# PPL Montana's Responses to EPA's Recommendations in its September 2009 Report on Structural Integrity Inspection at the Colstrip plant from June 2009

## 12.1 Corrective Measures for the Structures

### 12.1.1 Units 1 8 2 Bottom Ash Pond Embankments

1. A check slope stability analysis was performed by GEI because an existing analysis was not available. The check stability analysis indicates the west embankment of the Bottom Ash Ponds meets the minimum required factors of safety in accordance with the FERC. However, we recommend that slope stability analyses be performed and documented for these embankments based on site-specific information.

***Response: PPL Montana will perform a slope stability analyses for these embankments based on site-specific information by the end of 2009. Details on the work planned and underway are attached.***

2. Modify the 24-inch HDPE carrier pipe in the southwest corner of the west cell to prevent a potential seepage path at higher reservoir elevations through the HDPE lining to the interior of the embankment.

***Response: PPL Montana has removed the 24-inch HDPE carrier pipe in the southwest corner of the west cell to eliminate this potential seepage path. An overflow pipe has been added from the Bottom Ash Clearwell (west cell) that discharges to Pond "A" to ensure appropriate freeboard within the Bottom Ash Clearwell.***

3. Remove the out-of-service box culvert located near the embankment crest on the east cell and backfill with engineered fill.

***Response: PPL Montana has removed and backfilled the out-of-service culvert box on the east cell and backfill with engineered fill.***

4. Implement rodent control measures on the downstream slope of the embankment to reduce the potential for shortened seepage pathways through the burrows.

***Response: PPL Montana's contractor Ecolab had implemented rodent controls in May 2009 prior to the EPA inspection. Ecolab conducted followup control measures in August 2009 to ensure that effective rodent control measures have been taken.***

5. Place engineered fill and regrade the downstream toe of the embankment to eliminate oversteepened slopes.

***Response: PPL Montana has placed engineered fill and regrade the downstream toe of the embankment.***

6. Remove and backfill the out-of-service manhole at the downstream toe of the northwest corner of the west cell to eliminate this potential seepage pathway. Careful construction is required working at the toe of a dam to not destabilize the slope.

***Response: PPL Montana has carefully removed and backfilled the out-of-service manhole at the downstream toe of the northwest corner of the west cell.***

7. Design and install piezometers to monitor water pressures in the embankment and foundation. Collect and evaluate data at least twice per year.
***Response: PPL Montana has designed and will install piezometers to monitor water pressures in the embankment and foundation by the end of 2009. PPL will collect and evaluate data at least twice per year. Details on the work planned and underway are attached.***

**12.1.2 Units 1 8 2 "A" Pond Embankments**
1. Slope stability check analyses performed by GEI indicate the south part of the west embankment of Pond "A" has a factor of safety that is somewhat less than required for the rapid drawdown loading condition. The application of a full rapid drawdown analysis to this pond is considered a conservative analysis and the resulting calculated factor of safety is considered adequate, We recommend further documentation of the stability of these embankments be performed using site-specific soil strength information.
***Response: PPL Montana will perform a slope stability analyses for these embankments based on site-specific information by the end of 2009. Details on the work planned and underway are attached.***

2. Implement rodent control measures on the downstream slope of the embankment to reduce the potential for shortened seepage pathways through the burrows.
***Response: PPL Montana's contractor Ecolab had implemented rodent controls in May 2009 prior to the EPA inspection. Ecolab conducted followup control measures in August 2009 to ensure that effective rodent control measures have been taken.***

3. Fill and regrade the oversteepened areas at the downstream toe of the embankment.
***Response: PPL has filled and regraded the oversteepened areas at the downstream toe of the embankment.***

4. Design and install piezometers to monitor water pressures in the embankment and foundation. Collect and evaluate data at least twice per year.
***Response: PPL Montana has designed and will install piezometers to monitor water pressures in the embankment and foundation by the end of 2009. PPL will collect and evaluate data at least twice per year. Details on the work planned and underway are attached.***

***12.1.3 Units 1 8*** **2 STEP Dam**
1. Correct the low area of the dam crest at the right abutment by placing engineered fill.
***Response: PPL Montana has corrected the low area of the dam crest at the right abutment by placing engineered fill.***

2. Repair the erosion on the upstream slope near the right groin. Correct surface water run-on to eliminate the water source for future erosion. Repair the minor surface erosion on the upstream and downstream slopes of the STEP Dam.
***Response: PPL Montana has repaired the erosion on the upstream slope near the right groin, corrected surface water run-on to eliminate the water source for future erosion, and repaired the minor surface erosion on the upstream and downstream slopes of the STEP Dam.***

