduction	1
2.0	Closure Narrative	1
3.0	Final Cover System Design.....	2
4.0	Final Cover System Performance.....	2
4.1	Phase I Final Cover System	2
4.2	Phase II Final Cover System	4
5.0	Closure Procedures and Methods.....	5
6.0	CCR Inventory and Maximum Closure Area Estimates	7
7.0	Estimated Closure Schedule	7
8.0	Recordkeeping	9
9.0	Reporting	9

List of Tables

Table 7-1	Estimated Closure Schedule	8
-----------	----------------------------------	---

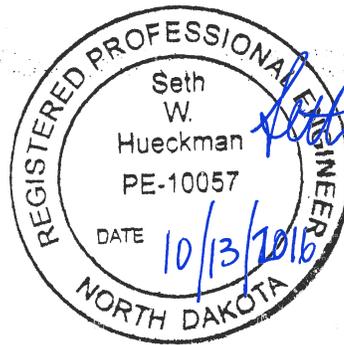
List of Appendices

Appendix A	Figure	
------------	--------	--

Certifications

I hereby certify that I, or my agent, have examined the facility and, being familiar with the provisions of 40 CFR 257 Subpart D, attest that this Coal Combustion Residuals landfill closure plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and the requirements of 40 CFR §257.102. I certify that the plan is adequate for this facility and that procedures for recordkeeping and reporting have been established.

Revision	Date	Summary of Revisions
0	October 13, 2016	Initial Plan



Seth W. Hueckman
Barr Engineering Co.
ND Registration Number PE-10057

Dated this 13th day of October, 2016

Certifications

I hereby certify that I, or my agent, have examined the facility and, being familiar with the provisions of 40 CFR 257 Subpart D, attest that this Coal Combustion Residuals landfill design of the final cover system as described in this closure plan is in accordance with good engineering practice, including consideration of applicable industry standards and the requirements of 40 CFR §257.102. I certify that the final cover system design is adequate for this facility.



Seth W. Hueckman
Barr Engineering Co.
ND Registration Number PE-10057

Dated this 13th day of October, 2016

1.0 Introduction

Montana-Dakota Utilities Co. (MDU) operates the R.M. Heskett Station (Heskett), near Mandan, North Dakota. Operations at Heskett results in the production of coal combustion residuals (CCR). CCR management is subject to Federal Standards for the Disposal of Coal Combustion Residuals in Landfills per 40 CFR 257 Subpart D. Heskett currently operates a coal ash landfill under North Dakota Department of Health (NDDH) solid waste management facility Permit No. SP-087. This CCR landfill closure plan has been developed to satisfy the requirements of 40 CFR §257.102 (b), initial written closure plan for CCR landfills.

MDU's coal ash landfill at Heskett was developed in two phases covering approximately 36 acres. Phase I to the north and Phase II to the south were initially designed to act as two adjacent landfills separated by a haul road. Each phase was further divided into slots; each slot covering an area consisting of a single liner construction event. Phase I (Slots 1-5) is lined with a clay liner while Phase II (Slots 6-10) is composite-lined with a clay liner overlain by a 60-mil high density polyethylene (HDPE) geomembrane liner.

Prior to beginning Phase II construction in 2000, MDU was granted a permit modification to raise the height of the landfill and place ash fill above the haul road, thereby merging Phase I and II into one continuous landfill. Approximately 25 acres of the combined landfill is closed and capped with a cover system consisting of a clay barrier layer and a cover soil layer. Less than approximately one acre of the Phase I landfill (portion of the southern slope of Slot 4 and Slot 5) is temporary closed with an interim cover system consisting of a 12-inch thick clay barrier layer overlain by a 6-inch thick topsoil layer. The final cover slopes range from 3 percent to nearly 25 percent, but average roughly 10 percent around the perimeter. As of Fall 2013, approximately 11 acres of the landfill is currently active, including Slot 10 and portions of Slot 8 and Slot 9, as shown in Figure 1 of Appendix A.

In 2011 MDU was granted another permit modification to vertically expand the landfill to 25 percent cover slopes around the entire perimeter that included some southward expansion of the existing liner limits. The additional vertical airspace permitted in 2011 has yet to be utilized as there is still airspace remaining in Phase II (primarily Slot 10) through approximately 2019. Modifications to the 2011 vertical expansion plan are currently underway to avoid horizontal expansion to the south while also updating the sequencing plan so vertical expansion of the newly permitted airspace begins in active Slot 10.

