2014 PERIODIC ENGINEER'S INSPECTION UNITS 3 & 4 EFFLUENT HOLDING POND MAIN AND SADDLE DAMS COLSTRIP, MONTANA

Prepared For:

PPL MONTANA, LLC
Colstrip, Montana

Hydrometrics, Inc.
Consulting Scientists and Engineers

SEPTEMBER 2014

2014 PERIODIC ENGINEER'S INSPECTION
UNITS 3 & 4 EFFLUENT HOLDING POND
MAIN AND SADDLE DAMS
COLSTRIP, MONTANA

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2014 PERIODIC ENGINEER'S INSPECTION
UNITS 3 & 4 EFFLUENT HOLDING POND
MAIN AND SADDLE DAMS
COLSTRIP, MONTANA

1.0 PURPOSE AND SCOPE OF STUDY

This report presents the results of a Periodic Engineer's Inspection of Units 3 & 4 Effluent Holding Pond (EHP) Main and Saddle Dams near Colstrip, Montana. The dams at Colstrip fall under the regulation of the Major Facilities Siting Act (MCA, 2007). Although they are exempt from the Montana Dam Safety Rules, PPL Montana has agreed to have them inspected in accordance with these rules (ARM, 1988).

This report has been prepared in accordance with Montana Dam Safety Rules. In general terms, a Periodic Engineer's Inspection includes:

(a) Review and analysis of previous inspection reports and available data on the design, construction, operation, and maintenance of the dam and its appurtenances.

(b) Visual inspection of the dam, its appurtenances, the downstream area, and all other areas affected by the structure.

(c) Evaluation or plan for a full evaluation over no more than a 5-year period of the general conditions of the dam, spillways, and other appurtenances, including an assessment of the hydrologic and hydraulic capabilities, structural stability, and any other conditions that constitute or could constitute a hazard to the integrity of the structure.

(d) Evaluation of operation, maintenance, emergency, and inspection procedures employed by the owner.

(e) Analysis of piezometric levels or other data from any instrumentation or monitoring of the dam.

(f) Review and analysis of the rate and volume of seepage and condition and maximum flow capability of any seepage collection system.

(g) Review and documentation of the condition of surfaces and vegetation on the crest and slopes of the dam and area beyond the downstream toe of the dam.

(h) Review of maximum operating water surface elevation and amount of freeboard.

(i) Review and documentation of the condition of spillways and water level control structures, including all conduits exiting the dams.

(j) Other items the engineer determines are necessary to document and determine the safety of the dam (ARM Rule 36.14.602).

The purpose of the Periodic Engineer's Inspection is to identify current and physical operational conditions of the dam and appurtenances and to determine if emergency measures and/or additional studies, investigations and analyses are needed, so that corrections can be made by the owner in a timely manner.

The following tasks were completed by Hydrometrics, Inc.:

1. Review of previous engineering, design and construction data to verify completeness of information in characterizing the general safety of the 3&4 Effluent Holding Pond Main and Saddle Dams (*Section 5*).

2. Visual observations of the Main and Saddle Dams, appurtenant structures, and downstream areas for evidence of seepage, unstable slopes and erosion characteristics *(Section 6).*

3. Review of the previous inspection reports and comparison of existing conditions with conditions and recommendations noted in those reports *(Section 7).*

4. A summary of conclusions and recommendations *(Section 8).*

2.0 PROJECT DESCRIPTION

2.1 PROJECT OVERVIEW

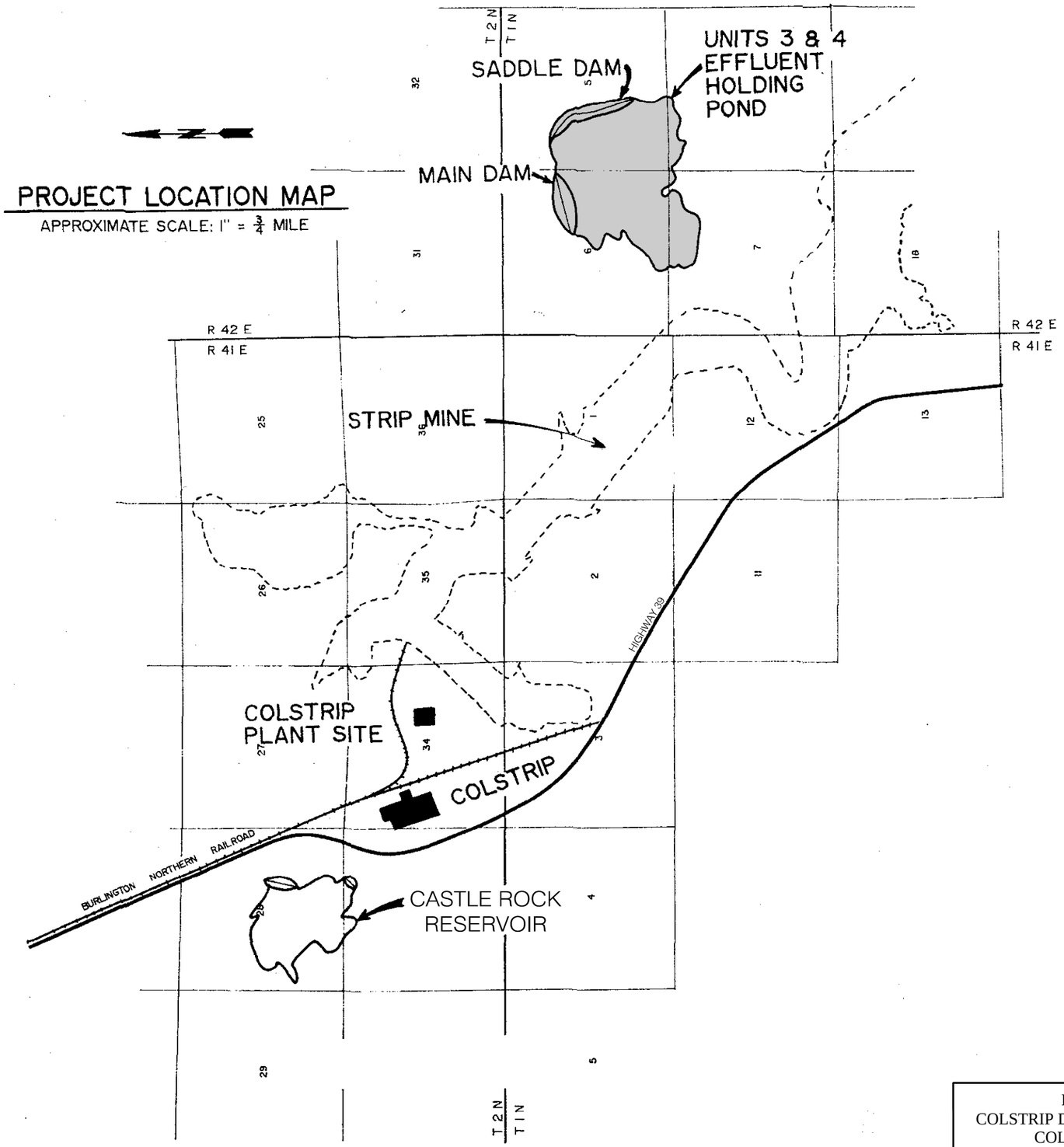
The Units 3 & 4 Effluent Holding Pond (EHP) is intended for permanent storage of scrubber particulate and bottom ash from the Colstrip Power Plant Units 3 & 4. Scrubber effluent is pumped to the pond as slurry via a pipeline. Water is decanted from the slurry and pumped back to the plant. Divider dikes, composed of bottom ash, separate the raw slurry from the decant water. Bottom ash is transported and placed in the divider dikes using trucks and/or scrapers.

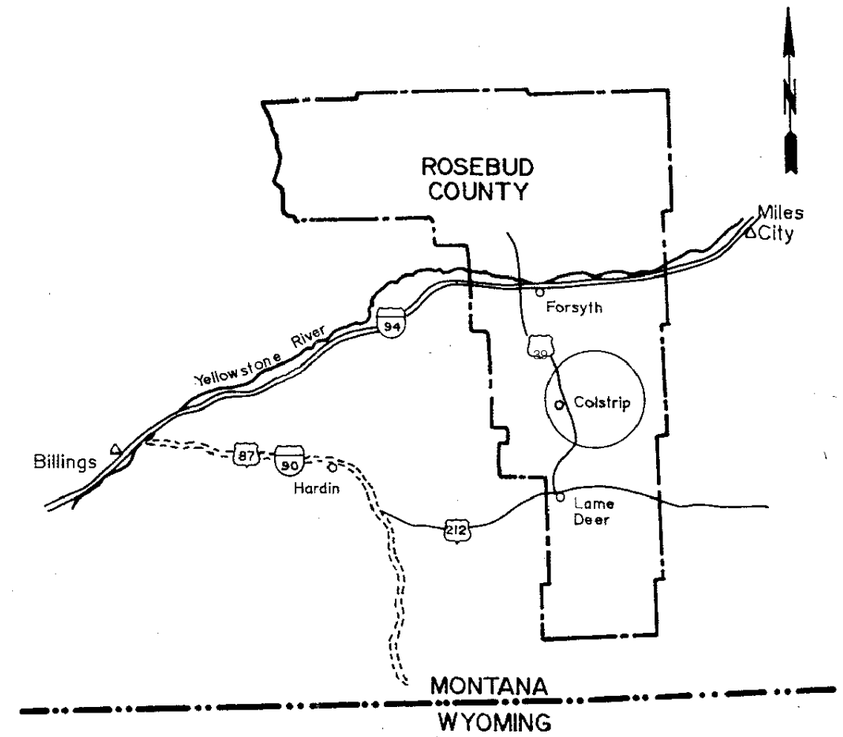
The pond is located about 4 miles east and south of Colstrip, in Sections 5 and 6, Township 1 North, Range 42 East, in Rosebud County, Montana. The project location is shown on Figure 2-1.

2.2 DESIGN AND CONSTRUCTION

The project consists of a storage pond impounded by two zoned earth dams: Main Dam on the north and Saddle Dam on the east. The embankments have been constructed in two phases: Phase 1 embankments were constructed in 1983; and Phase 2 embankment raises were constructed in 2012. A slurry wall as part of Phase 1 completely encompasses the pond perimeter for seepage control and a series of drainage systems collects and returns seepage to the pond. The pond is divided into cells to facilitate water treatment. It is intended to be a zero discharge facility and therefore has no outlet or other method for lowering the reservoir level, other than by evaporation and pumping of the decant water. Most of the pond volume is occupied by solids, consisting of scrubber particulate and bottom ash.