3. Design and install piezometers and movement monuments in the dam to monitor water pressures and displacement. Install a means of measuring seepage flow collected by the internal drain system. Collect and evaluate data at least twice per year.
***Response: PPL Montana has designed and will install piezometers to monitor water pressures in the embankment and foundation by the end of 2009. PPL will collect and evaluate data at least twice per year. Details on the work planned and underway are attached.***

***12.1.4 Units 3 8* 4 EHP Main Dam**
1. Design and install additional instrumentation in the dam and sandstone layer in the dam abutments. Some of these instruments should obtain data in the downstream shell and in the abutment at a location downstream of the core. Collect and evaluate data at least twice per year.
***Response: PPL Montana has designed and will install additional instrumentation in the dam and sandstone layer in the dam abutments by the end of 2009. PPL Montana will collect and evaluate data at least twice per year. Details on the work planned and underway are attached.***

2. Perform seepage and stability analyses to develop understanding of the potentially critical abutment seepage conditions in the baked shale and sandstone layer with respect to potential for seepage erosion at the darn-abutment contact and the generation of high pore pressures in the downstream shell.
***Response: PPL Montana will perform the recommended seepage and stability analyses by the end of 2009.***

3. Continue to monitor water levels in the dam and abutments and the associated seep that surfaces downstream of the Main Dam and the 1999 seep area downstream of the Saddle Dam.
***Response: PPL Montana will continue to monitor water levels in the dam and abutments and the associated seep that surfaces downstream of the Main Dam and the 1999 seep area downstream of the Saddle Dam.***

4. Evaluate and document whether the small saddle fill located about 500 feet left of the left abutment functions as part of the Main Dam. If determined to be part of the Main Dam, the fill should be analyzed for slope stability and inspected regularly like other portions of the dam.
***Response: PPL Montana will evaluate and document whether the small saddle fill located about 500 feet left of the left abutment functions as part of the Main Dam. This will be completed as part of the analyses and design for raising the dams and this will be implemented in 2010.***

5. Implement rodent control measures on the downstream slope of the dam to reduce the potential for seepage through burrows.
***Response: PPL Montana's contractor Ecolab had implemented rodent controls in May 2009 prior to the EPA inspection. Ecolab conducted followup control measures in August 2009 to ensure that effective rodent control measures have been taken.***

6. Continue to monitor and repair minor surface erosion rills on the downstream slope of the Main Dam.
***Response: PPL Montana has and will continue to monitor and repair minor surface erosion rills on the downstream slope of the Main Dam.***

7. Maintain the free water level restriction in the Old Clearwell at a maximum of El. 3,238.
***Response: PPL Montana will maintain the free water level restriction in the Old Clearwell at a maximum of El. 3238 unless the analyses completed in recommendations 1 or 2 indicate otherwise.***

### *12.1.5 Units 3 8* 4 EHP Saddle Dam

1. The 1999 seepage event that resulted in internal erosion of the Saddle Dam embankment and core was addressed by lowering and restricting the water level behind the darn, but no repairs were made to the dam. The water level restriction that was established in December 1999 should be continued and storage for the appropriate inflow design flood maintained. The dam is not considered safe if water levels are allowed to rise significantly above El. 3,237 because the potential for internal seepage erosion remains. PPL has noted that their studies attribute the seepage event to differential settlement at the concrete cutoff wall location between the upstream, saturated, part of the embankment, which settled, and the downstream part, which did not settle. However, the EHP ponds impounded by the Saddle Dam are currently being filled with paste consisting of 68 percent solids that cures to a solid. Filling the ponds with paste could greatly reduce seepage pressures on the dams and an engineering analysis of the potential to store paste above the restriction level should be documented.
***Response: PPL Montana has maintained the water level restriction in Cell G since December 1999 and will continue that restriction. The engineering analysis for storing paste in this cell will be completed by the end of 2009. Details on the work planned and underway are attached.***

2. Backfill the test pit located on the downstream slope of the dam after repairing the damaged toe drain pipe and restoring the granular drain materials.
***Response: PPL Montana has backfilled the test pit located on the downstream slope of the dam after repairing the damaged toe drain pipe and restoring the granular drain materials.***

3. Continue to monitor and repair minor surface erosion rills on the downstream slope of the Saddle Dam.
***Response: PPL Montana will continue to monitor and repair minor surface erosion rills on the downstream slope of the Saddle Dam.***

4. Maintain the free water level restriction in the "G" cell at a maximum of El. 3,237.
***Response: As indicated in response to 1 above, PPL Montana has since December 1999 and will continue to maintain the free water level restriction in the "G" cell at a maximum of El. 3237.***