2.0 Closure Narrative

Closure of the landfill will be accomplished by leaving existing CCR in-place and constructing a final cover system compliant with 40 CFR, Part §257.102 (d)(3). A 25 percent maximum closure grade was selected to maximize airspace, accommodate settling and subsidence of the CCR material, and to promote surface water run-off from the site. Final cover will be constructed in phases as closure grades are reached to limit the amount of open area and leachate generation in the landfill during the filling process

3.0 Final Cover System Design

Two different cover systems for the Phase I and Phase II portions of the landfill will be included in final closure. The Phase I portion of the landfill will utilize a soil barrier layer and the Phase II portion of the landfill will utilize a geomembrane barrier layer.

Closure of Phase I will consist of placement of a low permeability cover system as follows (from the top down):

- Vegetative cover consisting of 6 inches (minimum) of suitable plant growth material (SPGM) topsoil;
- 30 inches (minimum) of plant rooting zone soil;
- 24 inches of compacted clay soil material with a saturated hydraulic conductivity of 1×10^{-7} cm/sec; and
- Buffer layer over the subgrade soils to provide a suitable subgrade for the cover system, if needed.

Closure of Phase II will consist of placement of a low permeability cover system as follows (from the top down):

- Vegetative cover consisting of 6 inches (minimum) of SPGM topsoil;
- 12 inches (minimum) of plant rooting zone soil;
- 12 inches of granular drainage material;
- 40-mil (minimum) geomembrane hydraulic barrier layer; and
- Buffer layer over the subgrade soils to provide a suitable subgrade for the geomembrane layer and cover system, if needed.

4.0 Final Cover System Performance

The following subsections describe the performance for the differing final cover systems for Phase I and Phase II closure.

4.1 Phase I Final Cover System

The Phase I final cover design meets the requirements of 40 CFR §257.102 (d) as described below:

(d)(1)(i) Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;

The permeability of the final cover system will be less than or equal to the permeability of the bottom liner system and will be graded with up to a 25 percent (maximum) slope to promote surface water run-off.

(d)(1)(ii) Preclude the probability of future impoundment of water, sediment, or slurry;

The 24-inch thick clay hydraulic barrier component of the final cover system will preclude infiltration of precipitation. The final cover will be installed with up to a 25 percent (maximum) slope and will tie in to the perimeter embankment, thereby promoting surface water run-off from the site.

(d)(1)(iii) Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period;

The final cover will be installed with a vegetated 25 percent (maximum) slope that meets stability requirements.

(d)(1)(iv) Minimize the need for further maintenance of the CCR unit, and;

The final cover will be vegetated to minimize erosion and the need for maintenance.

(d)(1)(v) Be completed in the shortest amount of time consistent with recognized and generally good engineering practices.

Final cover will be constructed in phases as closure grades are reached to limit the amount of open area in the landfill.

(d)(3) Final cover system.

The final cover system for Phase I is considered a standard final cover design and meets the requirements described in 40 CFR §257.102 (d)(3)(i).

(d)(3)(i)(A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less.

Phase I was lined with a 5-foot thick clay barrier layer. The clay barrier layer for Phase I closure will be constructed to a saturated hydraulic conductivity of 1×10^{-7} cm/sec or less which will be less than or equal to the permeability of the bottom clay liner.

(d)(3)(i)(B) The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.

A 24-inch thick clay barrier layer with a saturated hydraulic conductivity of 1×10^{-7} cm/sec is included in the final cover design for Phase I closure, which meets the requirement.

(d)(3)(i)(C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.

A 36-inch thick erosion layer (SPGM topsoil and plant rooting zone soil) capable of sustaining native plant growth is included in the final cover design, which exceeds the minimum of six inches of earthen material required.

(d)(3)(i)(D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

Ash will be placed in lifts uniformly across the landfill to allow for settlement and subsequent backfilling of areas where differential settling and subsidence is observed. Construction of the final cover system will not commence until suitable cover subgrade is observed. As a result, minimal differential settlement and subsidence is expected following final cover construction so that performance of the clay barrier layer or cover system as a whole will not be affected.

4.2 Phase II Final Cover System

The Phase II final cover design meets the requirements of 40 CFR §257.102 (d) as described below:

(d)(1)(i) Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;

The permeability of the final cover system will be less than or equal to the permeability of the bottom liner system and will be graded with up to a 25 percent (maximum) slope to promote surface water run-off.

(d)(1)(ii) Preclude the probability of future impoundment of water, sediment, or slurry;

The geomembrane hydraulic barrier component of the final cover system will preclude infiltration of precipitation. The final cover will be installed with up to a 25 percent (maximum) slope and will tie in to the perimeter embankment, thereby promoting surface water run-off from the site.

(d)(1)(iii) Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period;

The final cover will be installed with a vegetated 25 percent (maximum) slope that meets stability requirements.