Phase 1 embankments were finished at elevation 3261.5 feet, National Geodetic Vertical Datum (NGVD). Phase 1 embankments are zoned earth structures with the slurry wall along the dams' centerlines. Phase 2 embankments were added on top of the Phase 1 embankments in a centerline raise to elevation 3290 feet NGVD. Phase 2 embankments consist of baked shale. Seepage control will be accomplished by a synthetic liner on the upstream slopes of the embankments. The liner had not been installed at the time of the 2014 inspection.





VICINITY MAP
APPROXIMATE SCALE: 1" = 15 MILES

Note:
Reproduced from construction drawings by
Bechtel Power Co.

PPL MONTANA COLSTRIP DAM SAFETY INSPECTION COLSTRIP, MONTANA	**PROJECT LOCATION MAP**	FIGURE **2-1**

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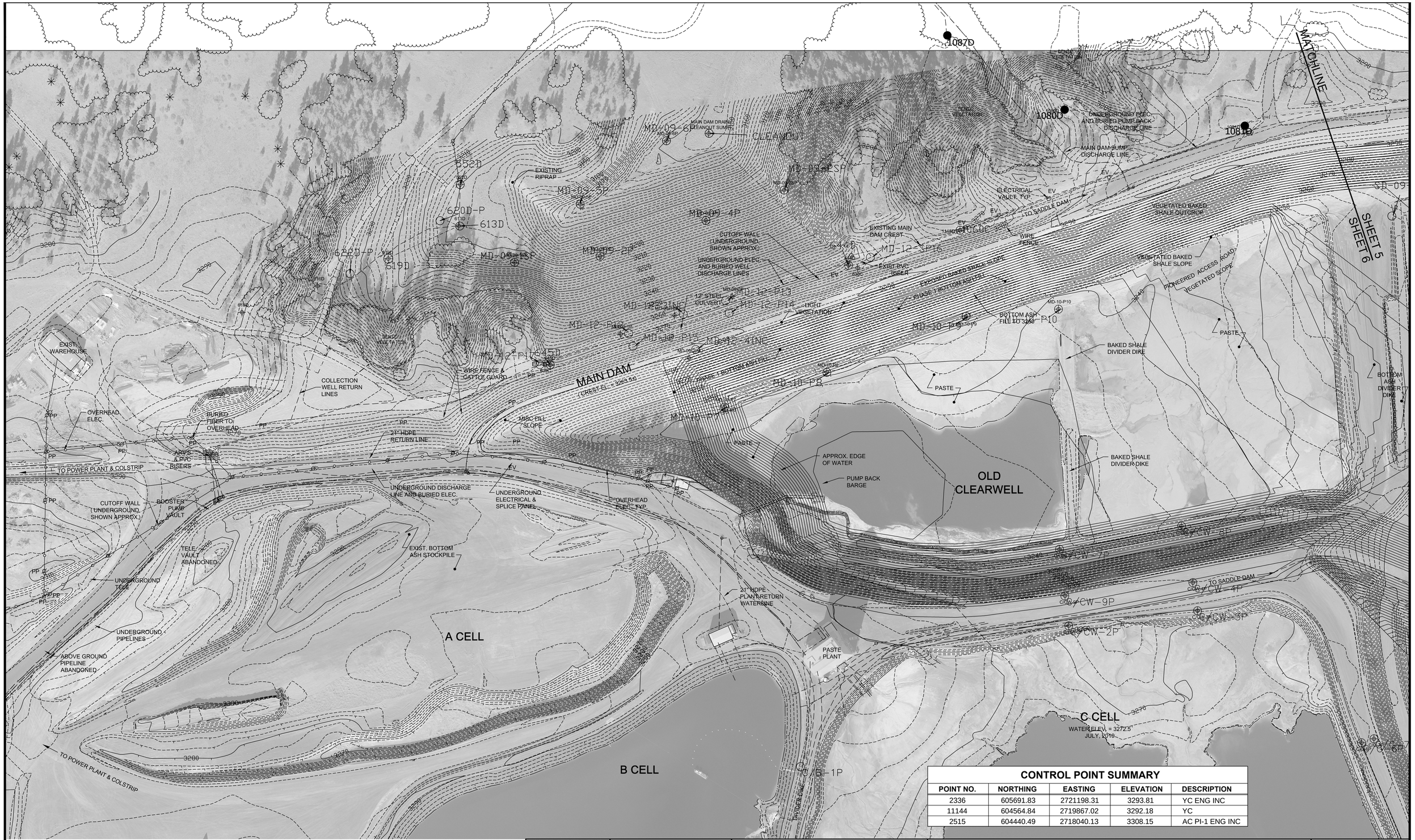
Hydrometrics, Inc.
Consulting Scientists and Engineers

Representative plan views of the Main and Saddle Dams are shown on Figures 2-2 to 2-4, taken from Womack and Associates drawings for Phase 2 construction. Figures 2-2 to 2-4 do not show the pond-side synthetic liner installation that will be part of the Phase 2 construction. According to Mike Holzwarth of PPL Montana, the future liner system for the Main and Saddle Dams will be similar to that used for Cell D in the Units 1 and 2 Stage II Evaporation Ponds (STEP). The liner system consists of, starting at the subgrade of the dam slope, an 8 ounce nonwoven geotextile, a 36-mil reinforced polypropylene (RPP) liner, a GEONET® drainage layer, and a 45-mil RPP liner. The liner will extend into the pond area, covering the Phase 1 embankments also. Cells B, F and H of the EHP have already been lined with the RPP system. Phase 1 embankments were constructed with a bentonite-amended concrete seepage cutoff wall that extends around the perimeter of the EHP, plus chimney, trench and toe drains, which are connected to perforated trench drains extending down the drainage valleys to concrete sumps for pumping back into the pond. Locally, the trench drains and sumps are referred to as valley drains. There are two valley drains with pumping equipment, one at the Main Dam and one east of the Saddle Dam. A concrete sump structure is located north of the Saddle Dam, which does not contain pumping equipment.

Table 2-1 contains information both from the original design report and construction drawings prepared by Bechtel Power Corporation (1982) and Phase 2 design data provided by PPL Montana.



CONTROL POINT SUMMARY

POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
2336	605691.83	2721198.31	3293.81	YC ENG INC
11144	604564.84	2719867.02	3292.18	YC
2515	604440.49	2718040.13	3308.15	AC PI-1 ENG INC

CALLOUT LEGEND
SD-XX-ICXX = SLOPE INCLINOMETER CASING
SD-XX-PXX = VIBRATING WIRE PIEZOMETER CASING
SD-XX-SPXX = STANDPIPE PIEZOMETER

GENERAL NOTES
1. AERIAL PHOTOGRAPHY FROM OCTOBER 2011. ACTUAL FIELD CONDITIONS MAY VARY FROM PHOTOGRAPHY. CONTRACTOR TO FIELD VERIFY CONDITIONS.
2. PHASE 1 DAM RAISE WITH BOTTOM ASH COMPLETE 2011.
3. CONTOUR INTERVAL = 2 FT

REVISED DATE: 02/15/2012

NORTH
0 100' 200'

SCALE VERIFICATION BAR IS ONE INCH ON ORIGINAL DRAWING
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IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Project No.: CP 202 A		
DRAWN BY	RS	
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APPROVED BY		
SCALE: AS NOTED		

WOMACK AND ASSOCIATES, INC.
Geotechnical Engineering • Geology
Jackson, Wyoming 83002
P.O. Box 12850
307.733.7209

PPL MONTANA – COLSTRIP POWER PLANT
UNITS 3 & 4 MAIN & SADDLE DAM RAISE – PHASE 2
UNITS 3 & 4 EHP
MAIN DAM – EXISTING CONDITIONS PLAN

DRAWING FILE NUMBER
PHASE 2.DWG
AUTOCAD 2011 DRAWING (DWG)
SHEET NUMBER 2-2
REV 1

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CONTROL POINT SUMMARY

POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
9	603940.52	2722977.93	3217.25	YC ENG INC
2336	605691.83	2721198.31	3293.81	YC ENG INC

CALLOUT LEGEND
SD-XX-ICXX = SLOPE INCLINOMETER CASING
SD-XX-PXX = VIBRATING WIRE PIEZOMETER CASING
SD-XX-SPXX = STANDPIPE PIEZOMETER

GENERAL NOTES
1. AERIAL PHOTOGRAPHY FROM OCTOBER 2011. ACTUAL FIELD CONDITIONS MAY VARY FROM PHOTOGRAPHY. CONTRACTOR TO FIELD VERIFY CONDITIONS.
2. PHASE 1 DAM RAISE WITH BOTTOM ASH COMPLETE 2011. INITIAL PHASE 2 BAKED SHALE FILL STARTED SEPTEMBER 2011
3. CONTOUR INTERVAL = 2 FT
4. SADDLE DAM INITIAL PHASE 2 FILL STARTS AT ~3260'

REVISED DATE: 02/15/2012

NORTH
0 100' 200'

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PPL MONTANA – COLSTRIP POWER PLANT
UNITS 3 & 4 MAIN & SADDLE DAM RAISE – PHASE 2
UNITS 3 & 4 EHP
NORTH SADDLE DAM – EXISTING CONDITIONS PLAN