5. Evaluate the high water level readings in two Saddle Dam piezometers that indicate minimal head loss between the reservoir and the piezometers.
***Response: PPL Montana will evaluate by the end of 2009 the high water level readings in two Saddle Dam piezometers that indicate minimal head loss between the reservoir and the piezometers. Details on the work planned and underway are attached.***

**12.2 Corrective Measures Required for Maintenance and Surveillance Procedures**
None.

**12.3 Corrective Measures Required for the Methods of Operation of the Project Works.**
None.

**12.4 Any New or Additional Monitoring Instruments, Periodic Observations, or Other Methods of Monitoring Project Works or Conditions That May Be Required**

The visual inspections and the instrumentation monitoring plan currently in place for the impoundments generally appears to be adequate.

The instrumentation for the dams is inadequate. Install additional instruments in the Units 3 & 4 Main Dam to enable engineering evaluation of water pressure within the core and downstream shell and within the abutment sandstone layer downstream of the core. Install instruments for monitoring water pressures and movement within the Units 1 & 2 STEP dam embankment and in the abutments, particularly the left abutment that is protected by the upstream soil blanket. Install instruments for monitoring water pressures within the Units 1 & 2 Bottom Ash and "A Pond embankments.

***Response: See response above to 12.1.4 recommendation 1, for which PPL Montana indicates that additional instrumentation will be installed in Units 3 8 4 EHP Main Dam by the end of 2009. See response above to 12.1.3 recommendation 3, for which PPL Montana indicates that additional instrumentation will be installed in the Units 1 & 2 STEP dam embankment by the end of 2009. See response above to 12.1.2 recommendation 4, for which PPL Montana indicates that additional instrumentation will be installed in the Units 1 & 2 "A" Pond embankments by the end of 2009. Details on the work planned and underway are attached.***

***Once PPL has completed the actions described above, it will contact EPA to discuss whether an upward adjustment to its assessment rating is appropriate.***

Womack & Associates, Inc.
Geotechnical Engineering and Geology

September 28, 2009

Mr. Gordon Criswell
Environmental Engineering Department
PPL Montana, LLC
Colstrip Power Plant
P.O. Box 38
Colstrip, MT 59323-0038

**RE: WORK PLAN FOR GEOTECHNICAL INVESTIGATIONS & ANALYSES FOR THE EPA RECOMMENDED CORRECTIVE MEASURES AT THE COLSTRIP POWER PLANT - UNITS 1 & 2 BOTTOM ASH WASTE IMPOUNDMENT POND**

Dear Gordon:

At your request, I have prepared this work plan to perform geotechnical investigations and analyses for the Colstrip Power Plant's Unit 1 & 2 Bottom Ash Impoundment Pond. The investigations and analyses proposed herein address the site specific corrective measures as recommended within GEI Consultant's ***Coal Ash Impoundment - Specific Site Assessment Report*** (GEI Project #091330, Dated July 2009). We appreciate the opportunity to propose these services.

Project description

According to GEI's assessment report, the Unit 1 & 2 Bottom Ash Impoundment Pond's embankments lack an instrumentation program – which would typically include the installation of piezometers to measure water pressures in the embankment and foundation areas. Such instruments are required to regularly assess embankment stability. Section 12.1.1 Units 1 & 2 Bottom Ash Pond Embankments of the GEI report recommends implementing an instrumentation program, sampling and testing site-specific embankment and foundation soil material, and performing embankment slope stability analyses.

Scope of services

We propose site-specific exploration, instrumentation, laboratory analysis and engineering analysis services to address GEI's recommended corrective measures for this structure. The services are detailed as follows:

Review:

The existing data base is quite extensive and will require review for adequacy. The reviewed documents will include the GEI Consultants *Coal Ash Impoundment - Specific Site Assessment Report* (GEI Project #091330, Dated July 2009), associated figures and exhibits, along with additional site-specific construction drawings prepared by Bechtel and other consultants. Additional material may be gathered and reviewed as necessary. The reviewed material may require minor adjustments to this work plan in order to meet the goals of the anticipated analyses.

Exploratory Field Work:

The primary geotechnical concern is existing embankment slope stability. In order to successfully analyze the existing slope stability conditions, a detailed instrumentation and sampling program must be effectuated. Such a program includes exploratory field work to install electronic piezometers (to measure water pressures) and the sampling of existing embankment and foundation soil material to define the soil stability input parameters.