(d)(1)(iv) Minimize the need for further maintenance of the CCR unit, and;

The final cover will be vegetated to minimize erosion and the need for maintenance.

(d)(1)(v) Be completed in the shortest amount of time consistent with recognized and generally good engineering practices.

Final cover will be constructed in phases as closure grades are reached to limit the amount of open area in the landfill.

The final cover system for Phase II closure is considered an *alternative final cover system design* and meets the requirements described in 40 CFR §257.102 (d)(3)(ii).

(d)(3)(ii)(A) The design of the final cover system must include an infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (d)(3)(i)(A) and (B) of this section.

Geomembrane hydraulic barriers of equivalent performance are used in the Phase II liner system and the final cover system proposed.

(d)(3)(ii)(B) The design of the final cover system must include an erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in paragraph (d)(3)(i)(C) of this section.

An 18-inch thick minimum erosion layer (SPGM topsoil and plant rooting zone soil) capable of sustaining native plant growth is included in the Phase II final cover design, which exceeds the minimum of six inches of earthen material required.

(d)(3)(ii)(C) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

Ash will be placed in lifts uniformly across the landfill to allow for settlement and subsequent backfilling of areas where differential settling and subsidence is observed. Construction of the final cover system will not commence until suitable cover subgrade is observed. As a result, minimal differential settlement and subsidence is expected following final cover construction so that performance of the geomembrane cover layer or cover system as a whole will not be affected.

5.0 Closure Procedures and Methods

Prior to starting closure construction activities, a notification of intent to close a portion of the landfill will be prepared that will include the certification by a qualified professional engineer for the design of the final cover system as required by 40 CFR §257.102 (d)(3). The notification will be complete when it has been placed in the facility's operating record as required by 40 CFR §257.105 (i)(7). In addition, the NDDH will be notified of an upcoming incremental closure project at least 5 working days prior to initiation of closure activities.

Partial sequential closure will commence for areas that are filled to final grade and when it is reasonable to mobilize construction equipment and crews to implement the closure, without incurring greater

administrative costs that are associated with smaller, more frequent closure events. Areas to be closed during each final cover construction event will be determined in conjunction with preparation of construction plans and specifications for the construction event. For areas filled to final grade, final cover will be placed as soon as practical, factoring in the timing constraints imposed by late fall, winter and early spring weather conditions. Construction of the final cover system will proceed as follows:

1. Grade and smooth ash fill subgrade surface as needed;
2. Place, grade and smooth surface buffer soil layer (if buffer layer is needed);
3. Install geomembrane cover and drainage material (Phase II) or compacted clay soil material (Phase I);
4. Place plant rooting zone soil;
5. Place SPGM topsoil layer;
6. Install permanent stormwater run-off controls (if needed), and;
7. Seed, fertilizer and mulch.

Closure activities will be carried out by a qualified earthwork contractor and geomembrane liner installer. Construction plans and specifications will be prepared for each phase of closure to direct the contractor's work.

The construction of the various components of the final cover will be tested and documented in accordance with the document titled "Article 5 – Quality Assurance for Construction of Landfill and Surface Impoundment Liners, Caps and Leachate Collection Systems" developed by the NDDH and included in the facility's permit. A closure construction documentation report will be prepared and submitted to the NDDH after completion of an incremental closure event. The report will contain descriptions of the construction process, record drawings, survey and material test data, pertinent correspondence, and photographs of important aspects of construction. The report will be signed by a professional engineer, registered in the state of North Dakota, stating that to the best of their knowledge and according to their records, cover construction has been completed in accordance with the approved plans, specifications, and permit requirements.

A notification of closure will be prepared within 30 days of completion of closure of the entire landfill. The notification will include the certification by a qualified professional engineer verifying that closure has been completed in accordance with the closure plan as required by 40 CFR §257.102 (f)(3). The notification will be complete when it has been placed in the facility's operating record as required by 40 CFR §257.105 (i)(8).

A notation on the deed to the property must be recorded following complete closure of the landfill. *"The notation on the deed must in perpetuity notify any potential purchaser of the property that: (i) The land has been used as a CCR unit; and (ii) Its use is restricted under the post-closure care requirements as provided by*

40 CFR §257.104 (d)(1)(iii). A notification stating that the notation has been recorded will be prepared within 30 days of recording a notation on the deed to the property. The notification will be complete when it has been placed in the facility's operating record as required by 40 CFR §257.105 (i)(9).