DRAWING FILE NUMBER
PHASE 2_EXIST.DWG
AUTOCAD 2011 DRAWING (DWG)
SHEET NUMBER 2-3
REV 1

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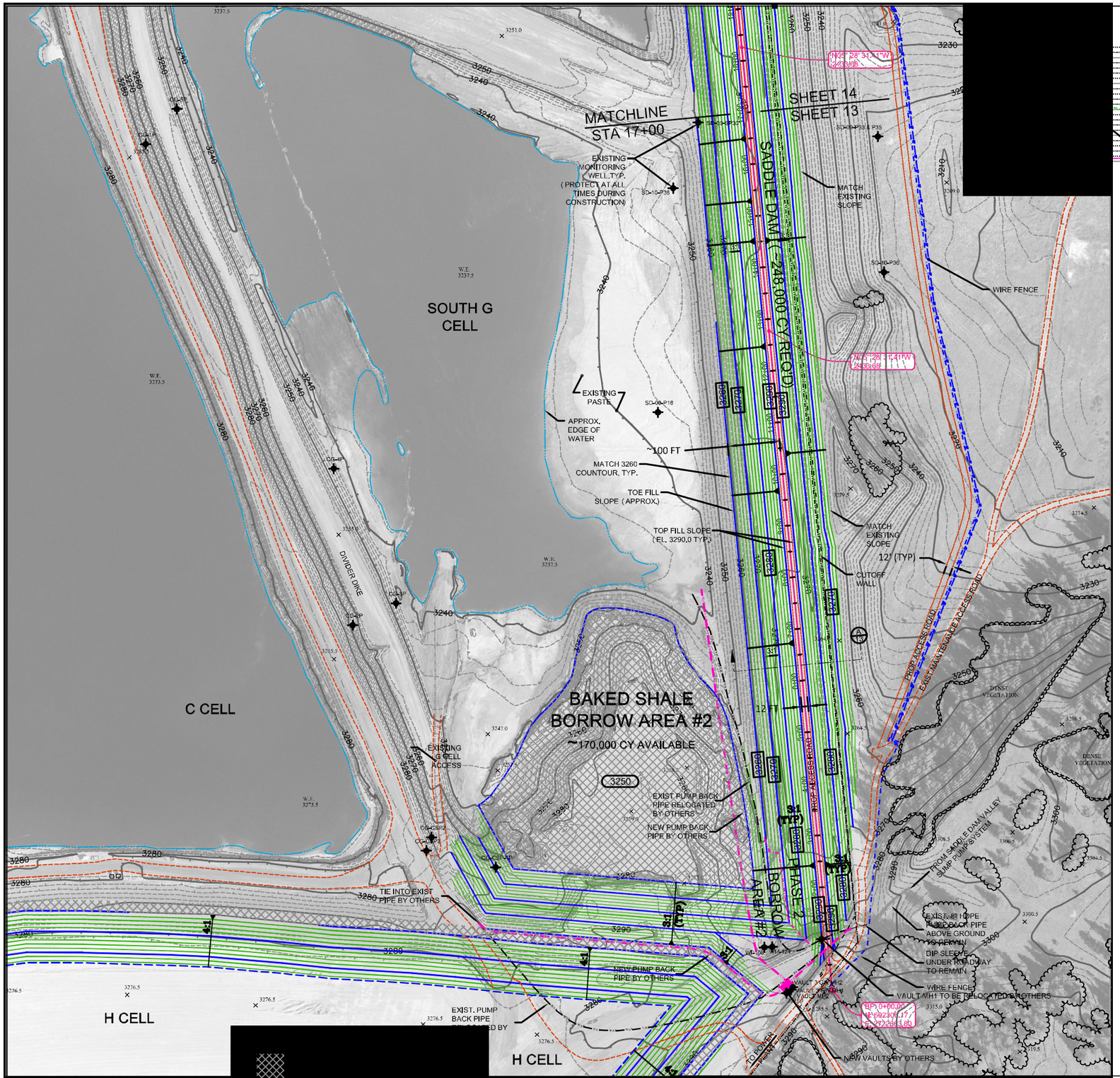

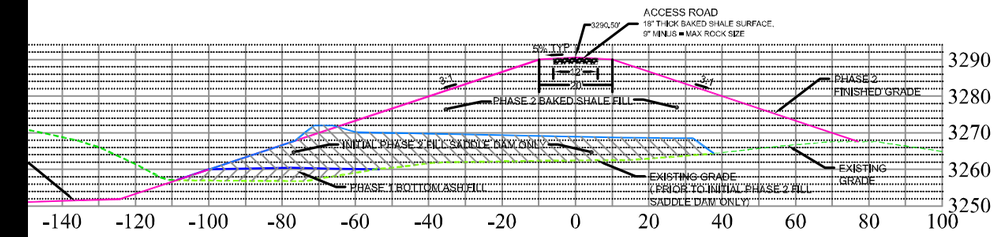

A/13 **TYPICAL SECTION**
SCALE: 1"=20'

CALLOUT LEGEND
SD-XX-ICXX = SLOPE INCLINOMETER CASING
SD-XX-PXX = VIBRATING WIRE PIEZOMETER CASING
SD-XX-SPXX = STANDPIPE PIEZOMETER

NORTH
0 100' 200'

SCALE VERIFICATION BAR IS ONE INCH ON ORIGINAL DRAWING
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IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Project No.:		
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APPROVED BY		
SCALE: AS NOTED		

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PPL MONTANA – COLSTRIP POWER PLANT
UNITS 3 & 4 MAIN & SADDLE DAM RAISE – PHASE 2
UNITS 3 & 4 EHP
SOUTH SADDLE DAM – GRADING PLAN

DRAWING FILE NUMBER	
PHASE 2_FILL.DWG AUTOCAD 2011 DRAWING (DWG)	
SHEET NUMBER	REV
2-4	△

TABLE 2-1. UNITS 3&4 EVAPORATION HOLDING POND MAIN AND SADDLE DAMS DESIGN SUMMARY

GENERAL INFORMATION

- Owner/Operator: PPL Montana (formerly the Montana Power Company).
- Date Constructed: 1983 (first stage); 2012 (second stage)
- Purpose: To provide permanent storage of scrubber particulate and bottom ash from Colstrip Units 3 & 4.
- Location: Sections 5 and 6, Township 1 North, Range 42 East, Rosebud County, Montana.
- Watershed: Cow Creek, a tributary of Rosebud Creek, which is a tributary of the Yellowstone River.
- Drainage Area: 0.79 square miles.

RESERVOIR DATA

	First Stage Estimate	Second Stage Estimate
• Maximum Normal Pool Elevation	3251.5 acre feet	3280 acre feet
• Particulate and Fluid Storage At Maximum Operating Elevation:	2,725 acre feet	17,000 acre feet
• Crest Elevation	3,261.5 NGVD	3290 NGVD
• Storage to Dam Crest	6,200 acre feet	18,200 acre feet

TABLE 2-1. UNITS 3&4 EVAPORATION HOLDING POND MAIN AND SADDLE DAMS DESIGN SUMMARY (continued)

EMBANKMENTS DATA	First Stage	Second Stage
• Type:	Zoned Earth	Homogeneous baked shale
• Wave Protection:	Soil Cement	RPP liner
• Height, feet: Main Dam	109	138
Saddle Dam	38	66
• Crest Elevation, feet NGVD:	3261.5	3290
• Crest Length, feet: Main Dam	1200	2500
Saddle Dam	2800	3500
• Crest Width, feet:	150	20
• Upstream & Downstream Slopes, H:V:	3:1	3:1

3.0 HAZARD POTENTIAL

The area downstream from the dams is a combination of rural, rangeland and agricultural land. The nearest structure is located about eight miles away along Rosebud Creek. Sudden failure of the dams is expected to result in a flood wave, which would dissipate in the relatively broad, flat drainage valleys of Cow Creek and Rosebud Creek and take over two hours to reach the first occupied structure. Damage to private and county roads is expected to be minimal and slow flooding of isolated farm buildings and residences is possible, but there appears to be little potential for loss of life.

In 2009, an EPA-mandated site-specific assessment of the PPL Montana coal ash impoundments was conducted (GEI, 2009). In their report, GEI recommended re-evaluation of the hazard classification of the Units 3 & 4 Main and Saddle Dams. According to Montana Dam Safety criteria, the dams at the time of the GEI report were classified as "not high hazard." GEI recommended a minimum hazard classification of "significant," which is an EPA-based classification and is recommended because of the potential for economic loss and environmental damage. GEI also suggested that the dam may need to be classified as high hazard based on the potential for loss of life due to flooding of inhabited structures and residences. According to PPL Montana, the classifications of the Main and Saddle Dams are now considered as "significant." Even so, PPL Montana maintains and operates both the Main and Saddle Dams according to Montana Dam Safety criteria for high hazard dams.

As required by the Montana Dam Safety Program for high hazard dams, PPL Montana maintains a current and updated emergency action plan (EAP) for the Units 3 & 4 Effluent Holding Pond Main and Saddle Dams (Hydrometrics, 2009a). The plan was last reviewed and updated in December 2013. The EAP is on file in the Colstrip plant offices and with local emergency response agencies.

4.0 REVIEW OF ENGINEERING DATA

Engineering data related to the safety aspects of the dam was reviewed as part of this inspection. This review included reports from previous investigations and inspections.

4.1 PREVIOUS INVESTIGATIONS AND INSPECTIONS

Geotechnical investigations for the dam site were performed by Bechtel Power Company in 1973 and 1981 and presented in a design report (Bechtel, 1982). That report summarizes the investigation activities, presents logs of borings and test pits, presents the results of field and laboratory tests, discusses site characteristics relating to seepage, settlement, flood routing, slope stability and construction materials, and presents a proposed design for the dam.

GEI Consultants conducted an EPA-mandated site-specific assessment of the PPL Montana coal ash impoundments in 2009 (GEI, 2009). This report encompassed evaluation of the impoundment and embankments for geologic and seismic considerations, instrumentation, spillway adequacy, structural stability, maintenance and methods of operation, and the emergency action plan. The report included seven recommendations for the Main Dam and five recommendations for the Saddle Dam. All recommendations were addressed in PPL Montana's responses to EPA's recommendations (PPL Montana, 2009). Action items considered pending in PPL Montana's response have since been completed and verified during this 2014 inspection.

In 2009, Womack & Associates completed a geotechnical analysis of the Saddle Dam (Womack & Associates, 2009c) and in 2010 Womack completed a geotechnical analysis of the Main Dam (Womack & Associates, 2010) in response to EPA recommendations. The 2009 and 2010 Womack analyses were completed for the Phase 1 embankments prior to the placement of the Phase 2 embankment raise. Both reports concluded the factors of safety for slope stability of the Main and Saddle embankments exceeded those required by the Federal Energy Regulatory Commission (FERC). The reports also concluded from piezometer data that internal drainage systems on both embankments adequately controlled the embankment phreatic surfaces.

In 2012, the Phase 2 embankments were added to the Phase 1 embankments for both the Main and Saddle Dams. Piezometers and instrumentation that were installed in the Phase 1 embankments had to be removed or abandoned. New instrumentation was installed in 2012 following placement of the Phase 2 embankments, as reported by Womack & Associates (2013).

The previous periodic engineer's inspection report (Hydrometrics, 2009b) was reviewed as part of this inspection. The 2009 report presented a series of recommendations for Units 3 & 4 Main and Saddle Dams. The status of each of those recommendations is summarized below.

Recommendation 1: Remove sagebrush and woody vegetation from both the Main Dam and Saddle Dam crests and downstream slopes.

Status: Only a few scattered woody bushes were seen on the Saddle Dam downstream slopes, which require removing. Grass cover exists over the Phase 1 embankments; Phase 2 embankments consist of baked shale fill with no vegetation.

