



Environment

Submitted to:
Platte River Power Authority
Fort Collins, CO

Submitted by:
AECOM
Greenwood Village, Colorado
60514657
October 13, 2016

Bottom Ash Transfer (BAT) Impoundment Closure Plan

Platte River Power Authority
Fort Collins, Colorado



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Platte River Power Authority Fort Collins, Colorado

A handwritten signature in black ink that reads "Emily Nebel".

Prepared By
Emily Nebel, P.E., Project Engineer

A handwritten signature in black ink that reads "Margaret C. Zebley".

Reviewed By
Margaret C. Zebley, P.E., Senior Engineer

A handwritten signature in black ink that reads "Geoff Webb".

Approved By
Geoff Webb, Senior Project Manager

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List of Acronyms

amsl	above mean sea level
BAT	Bottom Ash Transfer
CCR	coal combustion residuals
CDPHE	Colorado Department of Environmental Quality
CFR	Code of Federal Regulations
IDR	Impoundment Demonstration Report
in/hr	inches per hour
PRPA	Platte River Power Authority
Rawhide	Rawhide Energy Station
RCRA	Resource Conservation and Recovery Act
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USEPA	United States Environmental Protection Agency

1.0 Introduction

This Closure Plan has been prepared on behalf of Platte River Power Authority (PRPA) to meet the Coal Combustion Residuals (CCR) Regulations (Final CCR Rule) as detailed in 40 Code of Federal Regulations (CFR) 257.102. Closure of the Bottom Ash Transfer (BAT) impoundments will be completed by removal of the CCR and decontamination the CCR unit as required by the regulations. This section discusses site background, regulatory drivers, and purpose.

1.1 Background

Rawhide Energy Station (Rawhide) is a 4,560 acre facility located at 2700 East County Road 82 in Wellington, CO (**Figure 1**). Construction of Rawhide began in 1979 and it has operated as a coal-fired power plant since. The primary land use on the Rawhide property is those related to utility service: electric generation. The following six generating units are located at the Rawhide facility:

- 1) Rawhide Unit One – one 280-megawatt generator fueled by low-sulfur coal from the Antelope Mine located in Wyoming's Powder River Basin.
- 2) Rawhide Units A, B, C, D – four 65-megawatt, simple-cycle, natural gas-fired generators.
- 3) Rawhide Unit F – one 128-megawatt, simple-cycle, natural gas-fired generator.

Bottom ash is produced during the coal combustion process and is hydraulically sluiced from the boiler to one of the two BAT impoundments located northwest of the plant. These impoundments also receive resin filter backwash water from the demineralizer at the wastewater treatment plant. The impoundments were constructed in the early 1980s by excavating below grade into the Pierre Shale formation and then lining the bottom with 18 inches of clay. Each of the two impoundments measure approximately 725 feet by 225 feet at the surface (approximately 7.5 acres total) with a bottom elevation of 5,660 feet above mean sea level (amsl), a normal water elevation of 5,674 feet amsl, and a top of berm elevation of 5,679 feet amsl (**Figure 2**).

PRPA uses each impoundment for approximately one to two years before switching to the other BAT impoundment. At this point, the water in the inactive impoundment is left to evaporate and may be pumped into the active pond to dry the sediment for impoundment sediment removal. As previously mentioned, PRPA generally maintains five feet of freeboard in an impoundment prior to switching to the other impoundment. PRPA keeps this freeboard for both safety and structural integrity. Once significant bottom ash accumulates in an impoundment, its bottom ash is excavated and hauled to the on-site CCR Monofill for disposal. The sediment in each impoundment is cleaned out approximately every three years (Sound Earth Strategies, 2014).

Both of the BAT impoundments have a high-water concrete gate overflow structure that allows clarified process water to flow into the sluice water recycle pond (shown on **Figure 2**) prior to being circulated back to the plant for reuse. A gate valve also exists for transferring water between the sluice water recycle pond and the storm water retention pond (located north of the BAT impoundments as shown on **Figure 2**). According to PRPA, the gate valve has only been used to manage excess storm water, not sluice water. Additional information on the process water flow and the impoundment construction is provided in Appendix A of the Impoundment Demonstration Report (IDR) (Sound Earth Strategies, 2014).