6.0 CCR Inventory and Maximum Closure Area Estimates

Phase I and Phase II will contain approximately 1.85 million cubic yards (mcy) of CCR combined. The vertical expansion permitted in 2011 will add an additional 1.42 mcy of capacity; however, only approximately 1.10 mcy will ever be consumed without expanding the southern liner limits. Assuming no southward expansion, the estimated maximum inventory of CCR ever on-site over the active life of the CCR unit is 2.95 mcy. Approximately 11 acres, the current open area, will be the largest area ever requiring final cover at any time during the CCR unit's active life.

7.0 Estimated Closure Schedule

Estimated closure schedule is summarized in Table 7-1. The milestones and the associated timeframes are initial estimates and will likely change depending on actual fill rates. Furthermore, some activities will overlap.

Table 7-1 Estimated Closure Schedule

Closure Milestone	Year
Complete cover subgrade fill to grade on approximately 7 acres of landfill	2022
Prepare notification of intent to close approximately 7 acres of landfill	2022 (prior to initiating closure)
Construct final cover system on approximately 7 acres of landfill	2022
Prepare construction documentation report for approximately 7 acres of landfill	2022
Complete cover subgrade fill to grade on approximately 7 acres of landfill	2025
Prepare notification of intent to close approximately 7 acres of landfill	2025 (prior to initiating closure)
Construct final cover system on approximately 7 acres of landfill	2025
Prepare construction documentation report for approximately 7 acres of landfill	2025
Complete cover subgrade fill to grade on approximately 7 acres of landfill	2028
Prepare notification of intent to close approximately 7 acres of landfill	2028 (prior to initiating closure)
Construct final cover system on approximately 7 acres of landfill	2028
Prepare construction documentation report for approximately 7 acres of landfill	2028
Complete cover subgrade fill to grade on approximately 7 acres of landfill	2031
Prepare notification of intent to close approximately 7 acres of landfill	2031 (prior to initiating closure)
Construct final cover system on approximately 7 acres of landfill	2031
Prepare construction documentation report for approximately 7 acres of landfill	2031
Complete cover subgrade fill to grade on approximately 7 acres of landfill	2034
Prepare notification of intent to close approximately 7 acres of landfill	2034 (prior to initiating closure)
Construct final cover system on approximately 7 acres of landfill	2034
Prepare construction documentation report for approximately 7 acres of landfill	2034
Prepare notification of closure of entire landfill	2034 (within 30 days of closure completion)
Prepare notation on the deed to the property of landfill	2034
Prepare notification stating that the notation has been recorded for landfill	2034 (will be prepared within 30 days of recording a notation on the deed to the property)

8.0 Recordkeeping

40 CFR §257.102 (b)(2), Written closure plan, states, *“No later than October 17, 2016, the owner or operator of the CCR unit must prepare an initial written closure plan.”* The plan is considered complete when it is placed in the MDU facility operating record.

After October 17, 2016, MDU will maintain a copy of the most recent version of the closure plan in the facility's operating record. According to 40 CFR §257.102 (b)(3), *MDU “must amend the written closure plan whenever: there is a change in the operation of the CCR unit that would substantially affect the written closure plan in effect; or before or after closure activities have commenced, unanticipated events necessitate a revision of the written closure plan.”* MDU *“must amend the closure plan at least 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise an existing written closure plan. If a written closure plan is revised after closure activities have commenced for a CCR unit, the owner or operator must amend the current closure plan not later than 30 days following the triggering event.”* The amended plan is considered complete when it has been placed in the MDU facility operating record.