Recommendation 2: Monitor areas of erosion on the Main Dam including an area near the center of the downstream slope and another near the toe.

Status: Erosion was not evident. Grass cover was established in previous erosion areas.

Recommendation 3: Conduct monthly monitoring of seepage observed in the left groin area of the Main Dam upstream slope.

Status: Monitoring has not occurred, however, seepage was not present due to drainage of the Old Clearwell cell.

Recommendation 4: Periodic monitoring of the small seep at the toe of the Main Dam identified as 552 Seep should continue.

Status: Hydrometrics conducted a groundwater investigation in the area of North EHP Seep (552 Seep) (Hydrometrics, 2001). Of four borings drilled, one intercepted groundwater. Water samples indicate the groundwater is impacted by pond water. An Interception Drain Trench was installed approximately 30 feet upstream of the Units 3&4 Main Dam Sump to capture water that was issuing at the 552 Seep and from filter material below the Valley Drain. Water from the interception trench is piped into the Main Dam Sump. Water is no longer issuing from the 552 Seep. The report recommends that the level of water flowing through the riser pipe is periodically monitored and recorded. Capture flow is monitored by PPL Montana.

Recommendation 5: Initiate aggressive control of rodents on crests and downstream slopes of the Main and Saddle Dams. Backfill and compact rodent holes on both dams.

Status: PPL Montana indicated they have a rodent control program in progress on all dams. No rodent holes were observed on the Main Dam. Several holes were observed on the middle and south embankments of the Saddle Dam but it was unknown if rodents were present. We recommend backfilling the holes and monitoring to see if rodents are present. If rodents are active, we recommend reinstating the rodent control program.

Recommendation 6: Several sinkholes located along the crest and small sinkholes above the buried pump-back line near the north abutment were identified. These areas require backfill and monitoring.

Status: With the placement of baked shale as part of the Phase 2 embankments, sinkholes in the Phase 1 embankments were covered. No sinkholes were observed during the 2014 inspection.

Recommendation 7: Repair the area of erosion located on the north (left) downstream groin by installing riprap or other erosion control.

Status: The area shows no sign of erosion.

Recommendation 8: Fill and compact the man-made hole identified in the toe of the south dam.

Status: Area has been repaired and revegetated. No signs of disturbance.

Recommendation 9: Conduct a hydrologic analysis of the pond with the current configuration to determine if it will store the PMF.

Status: The pond area contains the volume of water from the PMF. See Section 4.3 of this report.

4.2 SEEPAGE

The facility is designed as a zero-discharge impoundment, which recirculates water decanted from the slurry back to the power plant. The initial design incorporated five features to reduce, accommodate and/or monitor seepage:

1. A core trench extending between two and five feet into bedrock.

2. A perimeter bentonite-amended concrete cutoff wall through the baked shale and into the Fort Union Formation and at some locations, through the McKay Coal Seam. Phase 2 design incorporates a synthetic liner system.

3. A drainage system at the dam, consisting of chimney, blanket and valley drains, all draining to a sump for pumping back to the pond.

4. A series of observation wells around the pond perimeter.

5. Provisions for future drainage wells and/or trenches.

The RPP liner system described in Section 2.2 has been installed in Cells B, F and H. The RPP system is also planned for Cells C, G and the Old Clearwell. It was reported by PPL Montana that pumping time data is collected monthly from the seepage collection systems, along with the decant pond elevation and water elevations in numerous observation wells, located mostly around the basin perimeter and in the drainage valleys downstream from the dams. The pumping time data is converted into an approximate capture rate in gallons per minute (gpm). We recommend having an engineer review and evaluate this data annually to evaluate for changes in the capture rate.

Previous inspections have noted slight concerns with seepage from the Units 3&4 Ponds. However, previous inspections have not included an engineering evaluation of the piezometer data that is available for the Main and Saddle Dams. Piezometers on the Main and Saddle Dams are located on Figures 2-2 through 2-4. Figure 4-1 is a profile of the Main Dam with the phreatic surface as determined by piezometer data. This data suggests the core and drain are effective in controlling seepage in the embankment, but that the foundation is likely permeable and there is likely seepage through the foundation.

Figures 4-2 through 4-5 show the relationship between the Main Dam piezometers and the pond level in the Old Clearwell cell. The data indicates there is no correlation between piezometer and pond levels, which would be expected in an embankment with a relatively impermeable core. Therefore, there is likely to be no direct hydraulic connection from the pond to the piezometers.