1.2 Regulations

The BAT impoundments are regulated by the Final CCR Rule promulgated by the United States Environmental Protection Agency (USEPA, 2015) under 40 CFR Part 257, Subtitle D of the Resource Conservation and Recovery Act (RCRA). The BAT impoundments are also regulated under the Colorado Department of Public Health and Environment (CDPHE) – Hazardous Materials and Waste Management Division under Section 9 of the Regulations Pertaining to Solid Waste Sites and Facilities (6 Code of Colorado Regulations 1007-2, Part 1) (Solid Waste Regulations) (CDPHE, 2015).

The Rawhide Energy Station Impoundment Closure Plan Revision 3 (AECOM, 2016a) was prepared in September 2016 to meet the Section 9 Solid Waste Requirements for closure of all Rawhide Section 9 regulated impoundments (including the two BAT impoundments). This Closure Plan, however, was developed to meet the requirements of the Final CCR Rule, as detailed in 40 CFR 257.102.

1.3 Owner/Operator Information

The owner and operator of the BAT Impoundments (and the contact during the post-closure period) is:

Platte River Power Authority
2000 East Horsetooth Road
Fort Collins, CO 80525
Attn: Christopher Wood
970-266-7906

1.4 Purpose

The purpose of this Closure Plan is as follows.

1. Describe the steps necessary to close the BAT Impoundments at any point during the active life of the BAT Impoundments consistent with recognized and generally accepted good engineering practices.
2. Provide a narrative description of how the BAT Impoundments will be closed in accordance with 40 CFR 257.102.
3. Describe the procedures that will be used to remove the CCR and decontaminate the CCR unit in accordance with 40 CFR 257.102.
4. Provide a schedule for completing all activities necessary to satisfy the closure criteria in 40 CFR 257.102.

2.0 Site Characterization

This section characterizes the site and includes a discussion of the site hydrology, hydrogeology, soil, and current conditions at the BAT Impoundments.

2.1 Site Hydrology and Hydrogeology

As discussed in the Annual Ash Monofill Inspection Report (AECOM, 2016b), the geologic setting at Rawhide lies on the high plains located immediately east of the Colorado Front Range, where soil and bedrock units are incised by drainage from nearby mountains to the west, forming small, relatively minor valley and ridge topographic expressions. Elevations within the project area range from about 5,580 to 5,805 feet amsl. The most distinctive topographic feature at Rawhide is a broad basin that occupies the center of the site and extends from northwest to southeast. Smooth ridges and rounded bluffs surround this basin and mark the transition to uplands that are 50 to 70 feet higher.

According to the United States Geological Survey (USGS) geologic map, bedrock at Rawhide consists of Cretaceous units including the Upper Pierre Shale Formation. Specifically, the majority of the Rawhide site lies on the Upper Pierre Shale Formation transition zone, the eastern extent of which transitions to the Lower Fox Hills Sandstone downslope and east of the Rawhide site. The Pierre Shale transition zone is described as shale with interbedded sandstones. The portions 600 feet below the contact with the Fox Hills sandstone are mapped by the USGS as being the most permeable within the unit, yielding 5 to 15 gallons per minute in wells. The Fox Hills Sandstone is described as a pale yellow, massive, silty, fine-grained sandstone with lenticular black shale partings but is not present on the Rawhide site.

The bedrock surface at the site is mapped as dipping east-southeast toward the Cooling Pond. The geologic map indicates bedrock bedding structure in the area striking roughly north-south with shallow dips five to 10 degrees to the east. The Rawhide site is considered to be in an area of overall minor seismicity.

Approximately two-thirds of the surface water at the Rawhide site drains to the Cooling Pond. The Cooling Pond is located on land that previously drained to an unnamed tributary of Coal Creek, but this area no longer drains to this unnamed tributary. The remaining one-third of the surface water at the Rawhide site is drained by Coal Creek. Coal Creek flows intermittently depending on the amount of precipitation.

2.2 Site Soil

According to the United States Department of Agriculture (USDA) Web Soil Survey (USDA, 2016), the BAT Impoundments were constructed in an area consisting primarily of three soil types: Altvan loam, Larim gravelly sandy loam, and Larimer-Stoneham complex. The Altvan loam is well drained and the surface layer consists of loam to a depth of approximately seven inches. Permeability of the soil is moderately high to high (0.60 to 2.00 inches per hour [in/hr]) and the available water storage capacity is very high. The Larim gravelly sandy loam is well drained and the surface layer consists of gravelly sandy loam to a depth of approximately four inches. Permeability of the soil is moderately high to high (0.60 to 2.00 in/hr) and the available water storage capacity is low. The Larimer-Stoneham complex is well drained and the surface layer consists of fine sandy loam or loam to a depth of four to seven inches. Permeability of the soil is moderately high to high (0.60 to 2.00 in/hr) and the available water storage capacity is high to very high.

