Prepared for

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COLSTRIP WASTEWATER FACILITY CLOSURE PLAN UNITS 3&4 EFFLUENT HOLDING POND SITE

Per Requirements of AOC Article IX

Colstrip Steam Electric Station
Colstrip, Montana

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ABBREVIATIONS AND ACRONYMS

AOC	Administrative Order on Consent
CCR	Coal Combustion Residuals
COI	Constituent of Interest
CSES	Colstrip Steam Electric Station
EHP	Effluent Holding Pond
GCL	Geosynthetic Clay Liner
HDPE	High Density Polyethylene
LCRS	Liquid Collection and Removal System
MDEQ	Montana Department of Environmental Quality
RPP	Reinforced Polypropylene
SOEP	Stage I Evaporation Pond
STEP	Stage II Evaporation Pond
USEPA	U.S. Environmental Protection Agency
USGS	United States Geologic Survey

1. INTRODUCTION

1.1 Purpose

This Facility Closure Plan (Plan) has been prepared by Geosyntec Consultants, Inc. (Geosyntec) on behalf of Talen Montana, LLC (Talen) pursuant to Article IX of the "Administrative Order on Consent Regarding Impacts Related to Wastewater Facilities Comprising the Closed-Loop System at Colstrip Steam Electric Station, Colstrip Montana" (AOC) [MDEQ 2012]. The AOC was entered between Talen, the successor of PPL Montana, LLC, and the Montana Department of Environmental Quality (MDEQ or the Department) in August 2012.

The AOC for Colstrip Steam Electric Station (CSES or the Station) applies to three areas:

i. Areas at and downgradient of Units 1&2 Stage I and Stage II evaporation ponds northwest of the main plant site (SOEP/STEP Site);
ii. Areas at and downgradient of the main plant site (Plant Site); and
iii. Areas at and downgradient of Units 3&4 effluent holding ponds southeast of the main plant site (EHP Site).

Article IX of the AOC requires a Facility Closure Plan be developed for each of the three areas (or sites). Figure 1 depicts the locations of the three sites. All wastewater facilities identified in Attachment A of the AOC will be addressed in one of the three plans. Table 1 replicates the facilities listed in Attachment A of the AOC and notes which plan addresses each facility. This Facility Closure Plan is for the EHP Site. The Plant Site and the SOEP/STEP Site will be addressed in separate facility closure plans.

1.2 Scope

This Plan specifically addresses the AOC Article IX requirements for the EHP Site including: (1) provisions for control, minimization, or elimination, to the extent necessary to protect human health and the environment, of post-closure escape of Constituents of Interest (COIs) to the environment; (2) proposed actions to inform and obtain input from the community consistent with AOC Article V – Public Participation; and (3) cost estimates for closure and post-closure care. Closure of all CCR units will occur in compliance with the criteria for closure set forth in 40 CFR 257.102.

The current version of the coal combustion residual (CCR) Master Plan Summary Report for the CSES (Master Plan Summary) prepared by Geosyntec [2016a], the written closure plan and post-closure plan for EHP J Cell prepared by Geosyntec [2016b, 2016c], and the written closure plan and post-closure plan for existing impoundments prepared by Geosyntec [2016d, 2016e], serve as the baseline for this Plan for the EHP Site.

1.3 Plan Updates

This Plan will be updated either every five years or when a major change or modification is made to the facility, per the requirement of AOC Article IX.E.

2. BACKGROUND

2.1 Facility Location

The CSES is a coal-fired steam electric generating facility partially owned and operated by Talen. The Station is located near the City of Colstrip, which lies within Rosebud County in south central Montana, approximately 90 miles east of Billings, Montana. An aerial location map of the CSES is shown in Figure 1. Figure 2 presents the location of the EHP Site on United States Geologic Survey (USGS) 7 ½ minute topographic quadrangle maps [USGS 2014].

2.2 EHP Site Description

The EHP Site contains several impoundments (or ponds) used for disposal of flyash scrubber slurry from Units 3 and 4 and bottom ash from Units 1 through 4. The EHP impoundments are also used to store captured groundwater and stormwater runoff for re-use. The EHP Site is located approximately 2.5 miles southeast of the Plant Site. The impoundments within the EHP Site are identified in Figure 3. Table 2 summarizes the historic and current process wastewater ponds at the EHP Site. Details of the construction history of the individual impoundments can be found in the "Colstrip Steam Electric Station History of Construction" prepared by Geosyntec [Geosyntec 2016f].

When CSES Units 3 and 4 were constructed in 1983, the EHP was constructed to manage CCR wastes and wastewater associated with plant processes. Through the 3-mile scrubber-EHP pipeline, scrubber slurry generated from Units 3 and 4 is transported hydraulically to the EHP, and decant water is either evaporated or pumped back to the plant for reuse. The scrubber slurry is currently received at the paste plant building at the EHP Site, where approximately 90 percent of the available free water in the flyash scrubber slurry is removed prior to disposal in ponds [Geosyntec 2016a]. Decant water is routed to the EHP clearwell and then returned to the scrubbers for reuse [Hydrometrics 2016]. Bottom ash is dewatered at the Plant Site and then transported via truck to the EHP Site for placement in disposal ponds [Geosyntec 2016a]. Clear water from the bottom ash clearwell is re-used at the plant [Hydrometrics 2016].

It is notable that during original construction, a bentonite amended concrete cutoff wall was built around the EHP Site perimeter down to the bedrock. Also during original construction, the EHP Site was partially lined with bentonite-amended soils below 3,200 ft-msl and an underdrain system was constructed above the soil liner (Figure 4).

2.3 Master Plan Summary

The Master Plan Summary [Geosyntec 2016a] for the CSES was prepared to describe the means and methods for managing water and waste at CSES in a manner that complies with the United States Environmental Protection Agency's (USEPA's) Final Rule for regulation of CCR under Subtitle D of the Resource Conservation and Recovery Act (RCRA), hereafter referred to as the CCR Rule or the Rule [USEPA 2015]. The current version of the Master Plan Summary was prepared by Geosyntec for Talen and updated on 23 September 2016 to reflect the shutdown of Units 1 and 2 by 1 July 2022 and non-liquid disposal of CCRs at the EHP by 1 July 2022.

A key consideration of the Master Plan Summary is to identify and coordinate the actions that will be implemented to comply with the CCR Rule and the requirements of the AOC. The actions recommended in this Plan are consistent with both the Master Plan Summary and the AOC, at this time. However, as the site investigation and remediation requirements of the CCR Rule are addressed, it will be necessary to verify that the EHP Site development and closure activities described in the Master Plan Summary are consistent with the AOC implementation plans and potential regulatory changes.

3. HEALTH AND ENVIRONMENTAL PROTECTION

3.1 EHP Site Closure Plan

To provide for control, minimization, or elimination, to the extent necessary to protect human health and the environment, of post-closure impact of COIs to the environment, a closure plan and post-closure plan for each impoundment regulated by the CCR Rule has been prepared [2016b, 2016c, 2016d, 2016e]. Impoundments not regulated by the CCR Rule will be similarly closed by removal of water prior to use as stormwater containment structures. Additionally, pipelines will be drained and closed in place, and their associated drain pits will be decommissioned, removed, and the disturbed area will be reclaimed with vegetation.