FIGURE 4-1. UNITS 3 & 4 EHP MAIN DAM PHREATIC SURFACE

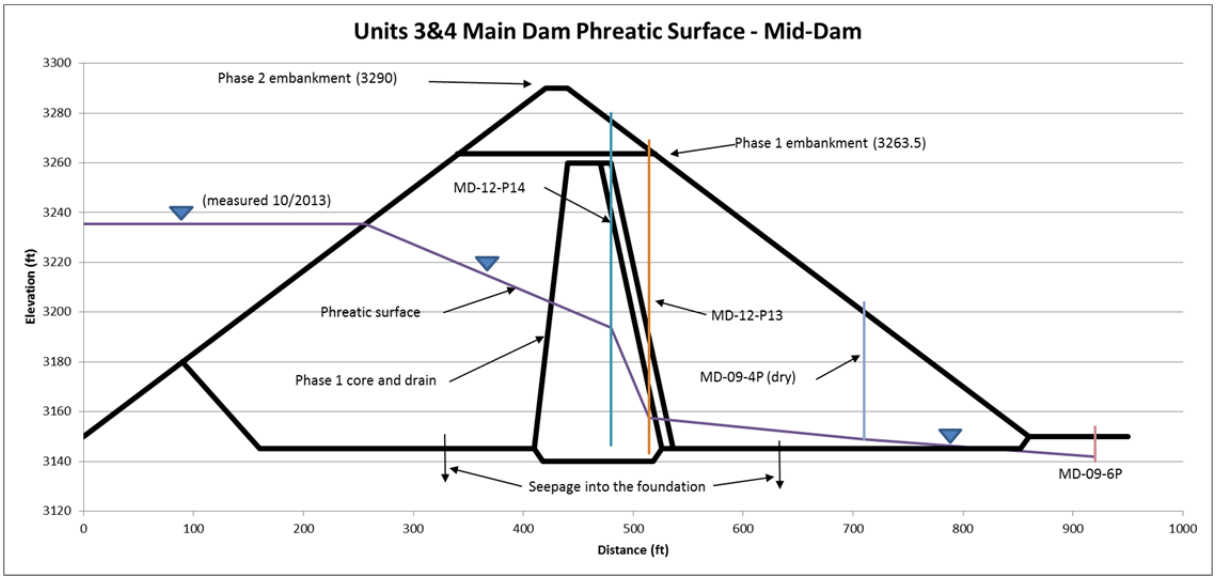


FIGURE 4-2. POND VS. PIEZOMETER LEVELS FOR THE MAIN DAM, LEFT SIDE, MD-12-12P

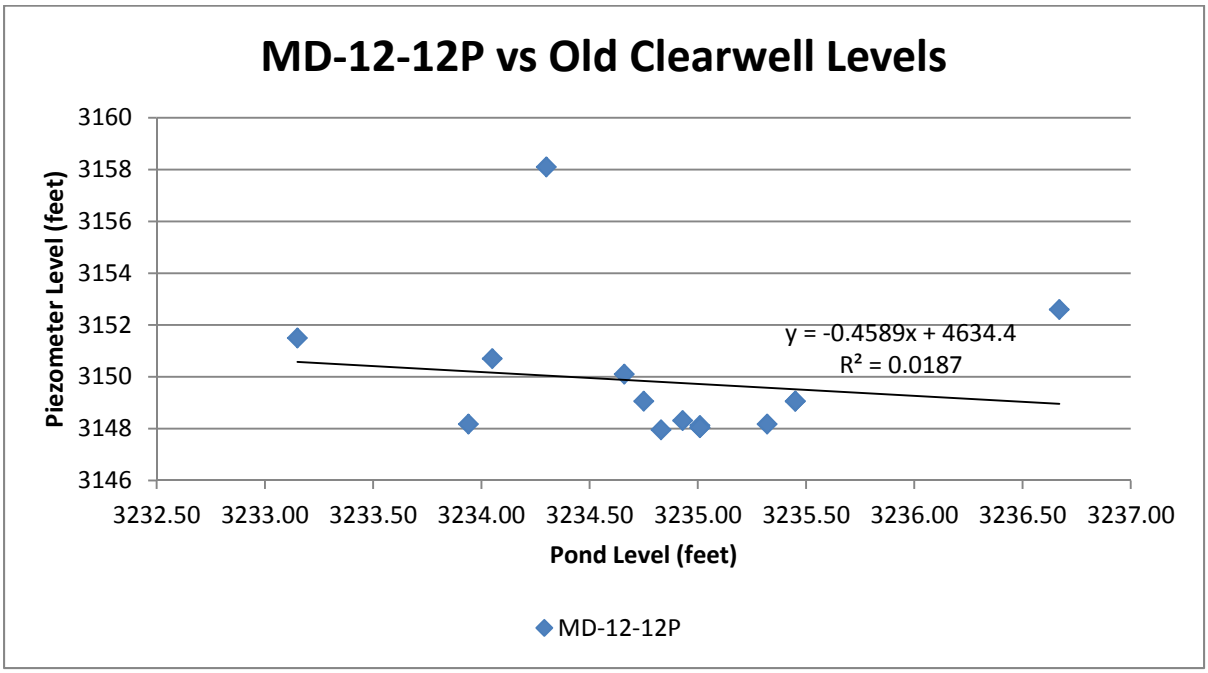


FIGURE 4-3. POND VS. PIEZOMETER LEVELS FOR THE MAIN DAM, LEFT SIDE, MD-12-15P

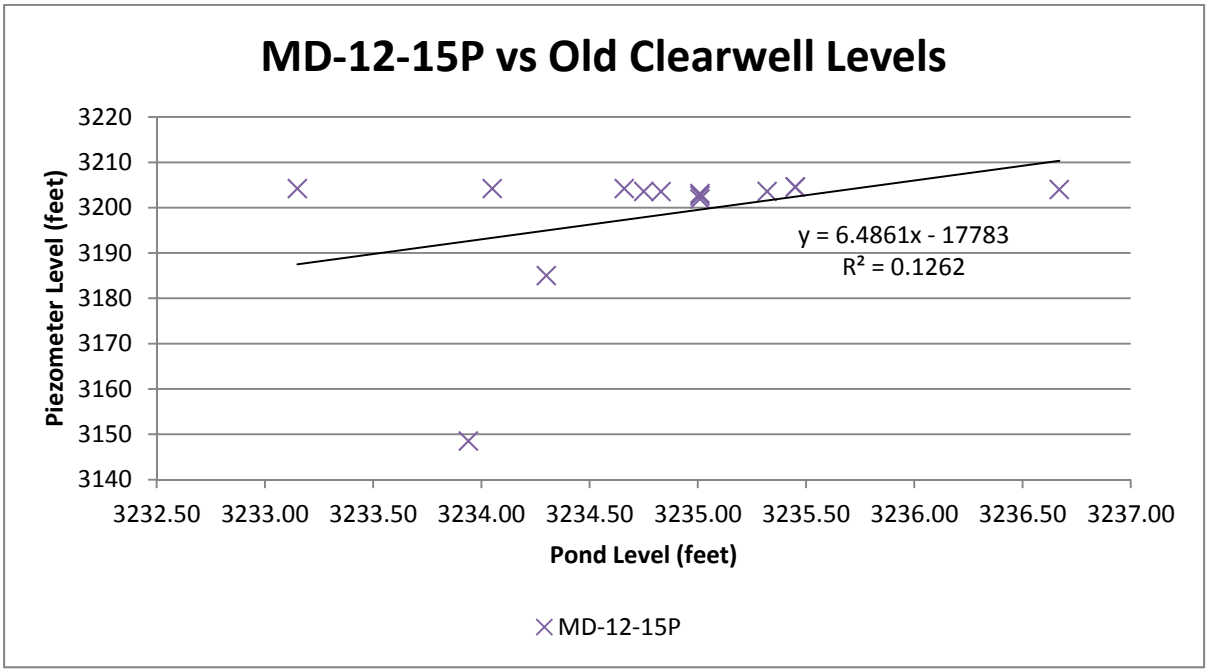


FIGURE 4-4. POND VS. PIEZOMETER LEVELS FOR THE MAIN DAM, MIDDLE SECTION, MD-12-13P

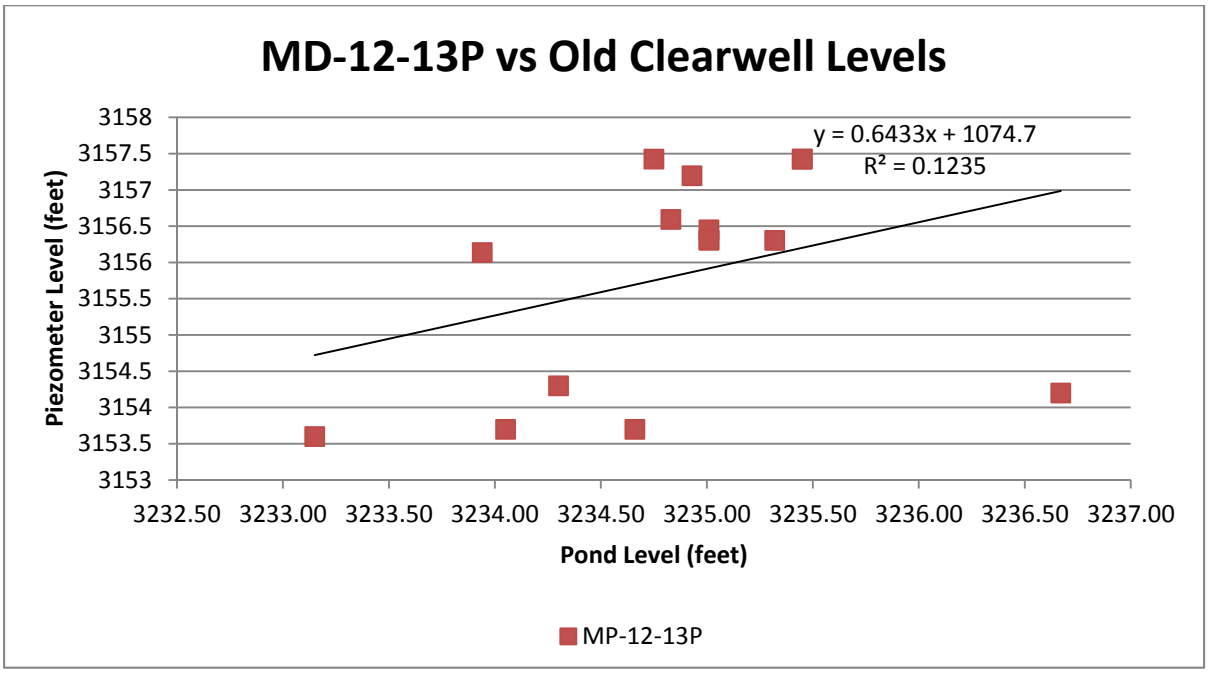


FIGURE 4-5. POND VS. PIEZOMETER LEVELS FOR THE MAIN DAM, MIDDLE SECTION, MD-12-14P

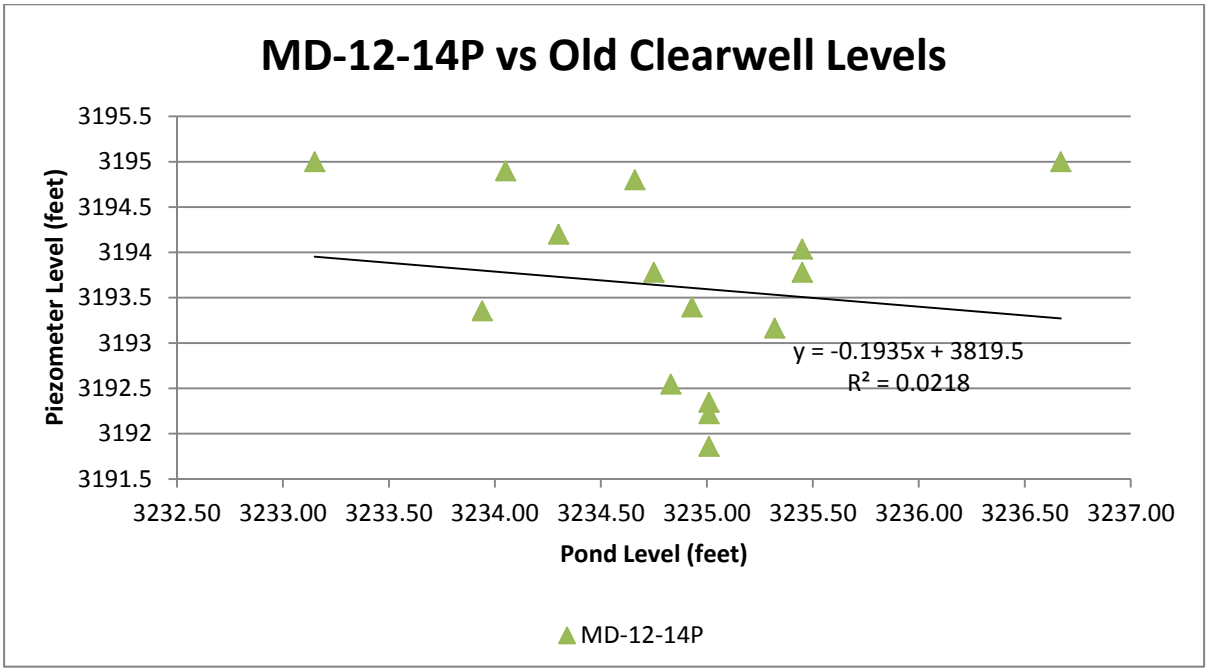


Figure 4-6 is a profile of the Saddle Dam with the phreatic surfaces as determined by piezometer data. There are few piezometers near the toe of the Saddle Dam and data was not available. The phreatic surface downstream of SD-12-P48 is unknown. No surface seepage was evident during the inspection. As shown in Figure 4-6, the water level in SD-12-P47 has consistently been above the water surface of Cell G since the piezometer's installation. SD-12-P47 is installed within the core of the Saddle Dam. The high phreatic readings indicate the pore pressures in the piezometer's screened zone are higher than those that could result from seepage through the core. The high pore pressures are likely the result of construction pore pressure formation. Construction pore pressure is a term used to describe an increase in pore water pressure within earthen dams during the construction phase, induced by the weight of the earthen embankment overburden (Oelrich, 1989). In this case, the higher pore pressures are likely from placement of the Phase 2 overburden and subsequent compression of the soil pore spaces.