We propose to install electronic piezometers at four locations - two within the top level of the embankment and the others within the actual embankment shell. The piezometer borings are anticipated to be installed to depths of approximately 35 to 50-feet. The boring depth should be sufficient to provide adequate sampling of the embankment fill and foundation materials. Determination of the embankment fill and foundation material properties will be required for the site specific slope stability analyses input parameters.

The boring within the embankment core will be drilled from the top of the embankment using a truck-mounted hollow stem auger rig equipped to perform geotechnical sampling and coring. The number and location of the borings and test pits scoped herein may be adjusted to correspond to the actual field conditions. Standard Penetration Tests (SPT) will be performed at intervals sufficient to determine the material properties. The embankment shell on the downstream face will be sampled using an excavator. Piezometers will be installed in the borings and test pits. A geologist or engineer from this office will be on-site during placement of the piezometers and for logging the borehole samples. Thin-wall tubes and split-spoons will be used collected the fine-grained soil samples.

As recommended in the GEI report, water pressures at the piezometers will be read by PPL staff semi-annually. If sufficient changes are measured overtime, future stability analyses will be required to ensure embankment safety is preserved.

Laboratory testing:

Laboratory testing will include the following, depending upon the soil types encountered on site:

1. moisture content
2. bulk density
3. grain size analysis
4. Atterberg limits
5. shear strength tests – two per boring hole

Engineering services:

Field and laboratory data will be analyzed, and a geotechnical report will be prepared which will include the Unit 1 & 2 Bottom Ash Pond embankment slope stability analyses and associated recommendations for improvements, if necessary. Data in the report will include a drill hole and test pit location plan, logs, laboratory results, penetrometer and piezometer results, geological observations, and cross-sections. Logs and subsurface profiles will be presented graphically.

The slope stability analyses will be performed using the limited equilibrium program within Slope/W. The embankment geometry will be based off of field observations and design cross-sections.

**Recommendations and analyses** in the report shall include:

1. Slope stability analyses for the finished grade and measured pore pressure conditions.

2. Seismicity: acceleration appropriate for the area will be provided per USGS.

3. Report of monitoring results for piezometers. This information will be updated semi-annually.

4. Recommendations for remediation, if necessary

All engineering services will be conducted by or under the direct supervision of a Montana registered Professional Engineer.

Safety:

WAI's work at PPL Montana is consistently performed using health and safety procedures adopted by Hydrometrics. Our personnel have many years' experience at the PPL facility.

Schedule:

The boreholes will be drilled at PPL's convenience, which we assume may be in October and November 2009. Laboratory testing of the soil samples will require about 4-weeks. Assuming the aforementioned schedule, the draft report should be ready for your review around early-

December 2009 with the final report issued prior to the end of December 2009. After the final report has been submitted, we anticipate at least one follow-up meeting with PPL and the various reviewing agencies – such as EPA and MTDEQ.

Experience and Personnel

WAI has performed many site investigations in the vicinity, including the investigation for the existing Paste Plant, embankment dams, and other structures. Our personnel are very familiar with local geology, seismicity, and geotechnical conditions. Ray Womack, P.E., P.G., will be responsible for the work. Other technical specialists from our office will be involved as needed. Randy Schrauder, PE in particular will be involved at the site. Randy will provide drilling oversight, monitoring of instrumentation, slope stability analysis, and geotechnical reporting. Frank Greguras, P.E., G.E., a highly experienced geotechnical engineer who has provided consulting and review services at the EHP in the past, is proposed as Senior Review Engineer. Brief resumes follow.

Ray Womack established a consulting practice in Billings in 1982 which grew into Womack & Associates, Inc. (WAI). The firm is now located in Jackson, Wyoming, and specializes in geotechnical engineering, engineering geology, and geomorphology. We work in a large geographical area, routinely performing projects throughout the western United States and abroad. Our work has consisted of a mix of commercial, residential, and industrial projects. We have provided geotechnical consulting services for many hotels, schools, roads, and high-end residences. Our industrial experience has been gained from work on large mine structures, railroads and cleanups at contaminated industrial sites, including many CERCLA (Superfund) projects. We have particular expertise in evaluation of slope stability and seismicity. WAI has installed numerous boreholes and instrumentation at this site. Existing post-construction borehole data at the Stage 3&4 site was collected by staff of WAI and our sister firm Hydrometrics.

At present the staff consists of two geotechnical engineers, two geologists, and one drafter. Although we are a small firm, we have been involved in many large, complex projects, and we believe our background and experience prepare us very well to address the problems that occur at complex sites.