3.1.1 EHP Site Wastewater Facility Closure

Closure plans for the individual impoundments within the EHP Site, the pipelines, and the drain pits along the pipeline are described below. Table 2 summarizes these plans.

EHP A Cell

EHP A Cell was originally used for fly ash disposal and now is filled with dry fly ash, ash paste, and bottom ash. The footprint of A Cell is 45.6 acres. Bentonite-amended soils were used to line a portion of the original floor where the elevation was below 3,200 ft-msl and where a more permeable rock type outcropped. An underdrain system was also installed in these areas above the liner soils. Per the Master Plan Summary, A Cell will be closed in accordance with the requirements

of the CCR Rule. A final alternative cover system will be constructed in 2017. The south portion of A Cell (23.1 acres) will be closed by leaving CCR in place. The north portion will also be closed by leaving CCR in place and will have a new impoundment constructed over it (see EHP New Clearwell).

EHP New Clearwell

The north portion of A Cell (22.5 acres) will be closed by constructing a new impoundment, EHP New Clearwell, over it in 2017. To construct the EHP New Clearwell, some CCR will be relocated to C Cell. EHP New Clearwell will be constructed using a double liner system with a liquid collection system placed in between. Taking the place of EHP B Cell, EHP New Clearwell will store decant water for reuse at the plant. When there is no longer the need for decant water reuse, the EHP New Clearwell will be dewatered through the treatment system identified in the Master Plan Summary and used for stormwater storage.

EHP B Cell

EHP B Cell (39.0 acres) was upgraded with a RPP liner and an underlying liquid collection system in 2008 and now serves as the clearwell for process water storage. B Cell will be closed in accordance with the requirements of the CCR Rule with a geomembrane, geocomposite drainage layer, and a secondary liquid removal system placed above the existing geosynthetic liner (liner components listed from top to bottom). After closure, currently planned for 2019, B Cell will be used for stormwater storage.

EHP C/C-1 Cells

EHP C Cell (74.9 acres) is currently being filled with bottom ash and ash paste. C Cell will be closed in accordance with the requirements of the CCR Rule, planned for 2023, with CCR left in place. An alternative cover system will be constructed over the entire area of C Cell. An overfill unit, C-1 Cell, will be constructed over a portion of C Cell with a geosynthetic liner system. C-1 Cell will be used for dry CCR disposal above the liner and will be closed with a final alternative cover system after the units are no longer in service.

EHP D/E Cells

EHP D/E Cell (39.2 acres) is currently filled with CCR. D/E Cell will be closed in accordance with the requirements of the CCR Rule. D/E Cell is planned to be closed by leaving CCR in place in 2022. A final alternative cover system will be constructed over the entire area of the cell.

EHP F Cell

EHP F Cell (59.2 acres) was upgraded with a RPP composite liner system and a liquid collection system installed over paste/scrubber slurry in 2005. F Cell will continue to be used for captured groundwater storage and excess water elimination by a forced evaporation system. Once the unit is no longer in service, F Cell will be dewatered, left empty and used for stormwater collection. Seepage analysis was performed to evaluate the infiltration through F Cell during the post-closure period. The pond is assumed to be dewatered and left dry when closed. The city of Billings, Montana was selected for weather data inputs, including evapotranspiration, precipitation, temperature and solar radiation data. Using these data inputs, the 30-year average annual percolation through F Cell is approximately 0.17 gallons per minute. The stormwater stored in the pond will evaporate quickly under the site conditions and little water will remain in the pond.

EHP H Cell

EHP H Cell (49.9 acres) was upgraded in 2013 with a double-RPP liner and a liquid collection system between the liners. H Cell will continue to be used for excess water storage until the excess water is eliminated through the forced evaporation system. H Cell will be dewatered, left empty and used for stormwater collection once the unit is no longer in service. Seepage analysis was performed to evaluate the infiltration through H Cell during the post-closure period. The pond is assumed to be dewatered and left dry when closed. The city of Billings, Montana was selected for weather data inputs, including evapotranspiration, precipitation, temperature and solar radiation data. Based on these data inputs, the 30-year average annual percolation through H Cell is negligible, approximately 9.5×10^{-3} gallons per minute. The stormwater stored in the pond will evaporate quickly under the site conditions and little water will remain in the pond.

EHP G/G-1 Cells

EHP G Cell (57.8 acres) was partially lined with bentonite-amended soils below 3,200 ft-msl during its original construction in 1983. G Cell is partially filled with fly ash and ash paste. Per the Master Plan Summary, G Cell will be closed in accordance with the requirements of the CCR Rule. G Cell will be closed in 2018 by leaving CCR in place. An alternative cover system will be constructed over G Cell. An overfill unit, G-1 Cell, will be constructed over the entire area of G Cell with a geosynthetic liner and a liquid collection system. G-1 Cell will be used for CCR disposal above the liner and will be closed with a final alternative cover system once the units are no longer in service.

EHP J/J-1 Cells

EHP J Cell (57.1 acres) was formed in 2014 by consolidating EHP Old Clearwell and the north portion of EHP G Cell. Old Clearwell and G Cell were partially lined with bentonite-amended soils below 3,200 ft-msl during their original construction. Per the Master Plan Summary, J Cell was closed in accordance with the requirements of the CCR Rule in 2017. An alternative cover system

was constructed over J Cell. An overfill unit, J-1 Cell, was constructed over the entire area of J Cell with a geosynthetic liner and a cover liquids collection system. J-1 Cell is designed for CCR disposal above the liner before closure with a final alternative cover system, currently planned for 2024.

Units 3&4 Scrubber-EHP Pipeline and Drain Pits #3 and #5

A three-mile pipeline was constructed in 1983 to transport Units 3&4 scrubber slurry from the scrubbers to the EHP Site and return clearwater to the scrubbers. The pipeline was originally fiberglass, and was replaced with HDPE between 1988 and 1998. Along the pipeline, Drain Pits #3 (0.40 acres) and #5 (0.35 acres) are lined with a geosynthetic liner and periodically used to facilitate draining the pipelines during maintenance. The pipelines and the drain pits will be decommissioned once the plant is no longer in service. CCR material and water in the pipeline and the drain pits will be drained and transported to the final disposal ponds at the EHP Site. The pipeline will be closed in place. The geosynthetic liner in the drain pits will be removed and disposed in the disposal ponds at the EHP Site after dewatering. The drain pits will then be pushed in with soils to achieve the natural-appearing grade that blends the area into the surrounding landscape. The disturbed area will be reclaimed with vegetation.

3.1.2 Final Cover System

As discussed above, EHP A, B, C/C-1, D/E, G/G-1, and J/J-1 Cell closures will be designed in accordance with the requirements of the CCR Rule §257.102(d)(3)(ii) for an alternative final cover system. A low-permeability final cover will be used to close all CCR Rule-regulated impoundments to control and reduce, to the extent feasible, post-closure infiltration of stormwater into the waste. The infiltration layer of the alternative final cover system will achieve an equivalent reduction in infiltration as the prescriptive final cover system such that the permeability of the final cover system is less than or equal to the permeability of the bottom liner or natural subsoils present (or 1×10^{-5} cm/sec, whichever is less). The design of the final cover system will include an erosion layer that provides equivalent protection from wind or water erosion as an erosion layer that contains a minimum of six inches of earthen material capable of sustaining native plant growth.