2.3 Estimated Capacity

As required by 40 CFR 257.102(b)(iv), the maximum inventory of CCR in the on-site BAT impoundments over the active life of the CCR unit is estimated to be approximately 117,000 cubic yards. This assumes that CCR has completely filled both BAT impoundments to the normal water elevation of 5,674 feet amsl.

3.0 Clean Closure Procedure

The impoundments will be subject to both federal and state requirements, with the most stringent requirements governing closure management of soil and groundwater. According to the Final CCR Rule 40 CFR 257.102(c), “clean closure” of CCR units are to be completed “by removing CCR and decontaminating all areas affected by releases from the CCR unit”. Furthermore, “CCR removal and decontamination of the CCR unit are complete when constituent concentrations throughout the CCR unit and any areas affected by releases from the CCR unit have been removed and groundwater monitoring concentrations do not exceed the groundwater protection standard...”. According to the Solid Waste Regulations Section 9.3.4(F), “clean closure” of impoundments are required to “remove all solid waste and residual contamination to meet unrestricted use concentrations”. The Solid Waste Regulations require sampling and testing of both soil and groundwater and completion of a Background Study. Groundwater sampling will be in accordance the Rawhide Energy Station Impoundment Closure Plan Revision 3 (AECOM, 2016a).

In order to meet the requirements of both the Final CCR Rule and the Section 9 Solid Waste Regulations, closure of the BAT impoundments will involve the removal of visually impacted soil in addition to completion of the procedures detailed within the Rawhide Energy Station Impoundment Closure Plan Revision 3 (AECOM, 2016a).

Per the Rawhide Energy Station Impoundment Closure Plan Revision 3 (AECOM, 2016a), closure will consist of removing all solid waste and residual contamination to meet acceptable levels in soil and groundwater. A background study will be performed to establish those acceptable levels. The background study will include a Sampling and Analysis Plan and a Data Evaluation Plan to determine relevant background concentrations. A licensed third party contractor will be hired by PRPA to close the BAT impoundments, per the procedure outlined herein:

1. If liquids exist, they will be allowed to evaporate prior to removing the residual solids. Then remaining fluids will be removed using a vacuum truck and disposed of at an approved waste disposal facility based on laboratory testing and waste characterization as required by the disposal facility. It is assumed that the waste disposal facility will be Clean Harbors’ Deer Trail Facility or another permitted off-site disposal facility that can accept the waste profile.
2. Any residual solids will be excavated and transferred to the on-site CCR Monofill.
3. All ancillary equipment within the limits of the BAT impoundments will be removed and disposed of at a permitted landfill.
4. Upon removal of the waste and the clay lining, soil underlying the BAT impoundments and groundwater from Rawhide monitoring wells will be sampled and tested to ensure residual contamination is below acceptable levels in soil and groundwater.
 - a. Verification sampling will ensure the residual contamination is below acceptable levels in soil and groundwater to allow for unrestricted use.
 - b. Eight soil samples will initially be collected from the bottom and sidewalls of each BAT impoundment after removal of the waste and clay lining (**Figure 2**). If the confirmation samples exceed the values in **Table 1** and indicate that impacts exist after initial excavation efforts, additional excavation and confirmation sampling will be conducted until sample results are below the appropriate screening level. If all results are below **Table 1** screening levels, the impoundment will be considered clean and no further soil sampling will be required.
5. The impoundments will not be backfilled. They will, however, be regraded (if needed) to minimize erosion and ensure that no slopes are greater than 3H:1V.
6. All locations disturbed during closure will be re-vegetated using native grassland-type species.

4.0 Closure Schedule

As required by 40 CFR 257.102(b), the following is an estimated/draft schedule for completion of all activities related to the clean closure of the BAT Impoundments. The schedule will be refined and details added prior to closure.