**Ray Womack, P.E., P.G.,** President and Principal Engineer, has more than 30-years experience as a geotechnical engineer and geoscientist. Mr. Womack holds degrees from Virginia Polytechnic Institute (BS-geophysics and geology) and Colorado State University (MS-geology). He is registered as a Professional Engineer in six states and as a Professional Geologist. He is a member of the Association of Engineering Geologists and the American Society of Civil Engineers. Mr. Womack has written papers and presented technical courses dealing with landslides, geological hazards, and river mechanics.

Mr. Womack has conducted foundation investigations, stability analyses, and geologic hazards evaluations in 17 states, including most of the Rocky Mountain states. He has worked extensively in South Africa, as well as Malawi, Swaziland, Kenya, Uganda, Haiti, Guatemala, Costa Rica, Kazakhstan, and the Republic of Georgia. He has prepared foundation reports for hundreds of structures, and has been responsible for investigation of many landslides affecting mines, railroads, hotels, schools, and other structures. He has led geotechnical efforts at numerous environmental projects, including Asarco CERCLA projects in Tacoma, Washington; East Helena, Montana; Murray, Utah, and elsewhere.

**Randy Schrauder, P.E.**, has nearly 15-years professional experience, primarily as a general civil engineer. He is a graduate of the University of Pittsburgh (B.S., Civil Engineering). Prior to Womack & Associates, he was the founder and principal engineer for Summit Consulting Group where he focused on a broad-spectrum of civil designs and construction management. With Womack & Associates, Randy has worked on projects involving slope stability, roadway design, foundation design and construction observation.

**Jason Rolfe, P.G.,** graduated from the University of California at Santa Barbara in 2000 with a B.S. in Geological Sciences. Mr. Rolfe worked for Cotton Shires & Associates in the South Bay Area of California on projects involving landslide investigation and mitigation, neotectonics, and expansive soils. Since 2001, Mr. Rolfe has worked in Jackson on projects including soil science, slope instability, foundations, retaining walls, and environmental hazard assessments. Mr. Rolfe led the exploration effort for the new Jackson Hole aerial tram, including rock slope assessments for heavily loaded foundations adjacent to cliff faces. He is an ACI Grade I Concrete Field Technician, a member of the Geological Society of America, and Secretary of the Geologists of Jackson Hole.

**Dominique Schmid**, engineering geologist, graduated from The University of Texas at Austin with high honors in 2005 with a B.S. in Geological Sciences. She worked for the Park Service in Yellowstone National Park for four seasons where she created and maintained multiple GIS projects. Ms. Schmid joined Womack & Associates in 2007 and has worked on projects that involve foundation design, roadway design, soil mechanics testing, and construction observation.

**Francis R. Greguras, P.E., G.E.,** is a graduate of the University of Nebraska at Omaha with a B.S. in Civil Engineering. He has more than 30 years experience in Geotechnical Engineering throughout the US. He is licensed as a P.E. in more than a dozen states, with a Geotechnical Engineering specialty in California. During his lengthy career, he has been an employee of Dames & Moore and URS Corp, where he currently manages geotechnical efforts in San Francisco. Mr. Greguras worked with Hydrometrics and WAI on the Asarco Tacoma Smelter Superfund site and has evaluated potential grouting solutions to seepage problems at the EHP.

WAI provides site investigation and design services for earthworks, dams, roads, railways, and other structures. Many of our projects have involved landslides and other slope stability

problems. Monitoring instruments, including extensometers, tiltmeters, and slope indicators have frequently been installed. In seismically active areas, we have analyzed seismicity and liquefaction potential for sensitive structures.

If unusual or unexpected conditions are encountered during the investigation, we will notify you before proceeding with additional work. If the work plan for this portion of the facility is acceptable, please sign and return a copy to this office.

Womack & Associates, Inc.,

Ray Womack, P.E.

Client Signature _____ Date _____

Womack & Associates, Inc.
Geotechnical Engineering and Geology

September 28, 2009

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Environmental Engineering Department
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Dear Gordon:

At your request, I have prepared this work plan to perform geotechnical investigations and analyses for the Colstrip Power Plant's Unit 1 & 2 Pond "A" Impoundment Embankment. The investigations and analyses proposed herein address the site-specific corrective measures as recommended within GEI Consultant's ***Coal Ash Impoundment - Specific Site Assessment Report*** (GEI Project #091330, Dated July 2009). We appreciate the opportunity to propose these services.