FIGURE 4-6. UNITS 3 & 4 EHP SADDLE DAM PHREATIC SURFACES

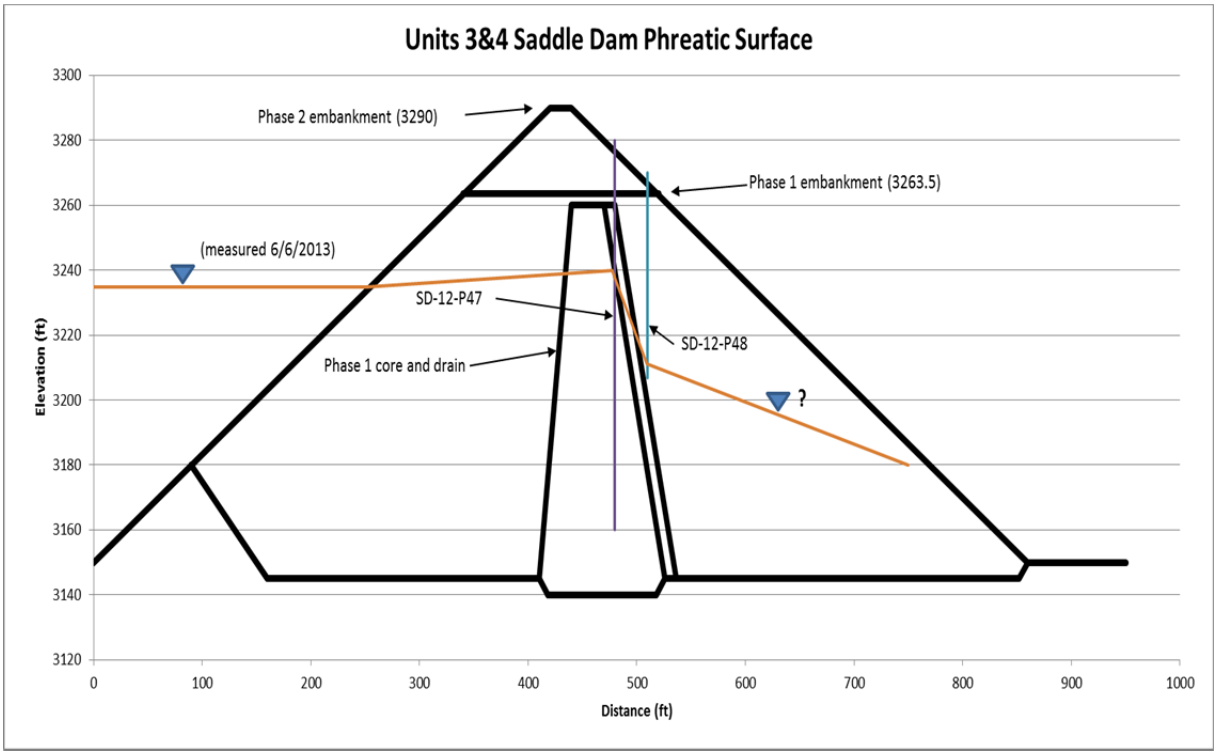


Figure 4-7 shows a moderate correlation between the Saddle Dam piezometer SD-12-47P, which is in the core of the dam, and the pond level in Cell G. For every foot of rise in the pool elevation, there is approximately 0.5 foot (6 inches) of rise in the piezometer. However, as shown in Figure 4-8, there is no correlation between the Saddle Dam piezometer SD-12-48P, which is downstream of the core, and the pond level in Cell G. Therefore, the core is probably saturated and responding at least to a limited extent to pond levels, while the shell downstream of the core is likely well-draining and not hydraulically connected. Therefore, the core is functioning well and controlling the level of the phreatic surface in the downstream shell.

FIGURE 4-7. POND VS. PIEZOMETER LEVELS FOR THE SADDLE DAM, SD-12-47P

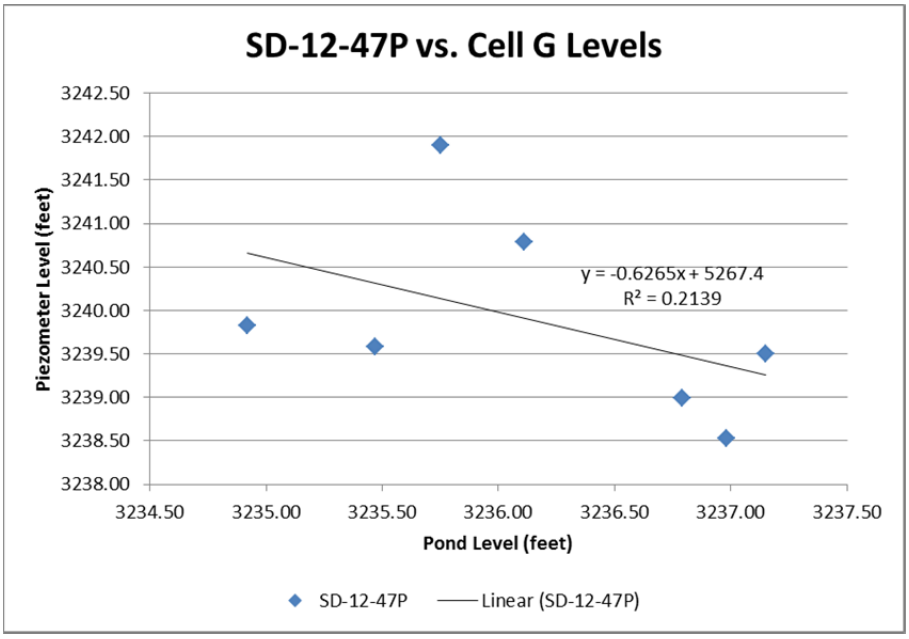
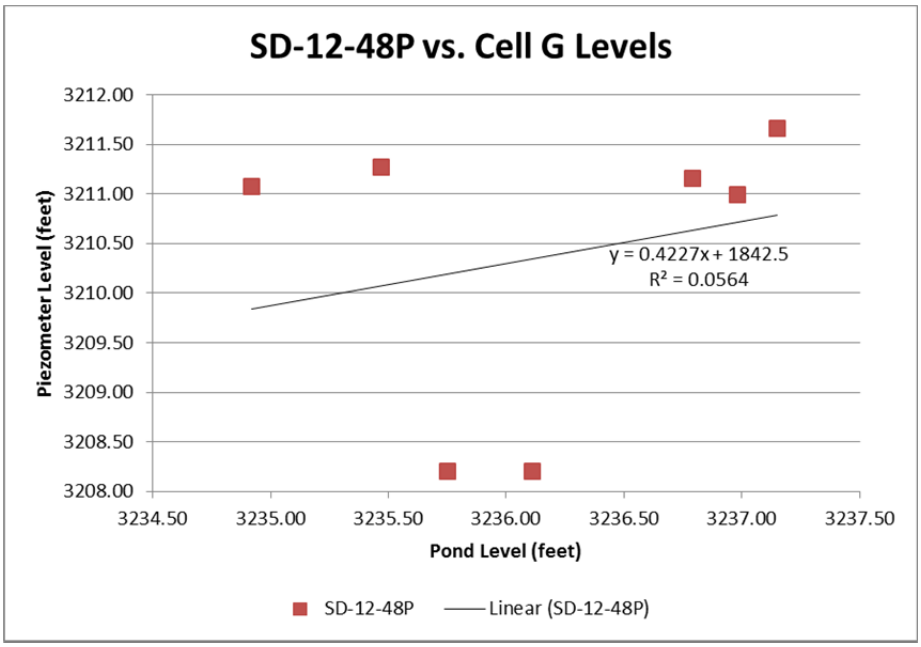


FIGURE 4-8. POND VS. PIEZOMETER LEVELS FOR THE SADDLE DAM, SD-12-48P



4.3 FLOOD ROUTING

The highest spillway standard required by State of Montana guidelines for dams whose failures have the potential to cause a loss of life of 1000 or more requires the spillway be able to pass the full Probable Maximum Flood (PMF) routed through the pond. The dams in the final Second Stage were designed to route a design flood of a 100-year flood followed by the PMF (Bechtel, 1982). The spillway design analysis (Bechtel, 1982) predicted that a combination of a 100-year flood followed by the PMF would raise the pond elevation about 3 feet from a normal maximum pool elevation of 3280 feet, or a maximum water level of 3283 NGVD. The Main and Saddle Dams' crest elevation for Phase 2 is 3290, so approximately 7 feet of freeboard would be available during the storage of the PMF plus the 100-year flood. This exceeds State of Montana criteria.

An independent check of flood routing for the full build-out condition was conducted and presented in the 1988 inspection report for the impoundment dam (Chen Northern, 1988). Chen Northern's analysis used two criteria different from the model performed by Bechtel in 1982: a 72-hour PMP event was used to be compatible with the current guidelines; and a spillway crest elevation of 3283.1 feet was used instead of 3286.1 feet, which seems to be more consistent with information provided in Bechtel's report. The value of 3286.1 presented in the Bechtel report was suspected of being a typographical error, since no mention of excess freeboard was made. The flood routing calculations performed in 1988 indicated that the impoundment would still contain most of the PMF. The spillway was predicted to have a maximum discharge rate of only 29 cubic feet per second and a flow depth of less than 0.4 feet. A review of Chen Northern's report shows that even without a spillway (as is the current Phase 2 design), the impoundment stores the volume of water produced by the PMF preceded by the 100-year storm.

4.4 SLOPE STABILITY

For the original design, shear strength properties of materials representative of soils for the foundations, shell and core were determined by triaxial tests. Shear strength properties for the shell materials were assumed by Bechtel's personnel to be equal to those of shell

materials used at the Units 1 & 2 Stage II Evaporation Pond, which is located about four miles away.

Acting on a recommendation contained in the 1988 Phase I Inspection report (Chen Northern, 1988), Montana Power Company authorized Chen-Northern, Inc. to perform exploration and laboratory testing of the actual shell materials to ascertain whether the slope stability assumptions by Bechtel were valid. Chen Northern concluded that the shear strength properties of the actual shell materials exceeded the values assumed by Bechtel personnel in the original design and additional analyses for slope stability were not warranted.

The 1999 Phase I Inspection report identified the presence of cracks in the crest of the Saddle Dam. Inclinometers and additional monitoring wells were installed on the crest between 1999 and 2009. An updated evaluation of the inclinometers (Womack & Associates, 2009a) concluded that the embankment has not experienced significant movement since 2006. The evaluation noted that cracks have not enlarged since 1999 and many have filled in due to weathering. The 2009 report recommended continued monitoring and evaluation of the inclinometers.

Seepage at the toe of the Main Dam prompted PPL to initiate precautionary monitoring and slope stability analyses (Womack & Associates, 2009b). The observations in the report indicate seepage is likely from underlying sandstone that was not reached by a constructed cutoff wall. The cutoff wall extends into the abutments and prevents seepage through an upper clinker material but does not extend far enough down to prevent seepage through the underlying sandstone layer. Stability analyses that used the pore pressures measured and seepage conditions observed in 2007 resulted in an acceptable factor of safety of 1.5 against dam failure for steady-state, normal-pool seepage conditions.

As mentioned in Section 4.1, Womack & Associates conducted geotechnical analyses in 2009 and 2010 for the Saddle and Main dams, respectively, for slope stability for the Phase 1

embankments. Both embankments were found to have adequate factors of safety for slope stability.

The project lies in a Seismic Zone 0 (UBC, 1994), which is characterized by little seismic risk. The original design report selected a seismic coefficient of 0.05 g for use in slope stability analysis, which is a conservative value for this seismic zone.

For the 2012 Phase 2 embankment raise, piezometers and standpipes in the Phase 1 embankment were abandoned and new inclinometers, piezometers and standpipes were installed. Details of groundwater monitoring modifications for the Phase 2 embankment raise are found in the 2012 annual monitoring report prepared for PPL Montana (Womack & Associates, 2013). Locations of instrumentation are shown on Figure 2-2 of this report. The Main Dam is adjacent to the Old Clearwell on the north side of the EHP. The surface water level within the Old Clearwell has been limited by EPA (2009) to a maximum elevation of 3,238 feet. The new piezometers installed in 2012 indicated the surcharge load imposed by the 30-foot embankment raise increased the pre-construction porewater pressures anywhere from 6 feet to 19 feet in newly installed piezometers. During a six week monitoring program in 2012, the porewater pressure dropped 2.6 feet in one piezometer, but pressures remained nearly constant in others (Womack & Associates, 2013). Porewater pressures are expected to reduce slowly over time as the clay core drains. The pore pressure response to construction loading had been anticipated and accounted for in pre-construction stability analyses. Main Dam slope stability was re-analyzed using piezometric surface elevations measured in the fall of 2012. The results of post-construction modeling indicate factors of safety higher than 1.9, consistent with preconstruction predictions (ibid). Slope inclinometers were also installed in 2012. Inclinometers have measured embankment movements that are determined as acceptable since being installed, as reported in the latest monitoring effort in 2013 (ibid).