Closure Task	Approximate Month/Year/Schedule
Prepare initial written closure plan	October 17, 2016
Complete Background Study	Approximately 6 months prior to beginning closure activities
Revise closure plan (including final design with revised schedule)	Approximately 6 months prior to beginning closure activities
Prepare notification of intent to close	Approximately 1 month prior to beginning closure activities
Coordinate with agencies and obtain necessary approvals and permits	Approximately 3 to 6 months prior to beginning closure activities
Execute Closure Plan	As determined by PRPA when BAT impoundments are no longer needed
Allow liquid to evaporate (both naturally and with enhanced mechanisms such as water pumping)	Estimated to take 12 months (or more)
Excavation of CCR and disposal in CCR Monofill	Estimated to take up to 2 months (contingent on weather)
Verification Sampling of Soil and Groundwater	Estimated to take approximately 1 month
Final grading and seeding	Estimated to take approximately 1 week (contingent on weather)
All closure activities for the BAT Impoundments are completed	Within 5 years of commencing closure activities (estimated plant retirement of December 2046, with impoundment closure to be completed by December 2051)
Prepare a notification of closure	Within 30 days of completing closure activities

The schedule outlined above will be updated prior to closure at the time of final design. The updated schedule will be based on contractor availability, weather, anticipated time required to dewater the impoundments, and other constraints.

Closure of the BAT Impoundments will occur when operations at the Rawhide site no longer warrant use of the impoundments as detailed in Section 1.1, above. In accordance with 40 CFR 257.102(e), closure of the BAT Impoundments will commence within two years of the last receipt of CCR (sluiced bottom ash) or no later than 30 days after the date on which the BAT Impoundments receives the known final receipt of CCR. PRPA may obtain two-year extensions provided they are able to demonstrate that there is reasonable likelihood that the BAT Impoundments will be used in the foreseeable future.

In accordance with 40 CFR 257.102(f), PRPA will complete closure of the BAT Impoundments within five years of commencing closure activities. This timeframe may be extended, however, if PRPA can demonstrate that it is not feasible to complete closure of the BAT Impoundments within the required timeframe due to factors beyond the facility's control. If PRPA seeks a time extension, a demonstration (including a narrative discussion providing the basis for additional time) will be completed.

5.0 Post-Closure Care

In accordance with 40 CFR 257.104, PRPA is not subject to the post-closure care criteria if the BAT impoundments are closed by removing CCR as provided by 40 CFR 257.102(c). Furthermore, Section 9.3.7 of the Section 9 Solid Waste Regulations requires a post-closure care plan only for impoundments with waste left in-place or for impoundments with residual contamination exceeding unrestricted use. Therefore, clean closure eliminates the need for post-closure care under both the Final CCR Rule and the Section 9 Solid Waste Regulations.

6.0 Amendment, Recordkeeping, and Notification

6.1 Amendment of the Plan

PRPA may amend this Closure Plan at any time provided the revised plan is placed in the facility's operating record. PRPA will amend this plan whenever there is a change in operation of the BAT Impoundments that would substantially affect the plan and if unanticipated events necessitate a revision of this plan (either before or after closure activities have commenced). PRPA will amend this plan at least 60 days prior to a planned change in the operation of the BAT Impoundments, or no later than 60 days after an unanticipated event requires the need to revise this existing plan. If this plan is revised after closure activities have commenced for the BAT Impoundments, PRPA will amend the plan no later than 30 days following the triggering event. Any amendment of this plan will be certified by a qualified professional engineer.

6.2 Recordkeeping

PRPA will maintain this Closure Plan in their files along with any subsequent revisions/amendments of this Closure Plan, inspection reports, documentation of maintenance, and other pertinent documents within the facility's operating record for a period of at least five years in accordance with 40 CFR 257.105.

6.3 Notification

PRPA will notify CDPHE whenever the Closure Plan (along with any subsequent updates) has been placed in the operating record in accordance with the notification requirements specified in 40 CFR 257.106. Prior to initiation of closure, PRPA will prepare a notification of intent to close the BAT Impoundments. Within 30 days of completion of closure of the BAT Impoundments, PRPA will prepare a notification of closure for the BAT Impoundments. The notification will include a written certification from a qualified professional engineer verifying that closure has been completed in accordance with this closure plan.

6.3.1 Deed Notations

In accordance with 40 CFR 257.102(i), PRPA is not subject to the requirements of the deed notations if the BAT impoundments are closed in accordance with 40 CFR 257.102(c).