The final cover will be constructed of earthen and geosynthetic components that are sufficiently flexible to accommodate expected local differential settlements and subsidence. The design of the final cover system, lateral drainage layer, and dewatering system are such that there will be no further impounding of water, sediment, or slurry in the closed impoundment.

Quality control and quality assurance measures will be implemented at the time of final cover system construction such that the final cover will be constructed as designed to achieve and maintain slope stability and integrity throughout the closure and post-closure periods. The

specific closure design varies depending on the future use of the unit. For more details of the final cover system design for each pond, please see the written closure plan for J Cell [Geosyntec 2016b] and the written closure plan for existing impoundments [Geosyntec 2016d].

The specific design for each cell varies depending on the future use of the cell as follows. The general cross sections for final alternative cover systems are provided in Figure 5 and described below.

Type I Cover System

EHP B Cell will be closed and used for future stormwater storage. The cover system design includes (from top to bottom):

- 60-mil textured high density polyethylene (HDPE) geomembrane; and
- geocomposite drainage layer.

The geocomposite will be placed directly on the existing RPP liner or installed above a prepared subgrade of CCR material.

Type II Cover System

EHP J Cell was closed followed by the construction of a new CCR Rule-compliant impoundment directly above the closed impoundment (EHP J-1 Cell) in 2016. A portion of EHP C Cell and all of EHP G Cell will be closed in the same manner, followed by the construction of a new CCR Rule-compliant impoundment directly above the closed impoundment (EHP C-1 and G-1 Cells, respectively). The composite cover system design for the underlying unit includes (from top to bottom):

- 18-inch bottom ash protective drainage layer;
- 8-oz non-woven geotextile cushion;
- 60-mil textured HDPE geomembrane; and
- geosynthetic clay liner (GCL).

The GCL will be installed above a prepared subgrade of CCR material.

As designed, the Type II cover system includes a bottom ash protective drainage layer overlaying a composite infiltration layer comprised of an upper geomembrane component and lower GCL component. The protective drainage layer provides lateral drainage, which will minimize the head on the geomembrane and limit infiltration through the final cover. The drainage layer will be graded at a two percent slope to allow drainage to a dewatering system. The drainage system is comprised of perforated HDPE liquid collection pipes embedded in protective gravel mounds at maximum 375 feet spacing on the final cover and in toe drains at the

boundary between cell side slopes and the final cover. Liquids collected in the pipes and toe drains will be conveyed to sumps fitted with riser pipes in which pumps will be operated to remove liquids.

Type III Cover System

A portion of EHP A Cell (north portion) will be closed followed by the construction of a new CCR Rule-compliant impoundment directly above the closed impoundment (EHP New Clearwell). The cover system design includes (from top to bottom):

- 60-mil textured HDPE geomembrane;
- geocomposite drainage layer;
- 60-mil textured HDPE geomembrane; and
- GCL.

The GCL will be installed above a prepared subgrade of CCR material.

As designed, the Type III cover system includes a composite infiltration layer comprised of an upper geomembrane component and a lower GCL component both overlain by a geocomposite drainage layer and an additional geomembrane to protect the geocomposite. The geocomposite drainage layer provides lateral drainage, which will reduce the head on the lower geomembrane and limit infiltration through the final cover. The drainage layer will be graded at a sufficient slope to allow free flow of liquid through the geocomposite. Liquids collected within the drainage layer will be conveyed to sumps fitted with riser pipes in which pumps will be operated to remove liquids to the decant water pond for use by the plant. After the plant is no longer in service, the liquids in the decant water pond will be treated before discharge.

Type IV Cover System

A portion of A Cell (south portion) and all of D/E, C-1, G-1, and J-1 Cells will be closed with a cover design that includes (from top to bottom):

- 6-inch thick erosion layer capable of sustaining native plant growth;
- 12-inch thick layer of earthen material serving as an infiltration layer;
- geocomposite drainage layer (where needed);
- 40-mil textured HDPE geomembrane; and
- 8-oz non-woven geotextile cushion (where needed).

The geomembrane will be installed above a prepared subgrade of CCR material.

As designed, the Type IV cover system will provide sufficient lateral drainage of liquids off the cap, which will reduce the head on the geomembrane and thus, the infiltration through the final

cover. The geomembrane infiltration layer will be overlain by an 18-inch protective cover soil layer, which will protect the geomembrane infiltration layer and provide vegetative support to limit erosion of the final cover. The drainage layer will be graded at a sufficient slope to allow free flow of liquid through the geocomposite. Liquids collected within the drainage layer will be conveyed off the cover and collected in stormwater management features such as channels, culverts, and storage ponds.

As discussed in Section 3.1.1, EHP H Cell was double-RPP lined and a liquid collection system was installed between and under the liners in 2013. The liner configuration of EHP H Cell is similar to that of EHP NEW Clearwell (Type III Cover System). Therefore, H Cell was constructed in a manner that satisfies the closure requirements of the CCR Rule. EHP F Cell was lined in 2005 with a RPP, geocomposite, and a liquid collection system installed over paste/scrubber slurry. The liner configuration of EHP F Cell is similar to that of EHP B Cell (Type I Cover System). Seepage analysis indicates that the 30-year average annual percolations through H and F Cells during the post-closure period are approximately 0.0095 gallons per minute and 0.17 gallons per minute, respectively. The stormwater impounded in the ponds will evaporate quickly under the site conditions and little water will remain in the ponds.

3.2 Post-Closure Care

Post-closure care activities considered in this Plan include maintenance of final covers as needed to maintain integrity and effectiveness and to addresses settlement and erosion, and operation and management of liquid collection and removal system. Groundwater activities, such as operation and maintenance of groundwater monitoring and groundwater capture systems, will be addressed by the groundwater remediation reports under the AOC.

3.2.1 Property Uses During Post-Closure Period

Planned uses for the EHP Site include stormwater or captured groundwater storage, and may include cattle grazing after the plant is out of service. Cattle grazing is recommended by the reclamation consultant to facilitate good vegetative cover. Disturbance to the integrity of the closure/containment system is not anticipated. To provide for control, minimization, or elimination, to the extent necessary to protect human health and the environment, of post-closure escape of COIs, an appropriate institutional control may be imposed on the real property, without conveying the property or creating a dominant and servient estate.

3.2.2 Final Cover System Maintenance

Construction of the final cover as described above uses passive management systems to the extent possible to reduce the need for long-term maintenance of cells after closure or after construction of an overfill cell. If the closed unit is not used as overfill or for storage of stormwater or captured groundwater, the final cover will be vegetated with native, non-woody

vegetation requiring little maintenance such as mowing. Following decommissioning, the Units 3&4 Scrubber-EHP Pipeline route will be reclaimed with vegetation and require no post-closure care.

For existing impoundments where a new CCR Rule-compliant surface impoundment overfill or a stormwater pond will be constructed directly above the closed CCR surface impoundment (i.e., the north portion of A Cell, all of B Cell), the cover system for the underlying impoundment will be protected from erosion damage by the placement of CCR solids and/or water in the lined overfill impoundment. This negates the need for the installation of an erosion layer as part of the cover system and eliminates the need for future maintenance and repair of erosion layer soils and vegetation.