5.0 FIELD INSPECTION

5.1 METHODOLOGY

Gary Fischer, P.E., of Hydrometrics conducted a detailed field inspection of Units 3 & 4 Effluent Holding Pond Main and Saddle dams on July 15, 2014. Mr. Fischer was accompanied by Mike Holzwarth of PPL Montana, Charles Freshman of the Montana Department of Environmental Quality, and Sam Johnson of the Montana Department of Natural Resources and Conservation. Observations were made for surface evidence of potential problems relating to settlement, seepage, slope stability, erosion and general condition of appurtenant structures. Inspection photographs document both general conditions and specific items which merit remedial action (Appendix A for both the Main and Saddle Dams). Copies of the field inspection forms are contained in Appendix B.

The dams may be accessed by roads on PPL property. The roads are guarded at the entrance to the power plant by a security station where access is limited to authorized personnel only.

Notation in the following text is referenced as “right” or “left” looking downstream of the dam.

Phase 2 construction on the Main and Saddle Dams was completed in 2012. The Phase 2 embankments consist of baked shale placed on top of the Phase 1 embankments. The embankments were raised from the Phase 1 crest elevation of 3261.5 to the Phase 2 crest elevation of 3290.0. At the time of the inspection, the Old Clearwell and Cells C and G were empty as construction on divider dikes took place. A lift of ash material from the holding ponds has been placed on the upstream slopes of both the Main and Saddle Dams to act as a cushion for an eventual synthetic liner that will control seepage through the embankments.

5.2 MAIN DAM

5.2.1 Crest

The crest of the Main Dam was in good condition (Photos 2 and 3). The crest is approximately 20 feet wide after the Phase 2 baked shale embankment was placed. The crest is bare, with no vegetation. No cracks, holes, or signs of instability were found.

5.2.2 Upstream Slope

The upstream slope is covered with a lift of pond ash to be used as cushion for the eventual synthetic liner for seepage control. The slope did not exhibit any signs of sliding, sloughing, scarps, erosion, or unusual movement (Photos 1 and 3). Animal burrows or sinkholes were not observed on the upstream slope. The contact between the embankment and abutment was in good condition.

A small slope failure observed in 1993 in natural ground south of the Main Dam embankment, about 100 feet from the Main Dam's left upstream groin, is still evident but appears to not have changed since the last periodic inspection. With no water in the Old Clearwell, no seepage was observed in the area of the slope failure, where seepage was previously observed. The natural ground slope failure does not present an immediate threat to stability of the dam but it should be monitored monthly for movement.

5.2.3 Downstream Slope

The downstream slope was in good condition (Photos 10 - 12). No signs of slope instability or unusual movement were observed on the slope or in the groins between the embankment and abutment.

The two areas of erosion on the downstream slope identified in 2009 were not evident on this inspection. Vegetation was in good condition and no areas of concern were identified.

No rodent holes were observed. The rodent control program appears to be effective on this embankment and PPL Montana is encouraged to maintain the rodent control efforts.

5.2.4 Downstream Area

The downstream area of the Main Dam has no evidence of sliding, sloughing, or scarps. Foundation seepage is collected by a drain and pump-back system. A wet area with standing and slowly-moving surface water was observed in the downstream toe area (Photo 15). The source of water is likely foundation seepage, but it occurs in a small eroded channel that was probably caused by surface runoff from the northwest. Groundwater flow in this area has

been studied and remedial action has been implemented over the years. A groundwater interception system was installed in 2001 as a result from a study that indicated groundwater was likely originating from both the Clearwell pond and faults in the foundation to the west, or what has been described as Seep 552 (Hydrometrics, 2001). Stability analyses of the Main Dam accounted for the influence of Seep 552, as reported by Womack & Associates (2009b). No significant changes were observed in the abutments or face of the dam associated with this seep and the toe area was in good condition except for the isolated seep and eroded area. Further monitoring of this situation is recommended to ensure no change in the situation.

5.2.5 Instrumentation

As shown on Figures 2-2 through 2-4, monitoring wells and piezometers in the vicinity of the Units 3 & 4 Main and Saddle Dams are in place. Since the addition of Phase 2 embankment fill, new piezometers have been installed to monitor seepage in the embankments. Old piezometers in the Phase 1 embankments have been abandoned.

Section 4.2 discusses monitoring well and seepage data collection and engineering evaluation. We recommend that the data are reviewed by an engineer familiar with dam design annually.

5.3 SADDLE DAM

Unit 3 & 4 Effluent Holding Pond Saddle Dam was also inspected on July 15, 2014 with the same personnel who inspected the Main Dam. The Saddle Dam has three embankments: north, middle and south embankments; which are contiguous but each abuts against natural hills that help partially separate the embankments. Reference to these embankments will be made in the report sections that follow.

5.3.1 Crest

The horizontal alignment of the crest appeared to be good. The crest is approximately 20 feet wide after the Phase 2 baked shale embankment was placed. The crest is bare, with no vegetation. No cracks, holes, or signs of instability were found (Photos 19, 31, 34 and 35).

5.3.2 Upstream Slope

The upstream slope, similar to the Main Dam upstream slope, is covered with a lift of pond ash to be used as cushion for the eventual synthetic liner for seepage control. The slope did not exhibit any signs of sliding, sloughing, scarps, erosion, or unusual movement (Photos 19, 31 and 32). Animal burrows or sinkholes were not observed on the upstream slope. The contact between the embankment and abutment was in good condition.

5.3.3 Downstream Slope

Inspection of the downstream slope showed no evidence of slides, sloughs, scarps, or unusual movement. No seepage or wet areas were observed. The contact between the embankment and abutments was good. Grass along the slope is well established. Scattered woody brush was evident on all embankments and should be removed (Photo 28).

Several rodent holes were found (Photos 25 and 27). We recommend backfilling rodent holes and monitoring to determine if rodents are active. If rodents are present, the rodent control program should be reinstated on the downstream slopes.

5.3.4 Downstream Area

The downstream area of Saddle Dam appeared to be in good condition (Photos 20 and 24). The abutment and foundation inspection showed no leakage, seepage, or evidence of instability. Toe drains collect subsurface flow, which is managed through a pump-back system (Photos 21 and 25). At the time of the inspection, the toe drain was not flowing because of no water in Cell G.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon our review of the previous inspection reports and recent field observations, in our opinion, the Units 3 & 4 Effluent Holding Pond Main and Saddle Dams appear to be well maintained and safely operated. No major deficiencies were identified in this inspection. Several items were identified which merit remedial action and/or monitoring. Those items lead us to provide the following recommendations:

1. Remove woody brush from the Saddle Dam downstream slopes.
2. Provide monitoring of toe drains and pump-back systems to correlate flow rate or volumetric readings to the ponds' levels.
3. Monitor and provide data collection on the surface seepage flowing at the downstream toe of the Main Dam. Flow measurements need to be correlated to pond level readings.
4. Backfill rodent holes on the downstream slopes of the Saddle Dam. Monitor the area for rodent activity. If rodents are present, reinstate the rodent control program.
5. Annually evaluate embankment piezometer readings. In addition to what is already accomplished by Womack & Associates, provide analysis of the phreatic surface in the embankments to compare to what a typical phreatic surface should look like for these embankments. Plus correlate the water levels measured in the piezometers to the pond levels to evaluate the potential for internal piping.

7.0 REFERENCES

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APPENDIX A

FIELD INSPECTION PHOTOGRAPHS OF THE MAIN AND SADDLE DAMS

Photo 1. Units 3 & 4 EHP Main Dam, July 15, 2014.
Crest and upstream slope from right abutment.

Photo 2. Units 3 & 4 EHP Main Dam, July 15, 2014.
Crest and downstream slope from right abutment.

Photo 3. Units 3 & 4 EHP Main Dam, July 15, 2014.
Crest and upstream slope from mid-dam.

Photo 4. Units 3 & 4 EHP Main Dam, July 15, 2014.
Crest and downstream slope from mid-dam.

Photo 5. Units 3 & 4 EHP Main Dam, July 15, 2014.
Piezometer MD-12-14P, mid-dam on crest.

Photo 6. Units 3 & 4 EHP Main Dam, July 15, 2014.
Piezometer MD-12-14P and two others on downstream slope.

Photo 7. Units 3 & 4 EHP Main Dam, July 15, 2014.
Inclinometer 4INC on Main Dam.

Photo 8. Units 3 & 4 EHP Main Dam, July 15, 2014.
Piezometer MD-12-15P, left side of dam on crest.

Photo 9. Units 3 & 4 EHP Main Dam, July 15, 2014.
Piezometer MD-12-15P and two others on downstream slope.

Photo 10. Units 3 & 4 EHP Main Dam, July 15, 2014.
Downstream slope, right side.

Photo 11. Units 3 & 4 EHP Main Dam, July 15, 2014.
Downstream slope, mid-dam.

Photo 12. Units 3 & 4 EHP Main Dam, July 15, 2014.
Downstream slope, left side.

Photo 13. Units 3 & 4 EHP Main Dam, July 15, 2014.
Seepage in downstream toe, eroded area.

Photo 14. Units 3 & 4 EHP Main Dam, July 15, 2014.
Seepage in downstream toe, eroded area.

Photo 15. Units 3 & 4 EHP Main Dam, July 15, 2014.
Seepage in downstream toe, eroded area.

Photo 16. Units 3 & 4 EHP Main Dam, July 15, 2014.
Downstream toe, eroded area.

Photo 17. Units 3 & 4 EHP Main Dam, July 15, 2014.
Downstream slope, interface between Phase 1 (grass) and Phase 2 (baked shale).

Photo 18. Units 3 & 4 EHP Main Dam, July 15, 2014.
Upstream slope from right abutment.

Photo 19. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Crest and upstream slope from left abutment.

Photo 20. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Downstream slope from left abutment.

Photo 21. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Seepage manhole, downstream toe, left side.

Photo 22. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Downstream slope on left side of left embankment.

Photo 23. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Downstream slope of mid-dam on left side embankment.