7.0 Certification

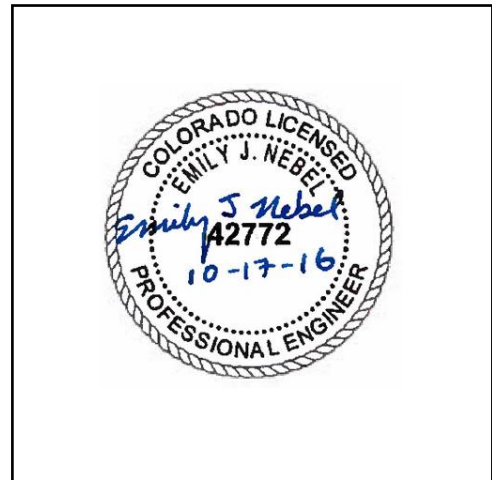
Certification Statement 40 CFR § 257.102(b)(4) – Bottom Ash Transfer (BAT) Impoundment Closure Plan

CCR Unit – Platte River Power Authority, Rawhide Energy Station, Bottom Ash Transfer Impoundments

I, Emily J. Nebel, being a Registered Professional Engineer in good standing in the State of Colorado, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the information contained in the Bottom Ash Transfer (BAT) Impoundment Closure Plan dated October 17, 2016 meets the requirements of 40 CFR § 257.102.

Emily J. Nebel
Printed Name

October 17, 2016
Date



8.0 References

- AECOM. 2016a. Rawhide Energy Station, Impoundment Closure Plan, Revision 3. Platte River Power Authority, Fort Collins, Colorado. September, 2016.
- AECOM. 2016b. Annual Ash Monofill Inspection Report, Rawhide Energy Station. Fort Collins, Colorado. April, 2016.
- Colorado Department of Public Health and Environment (CDPHE). 2015. Hazardous Materials and Waste Management Division. 6 Code of Colorado Regulations 1007-2, Part 1, Regulations Pertaining to Solid Waste Sites and Facilities, Effective June 30, 2015.
- Sound Earth Strategies. 2014. Impoundment Demonstration Report. Rawhide Energy Station. November 10.
- United States Department of Agriculture (USDA). 2016. Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at <http://websoilsurvey.nrcs.usda.gov/>. Accessed August 25, 2016.
- United States Environmental Protection Agency (USEPA). 2015. 40 CFR Parts 257 and 261 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. Federal Register, v.80, no. 74, April 17, 2015, 201 pp.

Tables

**Table 1
Proposed Closure Groundwater/Soil Sample Analytes**

Parameters	CAS Number	Colorado Groundwater Standards (µg/L)	Colorado Groundwater Protection Level (mg/kg)	EPA Risk-Based Screening Level	
				Residential Soil (mg/kg)	Industrial Soil (mg/kg)
Inorganic Constituents					
Antimony	7440-36-0	6 ^M		3.1	47
Arsenic	7440-38-2	10 ^M		0.67	3
Barium	7440-39-3	2000 ^M		1500	22000
Beryllium	7440-41-7	4 ^M		16	230
Cadmium	7440-43-9	5 ^M		7	98
Chromium	7440-47-3	100 ^M			
Cobalt	7440-48-4	50 ^M		2.3	35
Copper	7440-50-8	200 ^M		310	4700
Lead	7439-92-1	50 ^M		400	800
Nickel	7440-02-0	100 ^M		150	2200
Selenium	7782-49-2	20 ^a		39	580
Silver	7440-22-4	50 ^M		39	580
Thallium	7440-28-0	2 ^M		0.078	1.2
Vanadium	7440-62-2	100 ^a		39	580
Zinc	7440-66-6	2000 ^a		2300	35000
Organic Constituents					
Acetone	67-64-1	6300	32	6100	67000
Acrylonitrile	107-13-1	0.065		0.25	1.1
Benzene	71-43-2	5 ^M	0.17	1.2	5.1
Bromochloromethane	74-97-5			15	63
Bromodichloromethane	75-27-4	0.56	0.007	0.29	1.3
Bromoform	75-25-2	4	0.048	67	290
Carbon disulfide	75-15-0		1000	77	350
Carbon tetrachloride	56-26-5	0.5 to 5 ^M	1.704	0.65	2.9
Chlorobenzene	108-90-7	100 ^M	5.3	28	130
Chloroethane	75-00-3			1400	5700
Chloroform	67-66-3	3.5	0.085	0.32	1.4
Dibromochloromethane	124-48-1	14	0.11	0.73	3.2
1,2-dibromo-3-chloropropane	96-12-8	0.2 ^M	0.002	0.0053	0.064
1,2-dibromoethane	106-93-4	0.018	0.00018	0.036	0.16
1,2-dichlorobenzene	95-50-1	600 ^M	57	180	930
1,4-dichlorobenzene	106-46-7	75 ^M	7.8	2.6	11
Trans-1,4-dichloro-2-butene	110-57-6			0.0074	0.032
1,1-dichloroethane	75-34-3		1.8	3.6	16
1,2-dichloroethane	107-06-2	0.38 to 5 ^M	0.0036	0.46	2
1,1-dichloroethylene	75-35-4	7 ^M	12	23	100
Cis-1,2-dichloroethylene	156-59-2	14 to 70 ^M	0.261	16	230
Trans-1,2-dichloroethylene	156-60-5	140 or 100 ^M	5.4	160	2300
1,2-dichloropropane	78-87-5	0.52 to 5 ^M	0.0087	1	4.4
Cis-1,3-dichloropropene	10061-01-5				
Trans-1,3-dichloropropene	10061-02-6				
Ethylbenzene	100-41-4	700 ^M	100	5.8	25
2-hexanone	591-78-6	35	0.21	20	130
Methyl bromide	74-83-9		0.16	0.68	3
Methyl chloride	74-87-3			11	46