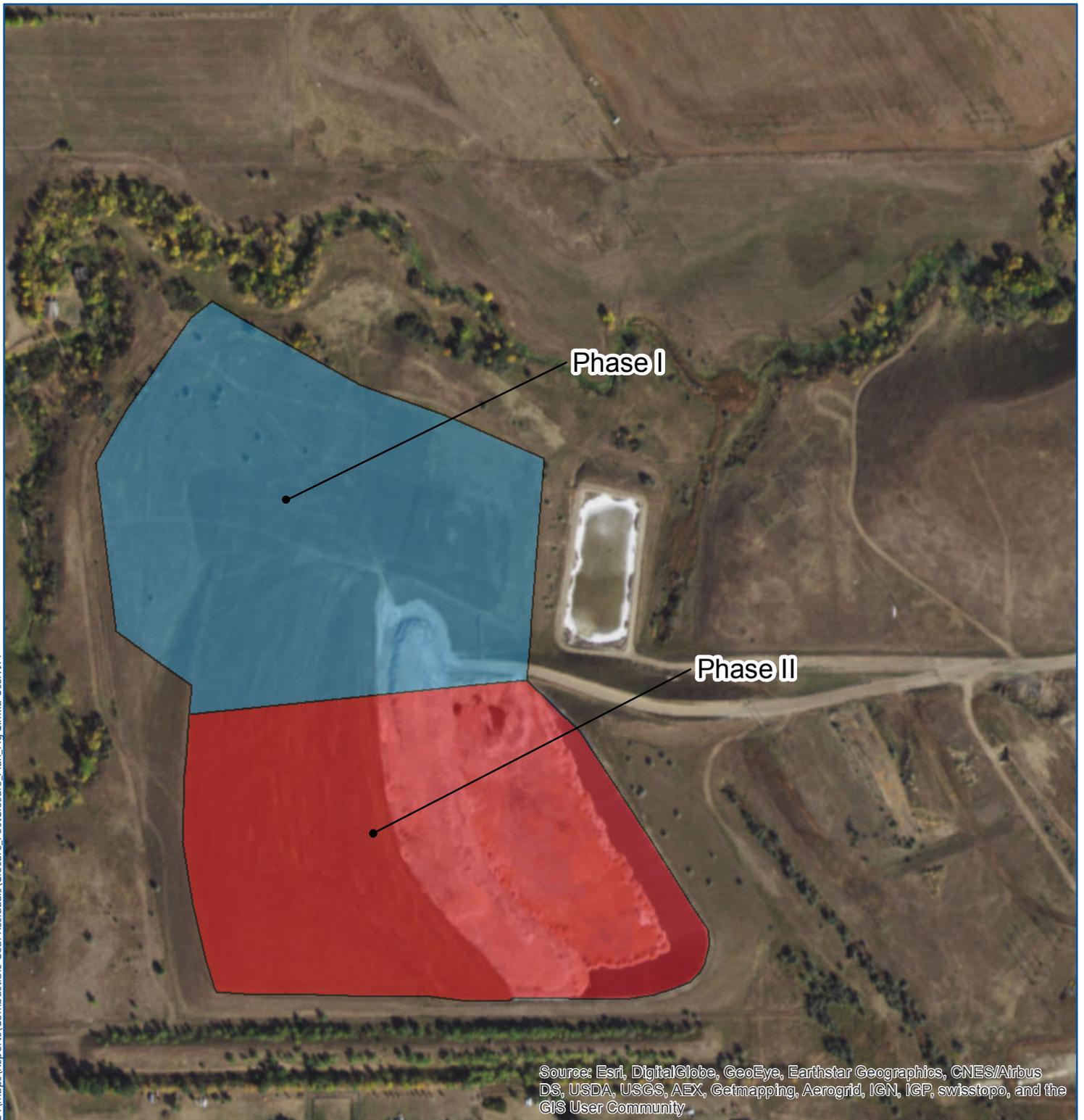
MDU will retain a copy of each applicable file derived from this closure plan *“for at least five years following the date of each occurrence, measurement, maintenance, corrective action, report, record, or study,”* in accordance with 40 CFR §257.105 (b); however, *“only the most recent closure plan must be maintained in the facility's operating record irrespective of the time requirement specified”* in 40 CFR §257.105 (b).

9.0 Reporting

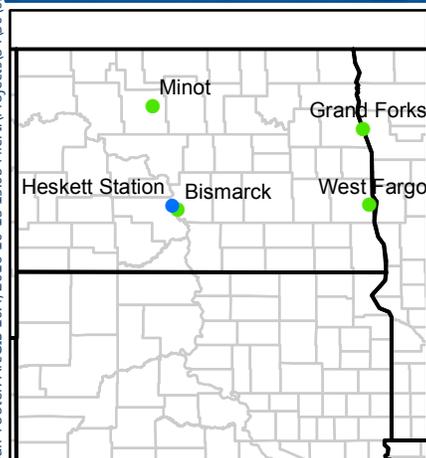
When the initial plan, and successive amendments to the plan, are placed in the operating record they will be made publicly available on the MDU CCR web site in compliance with 40 CFR §257.107 (i)(4), Publicly Accessible Internet Site Requirements. Additionally, to comply with 40 CFR §257.106 (i)(4), Notification Requirements, MDU will *“notify the State Director... when [the closure plan] has been placed in the operating record and on the owner or operator's publicly accessible internet site.”* Notification to State Director will be made to ccr.solidwaste.reports@nd.gov as requested by the North Dakota Department of Health.

Appendix A

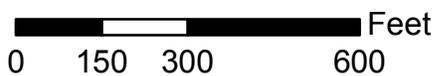
Figure



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



-  Heskett Station
- Landfill Sequence**
-  Phase I
-  Phase II



Heskett Station
CCR Landfill
Montana-Dakota Utilities Co.
Mandan, North Dakota

FIG 1 - LANDFILL SEQUENCE