Following the closure of a CCR surface impoundment where no overfill construction or stormwater storage is planned (i.e., the south portion of A Cell, all of D/E Cell, J-1 Cell, G-1 Cell, and C-1 Cell), erosion and sedimentation control measures will be maintained until vegetated surfaces of the final cover system are fully stabilized. After vegetation is fully established, routine site inspections will be performed as part of post-closure care to monitor the condition of the access roads, stormwater channels, and final cover and evaluate if repair maintenance is needed.

When identified during routine site inspections, eroded, non-vegetated, or otherwise damaged areas of the final cover will be repaired by the addition of soil, regrading, and revegetation, as necessary.

During detailed design of impoundment closure, a run-on and run-off control and stormwater management system will be developed. The run-on and run-off control system will be designed and constructed to limit erosion and other damage to the final cover. The run-on and run-off control system will also be designed and constructed to maintain its effectiveness following closure of the surface impoundment.

The drainage systems will be operated and monitored as needed to remove liquids from above the underlying impoundments' cover system, including managing cover liquids produced by the waste placed in the overfill impoundment and/or by managing water that drains from the overlying impoundment into the drainage system. If routine inspections and/or monitoring, or performance of the drainage system, indicate that the drainage system is not operating as designed, maintenance will be performed to correct the deficiency.

3.2.3 Liquid Collection and Removal System Maintenance

Each of the overfill impoundments will be constructed with a liquid collection and removal system (LCRS) consisting of one or more components that may include a geocomposite, bottom ash or soil protective drainage layer, piping, and/or gravel.

The underdrain collections system for the New Clearwell consists of one underdrain collection system situated between the primary and secondary liners (between liner collection). The double liner and underdrain collection system consist of the following components (from top to bottom):

- 60-mil textured HDPE primary geomembrane liner;
- 250-mil geocomposite intermediate drainage layer consisting of a geonet between two geosynthetic cushions (collection system between liners);
- 60-mil textured HDPE secondary geomembrane liner;
- 240-mil geosynthetic clay liner; and
- prepared CCR subgrade.

After B Cell closure, the underdrain collections systems for the B Cell will consist of: (i) one underdrain collection system situated between the primary and secondary liners (between liner collection), and (ii) a second underdrain collection system situated beneath the secondary liner (under liner). The double liner and underdrain collection system consist of the following components (from top to bottom):

- 60-mil textured HDPE geomembrane liner (primary);
- geocomposite drainage layer consisting of a geonet between two geosynthetic cushions (between liner or primary collection system);
- prepared CCR subgrade (if needed);
- 45-mil Reinforced Polypropylene (RPP) liner (secondary);
- geotextile cushion layer; and
- Compacted liner subgrade (under liner or secondary collection system).

The underdrain collections systems for the C-1, G-1 and J-1 Cells consist of one liquid collection system situated above the liner. The liner and LCRS consist of the following components (from top to bottom):

- 18-in protective drainage bottom ash layer (collection system above liner);
- 8-oz non-woven geotextile cushion layer;
- 60-mil textured HDPE geomembrane;
- geosynthetic clay liner; and
- prepared CCR subgrade.

The underdrain collection system for the F Cell consists of an underdrain collection system situated beneath the liner (under liner). The liner and underdrain collection system consist of the following components (from top to bottom):

- 45-mil Reinforced Polypropylene (RPP) liner;
- 8-oz geotextile cushion layer; and
- compacted liner subgrade (collection system under liner).

The underdrain collection systems for the H Cell consist of: (i) one underdrain collection system situated between the primary and secondary liners (between liner collection), and (ii) a second underdrain collection system situated beneath the secondary liner (under liner). The double liner and underdrain collection system consist of the following components (from top to bottom):

- 45-mil RPP primary geomembrane liner;
- 350-mil geocomposite drainage layer consisting of a geonet between two geosynthetic cushions (between liner or primary collection system);
- 36-mil RPP secondary geomembrane liner;
- geotextile cushion layer; and
- compacted liner subgrade (under liner or secondary collection system).

Liquids collected in the drainage system will be conveyed to a sump fitted with riser pipes in which a pump will be operated to remove liquids to the decant water pond for use by the plant and after plant shutdown to the treatment system identified in the Master Plan Summary. The LCRS installed above the geosynthetic liner will reduce the liquid head on the liner and limit infiltration from the overlying cells. The LCRS installed below the geosynthetic liner will be operated to remove any liquid seeping through the liner.

The LCRS will be operated and maintained throughout the post-closure period managing liquid produced by the waste placed in the impoundments if necessary. If monitoring or performance of the LCRS indicates that the system is not operating as designed, maintenance will be performed to correct the deficiency.

4. PROPOSED ACTIONS FOR PUBLIC PARTICIPATION

Per Article IX.C of the AOC, this Plan "shall include proposed actions to inform and obtain input from the community consistent with Article V." The proposed actions that Talen will conduct for public participation and that the Department shall perform as part of its action on this submission are in accordance with Article V.F of the AOC (Amendment entered effective March 1st, 2017). The following bullet points are a summary of those requirements:

- Talen will submit this Plan to the Department per the requirements of the AOC;
- The Department shall post this Plan on its website upon receipt of this report. If the Department disapproves the plan, it shall also post its written disapproval;
- The Department shall post any revised plans submitted by Talen addressing concerns identified by the Department in its disapproval;
- The Department shall post a preliminary approval or preliminary conditional approval of the plan or revised plan on its website and a notice to the public of a 30-day period within which to comment on the report;

- Upon receipt of a written request within 10 days of posting by 10 or more persons or by a group having 10 or more members, the Department will conduct a public meeting on the plan;
- If a request for a public meeting has been received, the Department will set a public meeting and publish a public notice of the meeting on its website and in the local newspaper and the Billings Gazette;
- The public meeting must be held at least 10 days prior to the close of the public comment period. The Department shall conduct the public meeting;
- The Department will respond to substantive public comment as part of its final action on the submission; and
- The Department shall conduct a public meeting annually to inform the public of progress made by the Department and Talen under the AOC and to accept any input the public may have on implementation of the AOC.

5. COST ESTIMATE FOR CLOSURE AND POST-CLOSURE CARE

Cost estimates are based on recent cost experience at CSES for similar construction work and Geosyntec's experience with similar projects. To estimate costs for future development activities, costs for typical construction activities anticipated to be performed at the Station were developed (e.g., capping, liner system) and these costs were then normalized on a per unit basis (e.g., acre, foot, square foot). This per unit cost was then used to estimate construction costs for each of the anticipated impoundment construction activities based on the size of the existing or proposed impoundment and the type of construction activity being performed. Costs for closure and post-closure care activities are presented in 2017 dollars.

Table 3 presents the cost estimate for closure and post-closure care of wastewater facilities at the EHP Site. It is notable that the future construction costs are heavily dependent on a few construction components (primarily geosynthetics but also, for some units, excavation), for which the costs are reasonably well known, and on several ancillary construction items (e.g., liquid or cover drainage systems), which are affected by specific design details and, therefore, are less certain. More detailed cost estimates will be developed during the design phase for each construction activity. In addition, the costs are dependent on the assumptions discussed throughout this Plan.