Table 1
Proposed Closure Groundwater/Soil Sample Analytes

Parameters	CAS Number	Colorado Groundwater Standards (µg/L)	Colorado Groundwater Protection Level (mg/kg)	EPA Risk-Based Screening Level	
				Residential Soil (mg/kg)	Industrial Soil (mg/kg)
Methylene bromide	74-95-3			2.3	9.8
Methylene chloride	75-09-2	5.6 or 5 ^M	0.06	35	320
Methyl ethyl ketone	78-93-3		18	2700	19000
Methyl iodide	74-88-4				
Methyl isobutyl ketone	108-10-1		3.3	530	5600
Styrene	100-42-5	100 ^M	14	600	3500
1,1,1,2-tetrachloroethane	630-20-6	2.1	0.16	2	8.8
1,1,2,2-tetrachloroethane	79-34-5	0.18	0.0024	0.6	2.7
Tetrachloroethylene	127-18-4	17 or 5 ^M	1.9	8.1	39
Toluene	108-88-3	560 to 1,000 ^M	50	490	4700
1,1,1-trichloroethane	71-55-6	14,000 or 200 ^M	62	810	3600
1,1,2-trichloroethane	79-00-5	2.8 to 5 ^M	38	0.15	0.63
Trichloroethylene	79-01-6	5 ^M	0.68	0.41	1.9
Trichlorofluoromethane	75-69-4		1000	73	310
1,2,3-trichloropropane	96-18-4	3.70E-04	0.00048	0.0051	0.11
Vinyl acetate	108-05-4		51	91	380
Vinyl chloride	75-01-4	0.023 to 2 ^M	0.11	0.059	1.7
Xylenes, total	1330-20-7	1,400 to 10,000 ^M	75	58	250
Water Quality					
Magnesium, Sodium, Potassium, Calcium, Carbonate, Bicarbonate, Chloride, Sulfate, Nitrite, Nitrate, pH, Specific Conductivity, Temperature, and Total Organic Carbon					

Notes:

^a = agricultural standards.

^M = Drinking water MCL.