Photo 24. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Downstream slope on right side of left embankment.

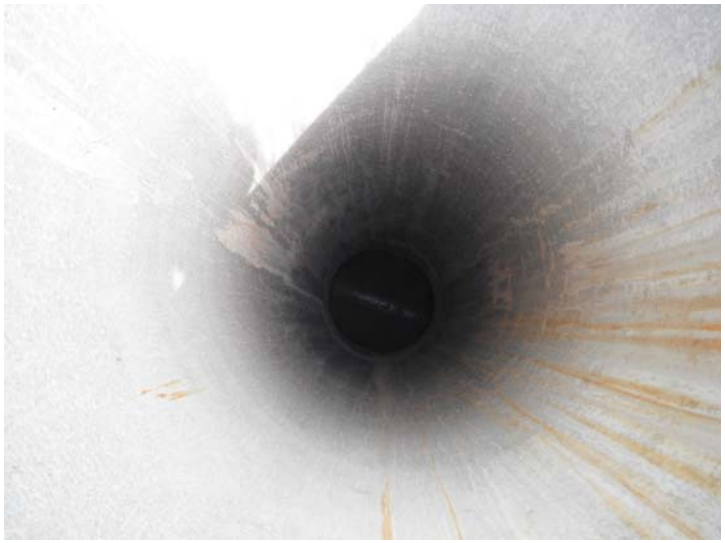

Photo 25. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Toe drain manhole, middle embankment.

Photo 26. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Downstream slope, middle embankment.

Photo 27. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Rodent hole, downstream slope, middle embankment.

Photo 28. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Downstream slope, right embankment.

Photo 29. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Rodent hole, downstream slope, right embankment.

Photo 30. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Downstream slope, interface between Phase 1 (grass) and Phase 2 (baked shale).

Photo 31. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Crest and upstream slope from right abutment.

Photo 32. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Upstream slope on right side embankment.

Photo 33. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Upstream slope from right embankment and pond area.

Photo 34. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Crest and downstream slope on right side embankment.

Photo 35. Units 3 & 4 EHP Saddle Dam, July 15, 2014.
Crest and downstream slope, looking to right abutment.

APPENDIX B

FIELD INSPECTION NOTES

NAME OF DAM: Units 3 & 4 EHP Main Dam

INSPECTION DATE: 7/15/2014

EMBANKMENT

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
CREST	1	SURFACE CRACKING	None			
	2	CAVE IN, ANIMAL BURROW	none			
	3	LOW AREA(S)	none			
	4	HORIZONTAL ALIGNMENT	OK			
	5	RUTS AND/OR PUDDLES	none			
	6	VEGETATION CONDITION	bare - Stage 2 fill was placed in 2012. Fill			
	7					
	8					
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP	none			
	10	SLOPE PROTECTION	none			
	11	SINKHOLE, ANIMAL BURROW	none			
	12	EMB.-ABUT. CONTACT	OK			
	13	EROSION	none			
	14	VEGETATION CONDITION	bare - pond was drained - slope will be lined			
	15					
	16					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

6. consists of baked shale and no topsoil.

14. prior to filling.

NAME OF DAM: Chifs 3 & 4 EHP Main Dam

INSPECTION DATE: 7/15/2014

EMBANKMENT

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATION	CHECK ( ) ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA(S) (NO FLOW)	none			
	18	SEEPAGE	none			
	19	SLIDE, SLOUGH, SCARP	none			
	20	EMB.-ABUT. CONTACT	OK			
	21	CAVE IN, ANIMAL BURROW	none			
	22	EROSION	none			
	23	UNUSUAL MOVEMENT	none			
	24	VEGETATION CONTROL	grass cover was good.			
	25					
	26					
INSTRUMENTATION	27	PIEZOMETERS/OBSERV. WELLS	measured by PPL or Womack staff			
	28	STAFF GAUGE AND RECORDER	pond level measured by PPL or contractors			
	29	WEIRS	NA			
	30	SURVEY MONUMENTS	NA			
	31	DRAINS	not measured - minimal flows w/ drained pond			
	32	FREQUENCY OF READINGS	monthly or quarterly			
	33	LOCATION OF RECORDS	PPL offices.			
	34					
	35					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Units 3 & 4 EHP Main Dam

INSPECTION DATE: 7/15/2014

OUTLET WORKS

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
OUTLET WORKS	70	INTAKE STRUCTURE	NA			
	71	TRASHRACK				
	72	STILLING BASIN				
	73	PRIMARY CLOSURE				
	74	SECONDARY CLOSURE				
	75	CONTROL MECHANISM				
	76	OUTLET PIPE				
	77	OUTLET TOWER				
	78	EROSION ALONG DAM TOE				
	79	SEEPAGE				
	80	UNUSUAL MOVEMENT				
	81					
	82					
	83					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Units 3 & 4 EHP Main Dam

INSPECTION DATE: 7/15/2014

SPILLWAYS

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
ERODIBLE CHANNEL	51	SLIDE, SLOUGH, SCARP	NA			
	52	EROSION				
	53	VEGETATION CONDITION				
	54	DEBRIS				
	55					
	56					
NON-ERODIBLE CHANNEL	57	SIDEWALLS	NA			
	58	CHANNEL FLOOR				
	59	UNUSUAL MOVEMENT				
	60	APPROACH AREA				
	61	WEIR OR CONTROL				
	62	DISCHARGE AREA				
	63					
	64					
DROP INLET	65	INTAKE STRUCTURE	N/A			
	66	TRASHRACK				
	67	STILLING BASIN				
	68					
	69					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Units 3 & 4 EHP Main Dam

INSPECTION DATE: 7/15/2014

DOWNSTREAM AREA AND MISC.

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
DOWNSTREAM AREA	36	ABUTMENT LEAKAGE	none			
	37	FOUNDATION SEEPAGE	possible - water in eroded channel in toe area	✓		
	38	SLIDE, SLOUGH, SCARP	none			
	39	DRAINAGE SYSTEM	in place - not flowing			
	40					
	41					
	42	DOWNSTREAM HAZARD DESCRIPTION	see latest EAP			
	43	DATE OF LAST UPDATE OF EMERGENCY ACTION PLAN	2013			
MISCELLANEOUS	44	RESERVOIR SLOPES	OK			
	45	ACCESS ROADS	secured			
	46	SECURITY DEVICES	guard gate			
	47					
	48					
	49					
	50					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Units 3 & 4 Elt P Saddle Dam

INSPECTION DATE: 7/15/2014

EMBANKMENT

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
CREST	1	SURFACE CRACKING	none			
	2	CAVE IN, ANIMAL BURROW	none			
	3	LOW AREA(S)	none			
	4	HORIZONTAL ALIGNMENT	OK			
	5	RUTS AND/OR PUDDLES	none			
	6	VEGETATION CONDITION	bare - Stage 2 fill was placed in 2012. Fill			
	7					
	8					
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP	none			
	10	SLOPE PROTECTION	none			
	11	SINKHOLE, ANIMAL BURROW	none			
	12	EMB.-ABUT. CONTACT	OK			
	13	EROSION	none			
	14	VEGETATION CONDITION	bare - pond was drained - slope will be lined			
	15					
	16					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

6. consists of baked shale and no topsoil.

14. prior to filling.

NAME OF DAM: Units 3 & 4 EHP Saddle Dam

INSPECTION DATE: 7/15/2014

EMBANKMENT

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATION	CHECK ( ) ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA(S) (NO FLOW)	none			
	18	SEEPAGE	none			
	19	SLIDE, SLOUGH, SCARP	none			
	20	EMB.-ABUT. CONTACT	OK			
	21	CAVE IN, ANIMAL BURROW	animal burrows on middle and south embankments		✓	✓
	22	EROSION	none			
	23	UNUSUAL MOVEMENT	none			
	24	VEGETATION CONTROL	OK - good condition except for scattered woody brush			✓
	25					
	26					
INSTRUMENTATION	27	PIEZOMETERS/OBSERV. WELLS	measured by PPL or Womack staff			
	28	STAFF GAUGE AND RECORDER	pond level measured by PPL or contractors			
	29	WEIRS	NA			
	30	SURVEY MONUMENTS	↓			
	31	DRAINS	not measured - minimal flows w/ drained pond			
	32	FREQUENCY OF READINGS	monthly or quarterly			
	33	LOCATION OF RECORDS	PPL offices			
	34					
	35					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Units 3 & 4 EHP Saddle Dams

INSPECTION DATE: 7/15/2014

OUTLET WORKS

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
OUTLET WORKS	70	INTAKE STRUCTURE	NA			
	71	TRASHRACK				
	72	STILLING BASIN				
	73	PRIMARY CLOSURE				
	74	SECONDARY CLOSURE				
	75	CONTROL MECHANISM				
	76	OUTLET PIPE				
	77	OUTLET TOWER				
	78	EROSION ALONG DAM TOE				
	79	SEEPAGE				
	80	UNUSUAL MOVEMENT				
	81					
	82					
	83					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Units 3 & 4 EHP Saddle Dam

INSPECTION DATE: 7/15/2014

SPILLWAYS

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
ERODIBLE CHANNEL	51	SLIDE, SLOUGH, SCARP	NA			
	52	EROSION				
	53	VEGETATION CONDITION				
	54	DEBRIS				
	55					
	56					
NON-ERODIBLE CHANNEL	57	SIDEWALLS				
	58	CHANNEL FLOOR				
	59	UNUSUAL MOVEMENT				
	60	APPROACH AREA				
	61	WEIR OR CONTROL				
	62	DISCHARGE AREA				
	63					
	64					
DROP INLET	65	INTAKE STRUCTURE				
	66	TRASHRACK				
	67	STILLING BASIN				
	68					
	69					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Units 3 & 4 EHP Saddle Dam

INSPECTION DATE: 7/15/2014

DOWNSTREAM AREA AND MISC.

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
DOWNSTREAM AREA	36	ABUTMENT LEAKAGE	none			
	37	FOUNDATION SEEPAGE	none			
	38	SLIDE, SLOUGH, SCARP	none			
	39	DRAINAGE SYSTEM	in-place - not flowing			
	40					
	41					
	42	DOWNSTREAM HAZARD DESCRIPTION	see latest EAP			
	43	DATE OF LAST UPDATE OF EMERGENCY ACTION PLAN	2013			
MISCELLANEOUS	44	RESERVOIR SLOPES	OK			
	45	ACCESS ROADS	secured			
	46	SECURITY DEVICES	guard gate			
	47					
	48					
	49					
	50					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.