6. REFERENCES

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TABLES

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Table 1 AOC Attachment A Facilities with Plan Reference

Wastewater Facility [1]	Facility Closure Plan
Units 1&2 A/B Flyash Pond	Plant Site
Clearwell	
A Pond	
B Pond	
1&2 Scrubber Pipeline [2]	SOEP/STEP Site
Units 1&2 Wash Tray Pond	Plant Site (currently Units 1&2 Bottom Ash Clearwell)
Units 1&2 Bottom Ash Pond w/ Clearwell	Plant Site
Units 1&2 Brine Waste Disposal Ponds	Not Applicable (previously closed per MDEQ approval)
D1-D3 ponds	
D4 pond	
Units 1&2 Cooling Tower Blowdown (Pond C)	Plant Site
Pond C North	
Pond C South	
Units 1&2 Stage I Evaporation Pond (E Pond)	Not Applicable (previously closed per MDEQ approval)
Units 1&2 Stage II Evaporation Pond	SOEP/STEP Site
Cells A, E	
Cell B	
Old Clearwell	
Cell D	
Units 3&4 Auxiliary Scrubber Drain Pond	Not Applicable (concrete structure being addressed as part of plant demo work)
Units 3&4 North Plant Area Drain	Plant Site
Units 3&4 Wash Tray Pond	Plant Site
Units 3&4 Scrubber Drain Collection (DC Pond)	Plant Site
Units 3&4 Bottom Ash Pond w/ Clearwell	Plant Site
Units 3&4 Effluent Holding Pond w/ Clearwell (EHP)	EHP Site
Effluent Holding Pond (EHP	
Units 3&4 Scrubber-EHP Pipeline [2]	EHP Site
Units 1-4 Sediment Retention Pond	Plant Site

Table 1 AOC Attachment A Facilities with Plan Reference (cont.)

Wastewater Facility [1]	Facility Closure Plan
Units 1-4 North Plant Sediment Retention Pond	Plant Site
Units 1-4 Surge Pond (Castle Rock Lake)	Not Applicable (Fresh water supply pond, not a wastewater facility)
Unit 4 Cooling Tower Canal	Not Applicable (concrete structure being addressed as part of plant demo work)
Drain Pit #3 [2]	EHP Site
Drain Pit #5 [2]	EHP Site
Drain 1AD Drain Pond [2]	SOEP/STEP Site

Notes: (1) Wastewater facilities from AOC Attachment A unless otherwise specified.

(2) Drain pits along the pipelines were not listed in AOC Attachment A.

Table 2 Description of Wastewater Facility Construction and Service History at the EHP Site

Wastewater Facility	Surface Area (acre) [1]	Years in Service	Contents Stored	Construction Upgrades/Operation Changes
A Cell [2] (south portion to be capped)	23.1	1983 - 2017	CCR solids	Close by capping south portion of A Cell, planned for 2017
New Clearwell [2] (over north portion of A Cell)	22.5	1983 - 2017	CCR solids	Close by constructing New Clearwell over north portion of A Cell, planned for 2017
		2017 - plant shutdown	CCR water	New Clearwell over A Cell to store CCR decant water until plant shutdown
		After plant shutdown	Stormwater	New Clearwell over A Cell to store stormwater after plant shutdown
B Cell (Clearwell)	39	1983 - 2008	CCR water and solids	B Cell stored CCR water and solids until 2008
		2008 - 2019	CCR water	Liner for B Cell upgraded in 2008 to serve as Clearwell
		After 2019	Stormwater	Close the unit by upgrading liner in 2019 for stormwater storage
C/C-1 Cells [3]	74.9	1983 - 2023	CCR water and solids	Close C Cell by installing new liner for C-1 Cell, planned for 2023
		2023 - plant shutdown [6]	CCR solids	Close C-1 Cell by capping after plant shutdown
D/E Cell	39.2	1983 - 2022	CCR solids	Close by capping the unit, planned for 2022
F Cell [4]	59.2	1983-2004	CCR water and solids	Stored scrubber slurry until 2004
		2005 plant shutdown	Impacted groundwater and excess pond water	Lined in 2005 using 10+ ft. of dried paste slurry as bottom liner and 45-mil RPP as upper liner with an underdrain collection system installed below the geomembrane. To be used for stormwater storage.

Table 2 Description of Wastewater Facility Construction and Service History at the EHP Site (cont.)

Wastewater Facility	Surface Area (acre) [1]	Years in Service	Contents Stored	Construction Upgrades/Operational Changes
G/G-1 Cells [3]	51.8	1983 - 2005	CCR water and solids	Close G Cell by installing new liner for G-1 Cell, planned for 2018
		2005 - plant shutdown [6]	CCR solids	Close G-1 Cell by capping, after plant shutdown
H Cell [4]	49.9	1983 - 2013	CCR water and solids	Stored scrubber slurry until 2013
		2013 - plant shutdown	Excess pond water to be evaporated as part of the excess water elimination program	Double-lined in 2013 with RPP and under drain systems installed in between and below the liners over dry scrubber slurry
J/J-1 Cells [3]	57.1	1983 - 2013	CCR water and solids	Old Clearwell received paste from 2009-2013. Old Clearwell and north portion of G Cell combined in 2014 to form J Cell
		2014 - 2016	CCR water and solids	Closed J Cell and lined J-1 Cell in 2017
		2016 - 2024 [6]	CCR water and solids	Close J-1 Cell by capping, planned for 2024
Units 3&4 Scrubber-EHP Pipeline and Drain Pits #3 and #5 [5]	Not Applicable	1983 - plant shutdown	Scrubber slurry transported from the scrubbers to the EHP and clearwater returned to the scrubbers	3-mile pipeline was originally fiberglass, changed out to HDPE from 1988 - 1998. Drain Pits #3 and #5 along the pipeline were GM lined. To be decommissioned and removed for disposal after plant shutdown.

Notes: (1) This is the footprint of the cell.

(2) Total area of EHP A Cell is 45.6 acres, including the south portion to be capped (23.1 acres) and the north portion (22.5 acres) where EHP New Clearwell is planned for 2017.

(3) EHP J-1 Cell was constructed over J Cell in 2017. EHP C-1 Cell over C Cell and G-1 Cell over G Cell are planned for 2018 and 2023, respectively.

(4) EHP F and H Cells will continue to be used for groundwater capture water and excess water storage to be eliminated through the forced evaporation system. EHP F and H Cells are intended to be dewatered and used for stormwater storage after plant shutdown.

(5) The Units 3&4 scrubber-EHP pipeline and Drain Pits #3 and #5 along the pipeline are an accessory to the EHP Site and are considered in the Report.

(6) The placement of CCRs will be dry after 1 July 2022.