Project description

According to GEI's assessment report, the Unit 1 & 2 Pond "A" embankments lack site-specific soil strength information and an instrumentation program to accurately analyze and monitor embankment slope stability under static seepage conditions. A monitoring program would typically involve installation of strategically placed piezometers and measurement of pore pressures. Such instruments monitor seepage in the impoundment embankments and are required to regularly assess the embankment stability. Section 12.1.2 Units 1 & 2 "A" Pond Embankments of the GEI report recommends implementing an instrumentation program, sampling and testing site-specific embankment and foundation soil material, performing embankment slope stability analyses and regularly monitoring pore pressures.

Scope of services

We propose site-specific exploration, instrumentation, laboratory analysis and engineering analysis to address GEI's recommended corrective measures for this structure. The services are detailed as follows:

Review:

The existing data base will require review for adequacy. The reviewed documents will include the GEI Consultants *Coal Ash Impoundment - Specific Site Assessment Report* (GEI Project #091330, Dated July 2009), associated figures and exhibits along with additional site-specific construction drawings prepared by Bechtel and other consultants. Additional material may be gathered and reviewed as necessary. The reviewed material may require minor adjustments to this work plan in order to meet the goals of the anticipated analyses.

Exploratory Field Work:

The primary geotechnical concern is assessment of the existing embankment slope stability. This task requires a detailed instrumentation and sampling program. Such a program includes exploratory field work to install electronic piezometers (to measure water pressures) and sampling of existing embankment material to define the soil stability input parameters.

We propose to install electronic piezometers at four locations - two within the core of the embankment and the others within the embankment shell. The piezometer borings are anticipated to be drilled to depths of approximately 35 to 50-feet. The boring depth should be sufficient to provide adequate sampling of the embankment fill and foundation materials. Determination of the embankment fill and foundation material properties will be required for the site specific slope stability analyses input parameters.

The borings within the dam core will be drilled from the top surface using a truck-mounted hollow stem auger rig equipped to perform geotechnical sampling and coring. The number and location of the borings and test pits scoped herein may be adjusted to correspond to the actual field conditions. Standard Penetration Tests (SPT) will be performed at intervals sufficient to determine the material properties. The embankment shell on the downstream face will be sampled using an excavator. Piezometers will be installed in the borings and test pits. A geologist or engineer from this office will be on-site during placement of the piezometers and for logging the test holes. Thin-wall tubes and split-spoons will be used collected the fine-grained soil samples.

As recommended in the GEI report, water pressures at the piezometers will be read semi-annually by PPL staff. If sufficient changes are measured over time, future stability analyses will be required to check embankment safety.

Laboratory testing:

Laboratory testing will include the following, depending upon the soil types encountered on site:

1. moisture content
2. bulk density
3. grain size analysis
4. Atterberg limits
5. shear strength tests – two per boring

Engineering services:

Field and laboratory data will be analyzed, and a geotechnical report will be prepared which will include the Unit 1 & 2 Pond "A" embankment slope stability analyses and associated recommendations for improvements, if necessary. Data in the report will include a drill hole and test pit location plan, logs, laboratory results, penetrometer and piezometer results, geological observations, and cross-sections. Logs and subsurface profiles will be presented graphically.

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Schedule:

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report has been submitted, we anticipate at least one follow-up meeting with PPL and the various reviewing agencies – such as EPA and MTDEQ.

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**Dominique Schmid**, engineering geologist, graduated from The University of Texas at Austin with high honors in 2005 with a B.S. in Geological Sciences. She worked for the Park Service in Yellowstone National Park for four seasons where she created and maintained multiple GIS projects. Ms. Schmid joined Womack & Associates in 2007 and has worked on projects that involve foundation design, roadway design, soil mechanics testing, and construction observation.

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WAI provides site investigation and design services for earthworks, dams, roads, railways, and other structures. Many of our projects have involved landslides and other slope stability

problems. Monitoring instruments, including extensometers, tiltmeters, and slope indicators have frequently been installed. In seismically active areas, we have analyzed seismicity and liquefaction potential for sensitive structures.

If unusual or unexpected conditions are encountered during the investigation, we will notify you before proceeding with additional work. If the work plan for this portion of the facility is acceptable, please sign and return a copy to this office.

Womack & Associates, Inc.,

Ray Womack, P.E., P.G.

Client Signature _____ Date _____

Womack & Associates, Inc.
Geotechnical Engineering and Geology

September 28, 2009

Mr. Gordon Criswell
Environmental Engineering Department
PPL Montana, LLC
Colstrip Power Plant
P.O. Box 38
Colstrip, MT 59323-0038

**RE: WORK PLAN FOR GEOTECHNICAL INVESTIGATIONS & ANALYSES FOR THE EPA RECOMMENDED CORRECTIVE MEASURES AT THE COLSTRIP POWER PLANT - UNITS 1 & 2 STAGE TWO EVAPORATION POND (STEP) DAM**

Dear Gordon:

At your request, I have prepared this work plan to perform geotechnical investigations and analyses for the Colstrip Power Plant's Unit 1 & 2 Stage Two Evaporation Pond (STEP). The investigations and analyses proposed herein address the site-specific corrective measures as recommended within GEI Consultant's ***Coal Ash Impoundment - Specific Site Assessment Report*** (GEI Project #091330, Dated July 2009). We appreciate the opportunity to propose these services.