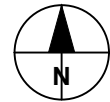
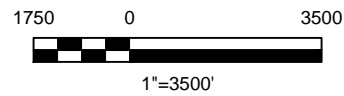
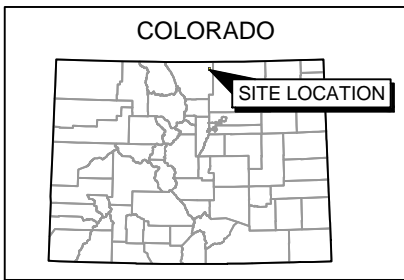
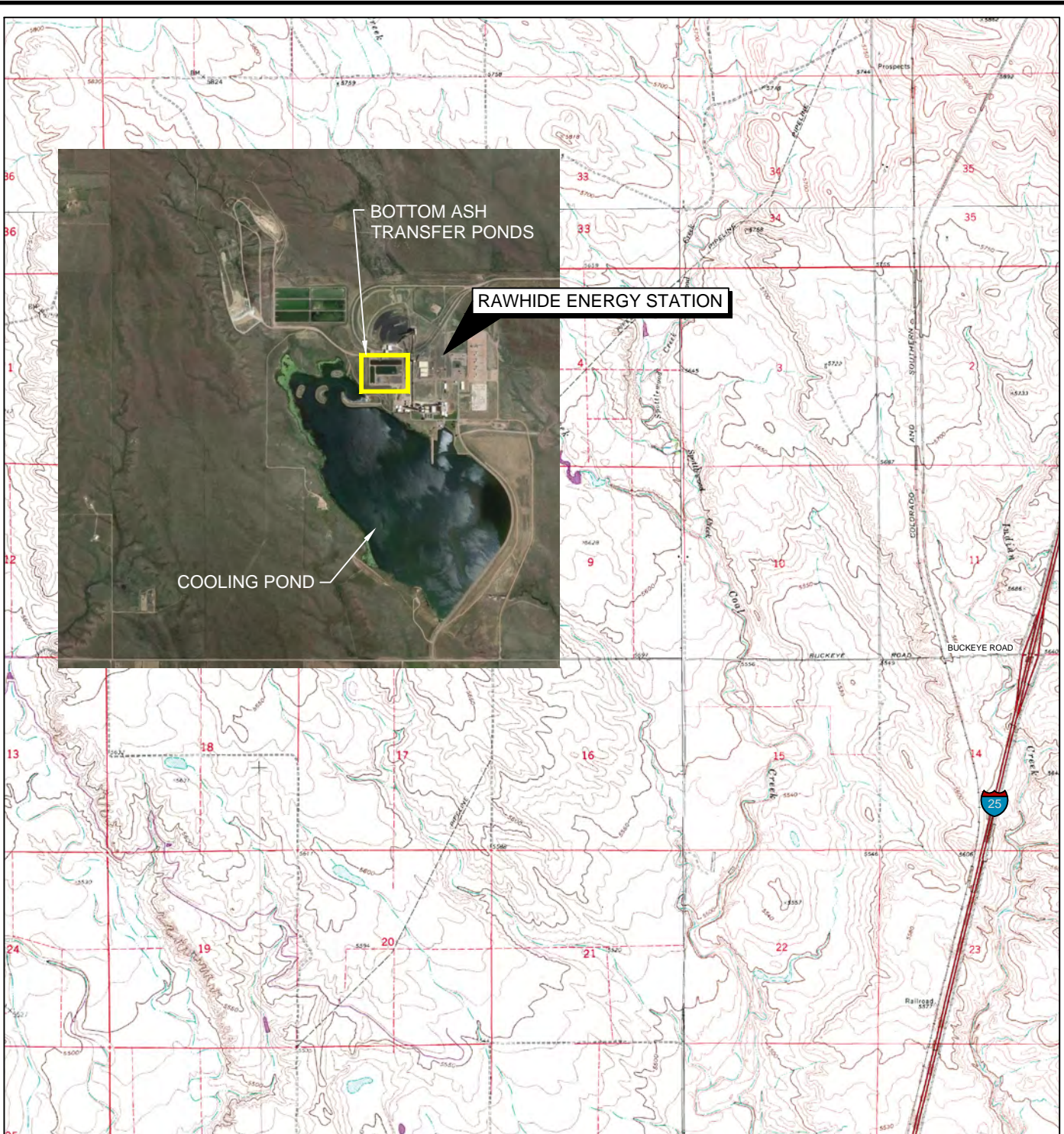
µg/L = micrograms per liter.

mg/kg = milligram per kilogram.

A blank indicates a standard or screening level is not available.

The BAT ponds will not be sampled for polynuclear aromatic hydrocarbons (PAHs), radioisotopes and radioactivity.

Figures



Bottom Ash Transfer (BAT) Impoundment Closure Plan

SITE LOCATION MAP



Platte River Power Authority, Fort Collins CO
Project No.: 60514657 Date: 10/12/16

Figure: 1