Table 3 Cost Estimates for Wastewater Facility Closure and Post-Closure Care at the EHP Site

Wastewater Facility	Closure (1)	Post-Closure Care (1)(2)(3)	Subtotal (1)
EHP A Cell (including New Clearwell)	$7.92 M	$ 1.39 M	$ 9.31 M
EHP B Cell	$ 5.70 M	$ 2.34 M	$ 8.04 M
EHP C/C-1 Cells	$ 18.18 M	$ 4.50 M	$ 22.68 M
EHP D/E Cells	$ 8.50 M	$ 2.36 M	$ 10.86 M
EHP F Cell	$ 0.50 M	$ 3.56 M	$ 4.06 M
EHP G Cells	$ 7.66 M	$ 3.11 M	$ 10.77 M
EHP H Cell	$ 0.50 M	$ 3.00 M	$ 3.50 M
EHP J-1 Cell (constructed over J Cell in 2017)	$ 12.00 M	$ 3.43 M	$ 15.43 M
Units 3&4 Scrubber-EHP Pipeline and Drain Pits #3 and #5	$ 0.19 M	$0.00	$ 0.19 M
		EHP SITE TOTAL	**$ 84.84 M**

Notes: (1) Costs for closure and post-closure care activities are presented in 2017 dollars

(2) A post-closure care period of 30 years is considered after the EHP Site is closed after plant shutdown. Under the CCR Rule, the owner or operator of a CCR unit should conduct post-closure care for 30 years.

(3) Post-Closure Care includes maintenance of final cover as needed to maintain integrity and effectiveness and addresses settlement and erosion, operation and management of liquid collection and removal system. Operation and maintenance of groundwater monitoring system and groundwater capture system will be addressed by the remediation report under the AOC.

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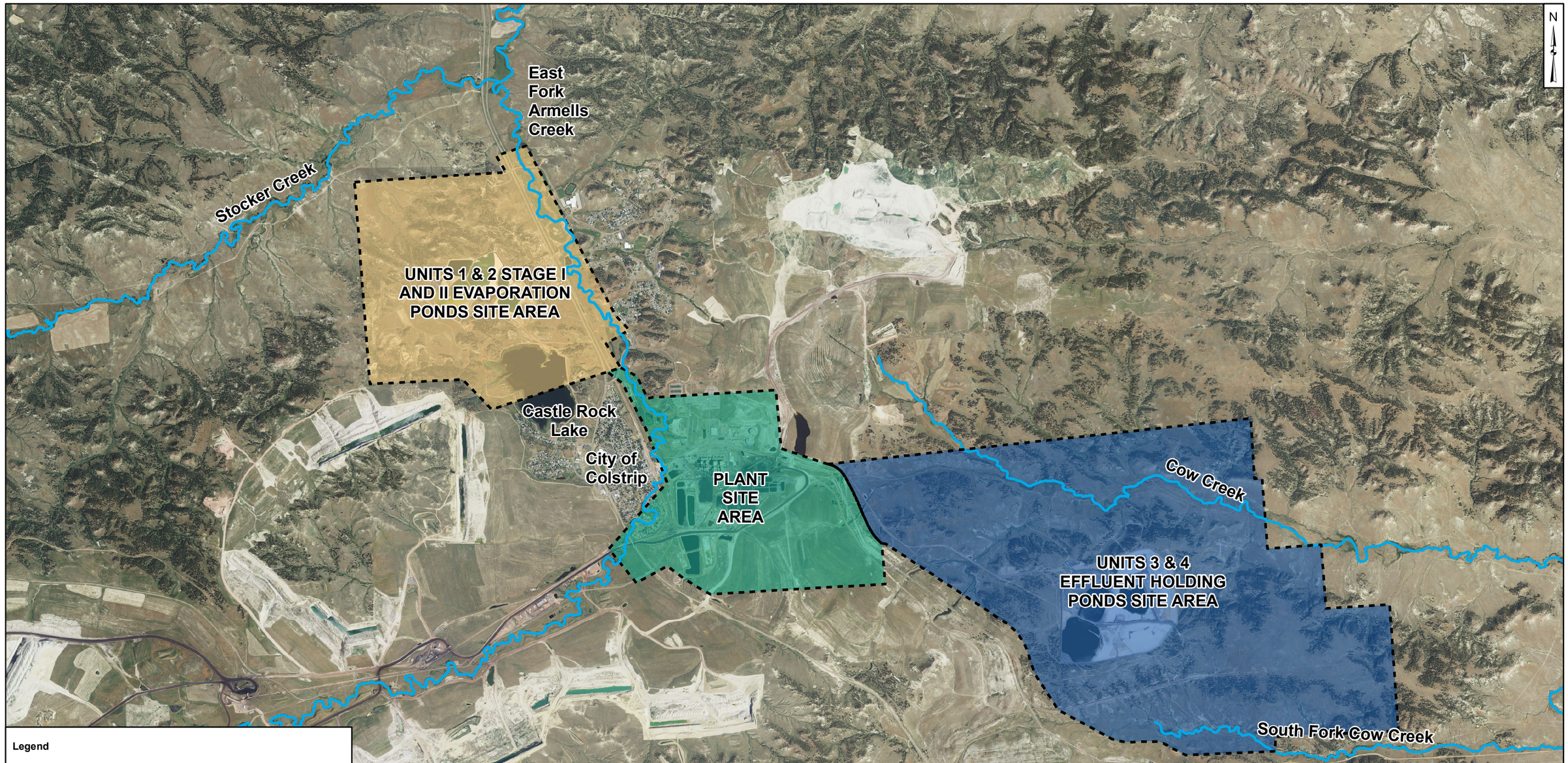
FIGURES



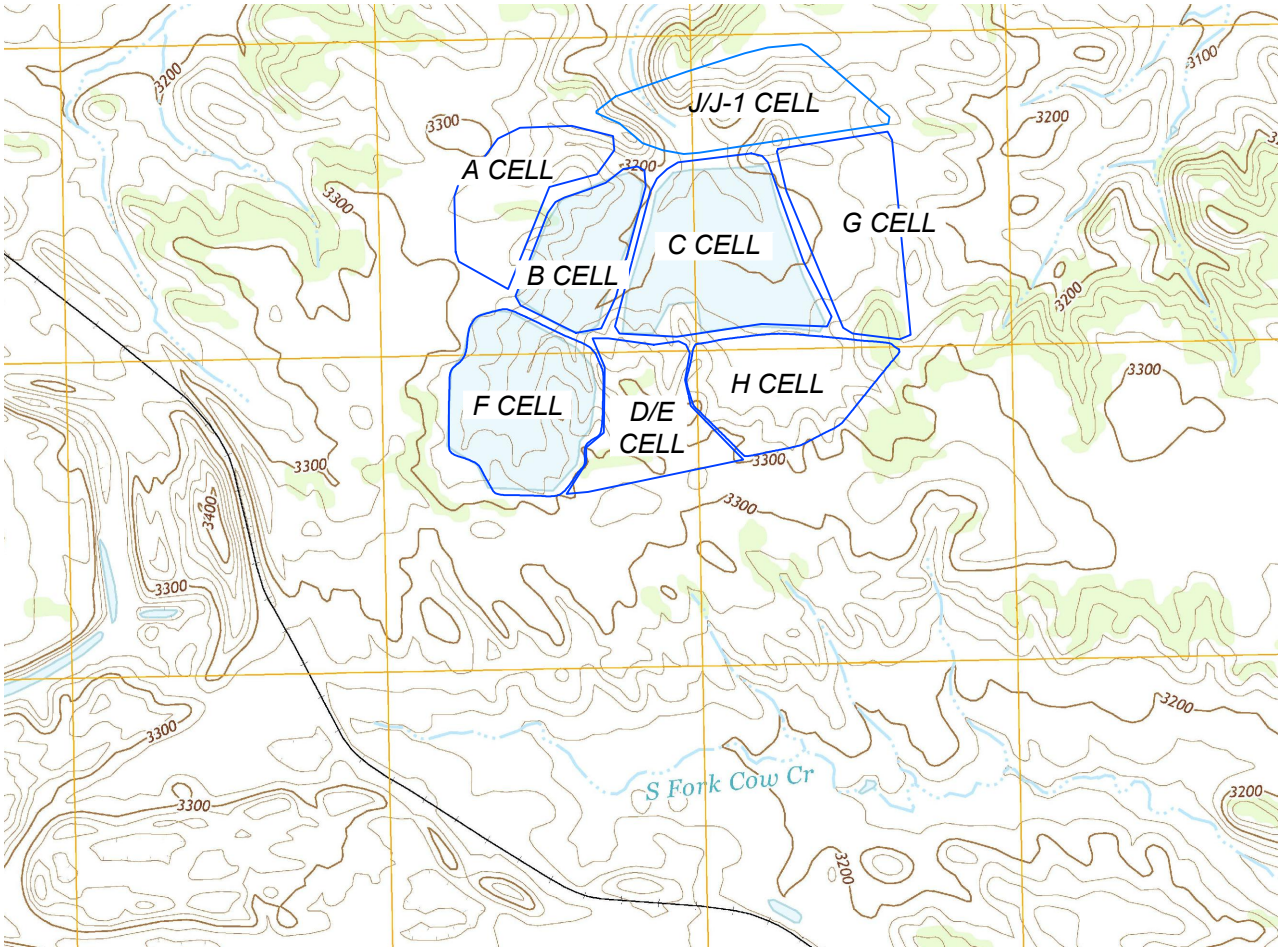
Administrative Order on Consent Site Areas