Project Description

According to GEI's assessment report, the Unit 1 & 2 STEP Dam lacks an instrumentation program to accurately measure and analyze embankment slope stability under static seepage conditions. Instrumentation recommended by GEI includes internal pore pressure and embankment deflection monitoring. We propose to install and monitor these conditions with vibrating wire electronic piezometers and slope inclinometers. Such instruments are required to regularly assess the embankment stability. Section 12.1.3 Units 1 & 2 STEP Dam of the GEI report recommends implementing an instrumentation program, performing embankment slope stability analyses and regularly monitoring the stability and seepage conditions. Part of our stability analyses will include a rapid drawdown to evaluate the potential effects of a dam breach or sudden leakage event, as requested in Section 8.2.2 Units 1 & 2 STEP Dam of the GEI report.

Scope of Services

We propose site-specific exploration, instrumentation, laboratory analysis and engineering analysis services to address GEI's recommended corrective measures for this structure. The services are detailed as follows:

Review:

The existing data base is quite extensive and will require review. The reviewed documents will include the GEI Consultants *Coal Ash Impoundment - Specific Site Assessment Report* (GEI Project #091330, Dated July 2009), associated figures and exhibits, along with additional site-specific soil data, construction drawings and design reports prepared by Bechtel and other consultants. Additional material may be gathered and reviewed as necessary. The reviewed material may require minor adjustments to this work plan in order to meet the goals of the anticipated analyses.

Exploratory Field Work:

The primary geotechnical concern is assessment of the existing embankment slope stability. In order to successfully analyze the existing slope stability conditions, a detailed instrumentation and sampling program must be implemented. Such a program includes exploratory field work to investigate subgrade conditions, install electronic piezometers to measure water pressures, and slope inclinometers to measure movement.

We will sample materials in the existing embankment core and foundation but will not perform shear strength tests. We plan to utilize data collected by Bechtel during their 1979 design. If deficiencies or soil data gaps are found in the Bechtel reports, we will have the site-specific soil samples available for testing.

We propose to install vibrating wire electronic piezometers in at least 3 locations within the dam core. The piezometer borings are anticipated to be installed at depths ranging from 35 to 120-feet. The boring depth will be sufficient to gain adequate pore pressure measurements. If pore pressures in the dam core are high, additional instrumentation and analysis may be required within the embankment shell. The borings will also enable sampling of the embankment core and foundation materials, which may be required for the site-specific slope stability analyses input parameters.

We propose to install 2 inclinometers within the dam core and foundation. This instrumentation will aid in the detection of movement within the dam. Inclinometer readings will require regular monitoring and analysis to assess dam stability.

The holes will be drilled using a truck-mounted hollow stem auger rig equipped to perform geotechnical sampling and coring. The number and location of the borings and test pits scoped herein may be adjusted to correspond to the actual field conditions. Standard Penetration Tests (SPT) will be performed at intervals sufficient to determine the material properties. Borings will be logged and sampled and installation of instruments will be supervised by an engineer or geologist from this office. Thin-wall tubes and split-spoons will be used collected the fine-grained soil samples.

As recommended in the GEI report, the piezometers will be read semi-annually by PPL staff. Inclinometers will be read by a WAI representative. If sufficient changes are measured overtime, future stability analyses may be required to assess embankment safety.

Laboratory Testing:

Laboratory testing will include the following, depending upon the soil types encountered on site:

1. moisture content
2. bulk density
3. grain size analysis
4. Atterberg limits

Engineering Services:

Field and laboratory data will be analyzed, and a geotechnical report will be prepared which will include the Unit 1 & 2 STEP dam slope stability analyses and associated recommendations for improvements, if necessary. Data in the report will include a drill hole location plan, logs, laboratory results, penetrometer results, inclinometer and piezometer results, geological observations, and cross-sections. Logs and subsurface profiles will be presented graphically.

The slope stability analyses will be performed using the limited equilibrium program within Slope/W. The embankment geometry will be based off of field observations and design cross-sections.

**Recommendations and analyses** in the report shall include:

1. Slope stability analyses for existing grade and measured pore pressure conditions. This will include a rapid drawdown case.