Colstrip Steam Electric Station
Colstrip, Montana

Geosyntec consultants

Columbia, MD | July 2017

Figure 1



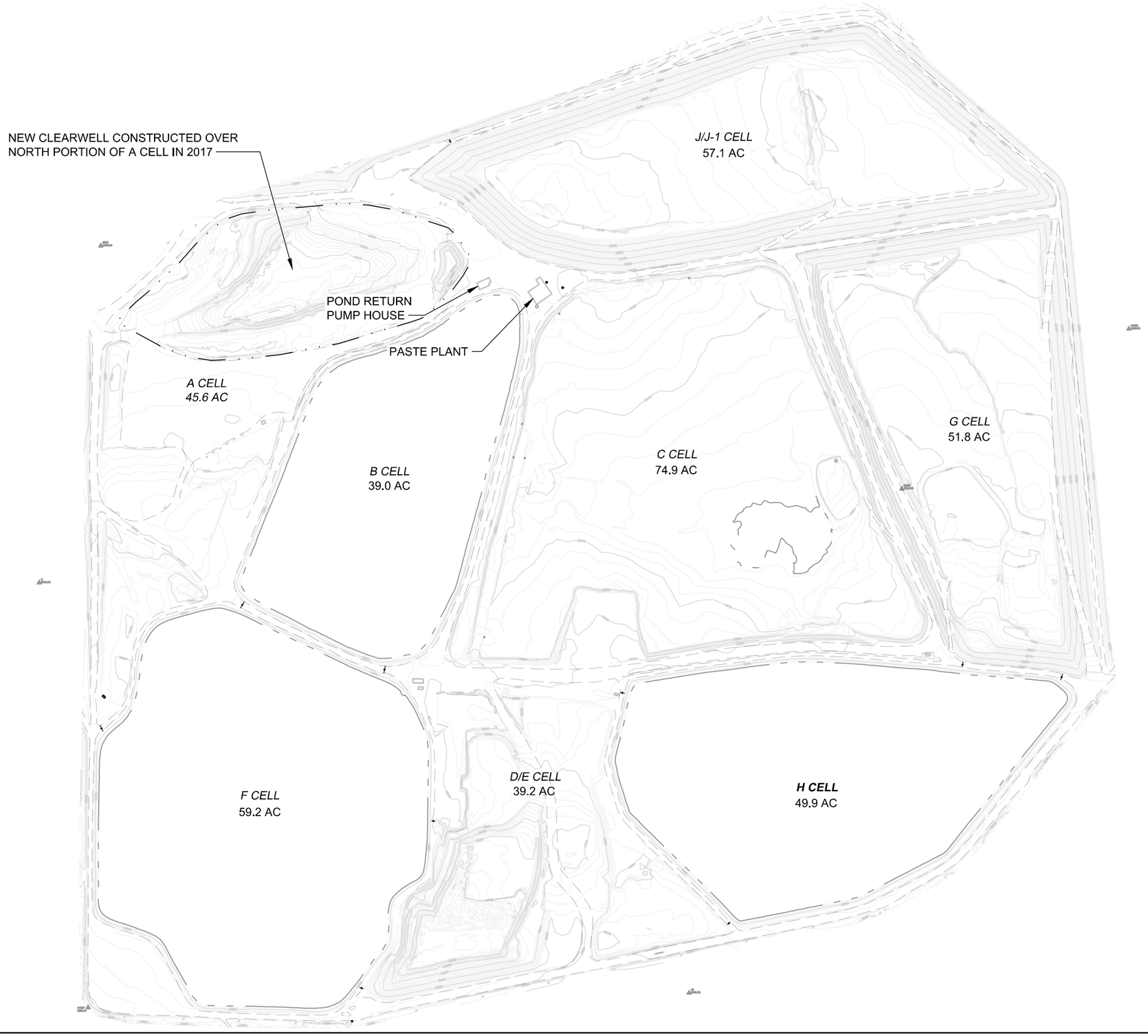
SOURCE: USGS MAP (7.5, MINUTE SERIES, ROSEBUD COUNTY, 2014)

0 2,000'
SCALE IN FEET

CELL LOCATIONS
UNITS 3&4 EHP AREA

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	JULY 2017
PROJECT NO.	ME1431
DOCUMENT NO.	MD17153
FILE NO.	F001–003
FIGURE NO.	2



LEGEND

- EXISTING GRADE CONTOUR (FEET-MSL)
- EXISTING ROAD / DRIVE
- EXISTING STRUCTURE
- EXISTING TREELINE
- EXISTING WATERLINE

NOTE:
EXISTING CONDITIONS FROM AN AERIAL SURVEY BY
AERIAL DESIGN DATA OF NORTH HUNTINGTON, PENNSYLVANIA
FROM FLYOVER CONDUCTED ON 8 DECEMBER 2014.

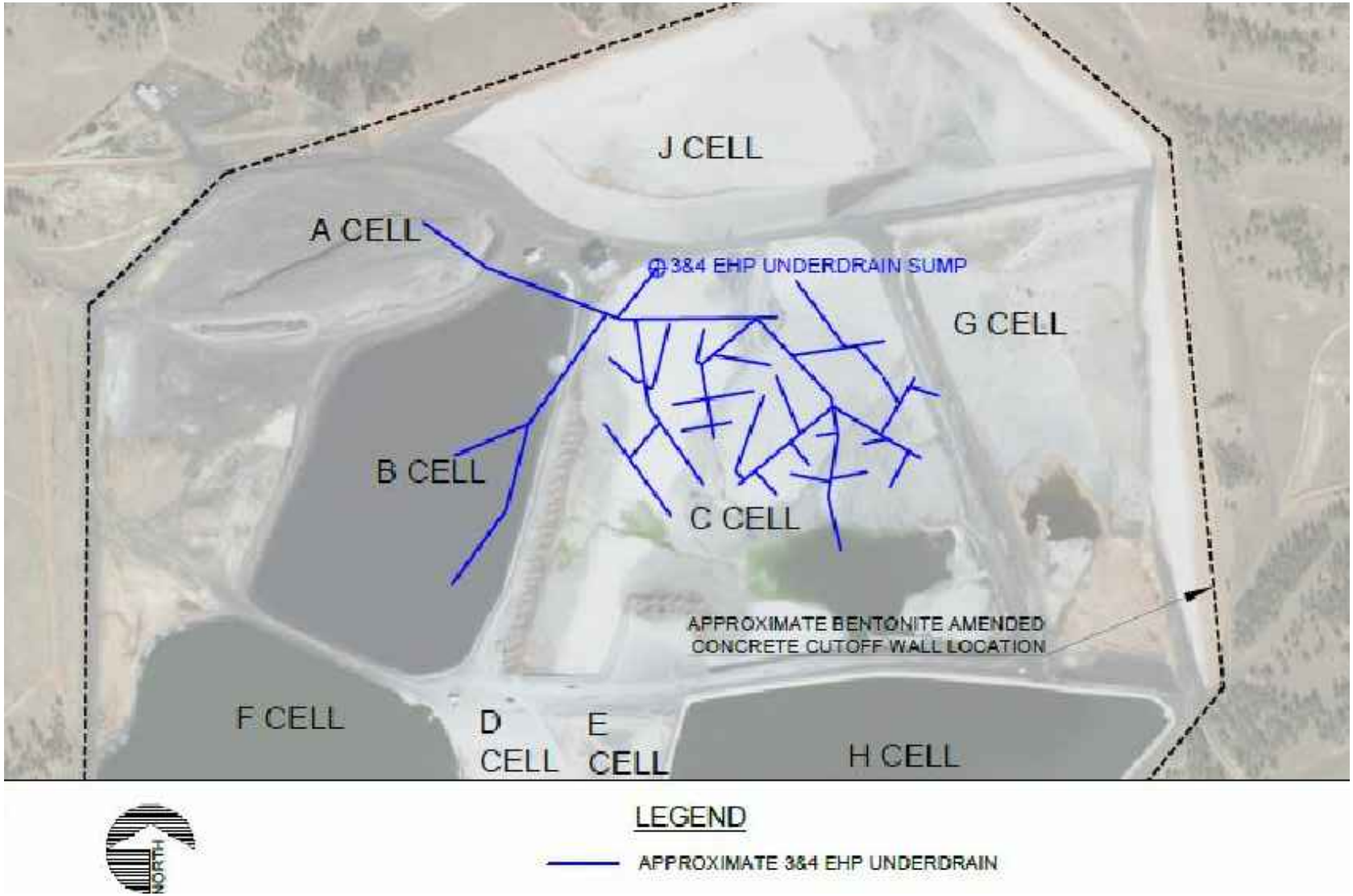
0 500'
SCALE IN FEET

SITE LAYOUT

UNITS 3 & 4 EFFLUENT HOLDING POND AREA
COLSTRIP STEAM ELECTRIC STATION
COLSTRIP, MONTANA

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	JULY 2017
PROJECT NO.	ME1431
DOCUMENT NO.	MD17153
FILE NO.	1199f153
FIGURE NO.	3



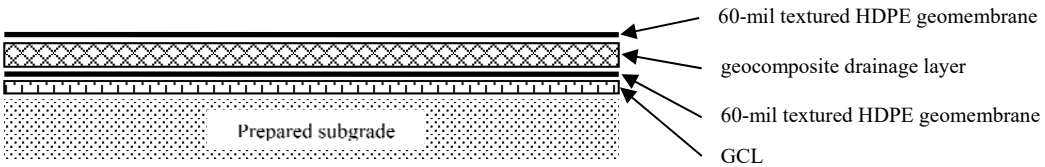
SOURCE: COLSTRIP PROJECT MONTANA.
EFFLUENT HOLDING POND EMBANKMENTS
CONSTRUCTION REPORT, BECHTEL 1985

SCHEMATIC OF 3&4 EHP UNDERDRAIN

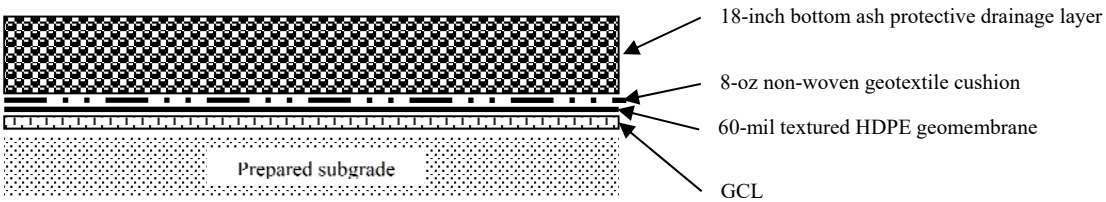
Geosyntec consultants

COLUMBIA, MARYLAND

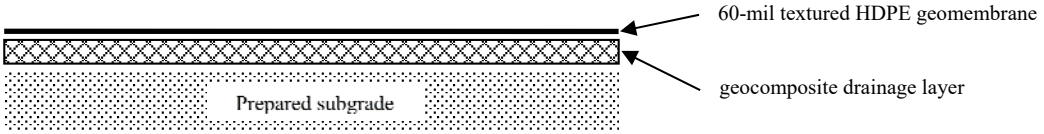
DATE:	JULY 2017
PROJECT NO.	ME1431
DOCUMENT NO.	MD17153
FILE NO.	F001–003
FIGURE NO.	4



(a) Type I Cover System



(b) Type II Cover System



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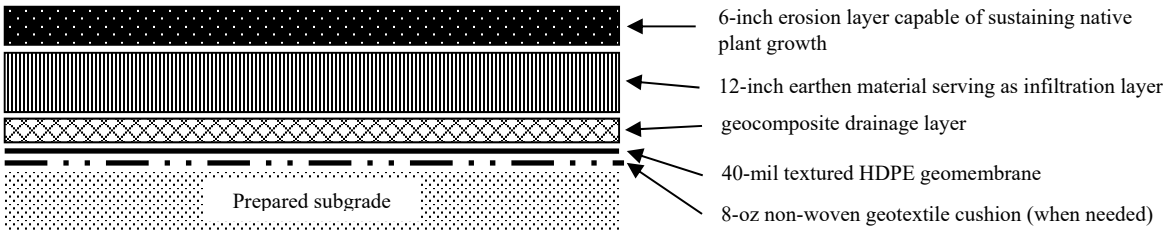

(d) Type IV Cover System

Figure 5 Final Alternative Cover Systems