2. Seismicity: acceleration appropriate for the area will be provided per USGS.

3. Report of monitoring results for piezometers and inclinometers. This information will be updated semi-annually.

4. Recommendations for remediation, if necessary

All engineering services will be conducted by or under the direct supervision of a Montana registered Professional Engineer.

Safety:

WAI's work at PPL Montana is consistently performed using health and safety procedures adopted by Hydrometrics. Our personnel have many years' experience at the PPL facility.

Schedule:

The boreholes will be drilled at PPL's convenience, which we assume may be in October and November 2009. Laboratory testing of the soil samples will require about 4-weeks. Assuming the aforementioned schedule, the draft report should be ready for your review around early-December 2009 with the final report issued prior to the end of December 2009. After the final report has been submitted, we anticipate at least one follow-up meeting with PPL and the various reviewing agencies – such as EPA and MTDEQ.

Experience and Personnel

WAI has performed many site investigations in the vicinity, including the investigation for the existing Paste Plant, embankment dams, and other structures. Our personnel are very familiar with local geology, seismicity, and geotechnical conditions. Ray Womack, P.E., P.G., will be responsible for the work. Other technical specialists from our office will be involved as needed. Randy Schrauder, PE in particular will be involved at the site. Randy will provide drilling oversight, monitoring of instrumentation, slope stability analysis, and geotechnical reporting. Frank Greguras, P.E., G.E., a highly experienced geotechnical engineer who has provided consulting and review services at the EHP in the past, is proposed as Senior Review Engineer. Brief resumes follow.

Ray Womack established a consulting practice in Billings in 1982 which grew into Womack & Associates, Inc. (WAI). The firm is now located in Jackson, Wyoming, and specializes in geotechnical engineering, engineering geology, and geomorphology. We work in a large geographical area, routinely performing projects throughout the western United States and abroad. Our work has consisted of a mix of commercial, residential, and industrial projects. We have provided geotechnical consulting services for many hotels, schools, roads, and high-end residences. Our industrial experience has been gained from work on large mine structures, railroads and cleanups at contaminated industrial sites, including many CERCLA (Superfund) projects. We have particular expertise in evaluation of slope stability and seismicity. WAI has installed numerous boreholes and instrumentation at this site. Existing post-construction

borehole data at the Stage 3&4 site was collected by staff of WAI and our sister firm Hydrometrics.

At present the staff consists of two geotechnical engineers, two geologists, and one drafter. Although we are a small firm, we have been involved in many large, complex projects, and we believe our background and experience prepare us very well to address the problems that occur at complex sites.

**Ray Womack, P.E., P.G.,** President and Principal Engineer, has more than 30-years experience as a geotechnical engineer and geoscientist. Mr. Womack holds degrees from Virginia Polytechnic Institute (BS-geophysics and geology) and Colorado State University (MS-geology). He is registered as a Professional Engineer in six states and as a Professional Geologist. He is a member of the Association of Engineering Geologists and the American Society of Civil Engineers. Mr. Womack has written papers and presented technical courses dealing with landslides, geological hazards, and river mechanics.

Mr. Womack has conducted foundation investigations, stability analyses, and geologic hazards evaluations in 17 states, including most of the Rocky Mountain states. He has worked extensively in South Africa, as well as Malawi, Swaziland, Kenya, Uganda, Haiti, Guatemala, Costa Rica, Kazakhstan, and the Republic of Georgia. He has prepared foundation reports for hundreds of structures, and has been responsible for investigation of many landslides affecting mines, railroads, hotels, schools, and other structures. He has led geotechnical efforts at numerous environmental projects, including Asarco CERCLA projects in Tacoma, Washington; East Helena, Montana; Murray, Utah, and elsewhere.

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If unusual or unexpected conditions are encountered during the investigation, we will notify you before proceeding with additional work. If the proposal is acceptable, please sign and return a copy to this office.

Womack & Associates, Inc.,

Ray Womack, P.E.

Client Signature _____ Date_____

Womack & Associates, Inc.
Geotechnical Engineering and Geology

September 28, 2009

Mr. Gordon Criswell
Environmental Engineering Department
PPL Montana, LLC
Colstrip Power Plant
P.O. Box 38
Colstrip, MT 59323-0038

**RE: WORK PLAN FOR GEOTECHNICAL INVESTIGATIONS & ANALYSES FOR THE EPA RECOMMENDED CORRECTIVE MEASURES AT THE COLSTRIP POWER PLANT - UNITS 3 & 4 EHP MAIN DAM**

Dear Gordon:

At your request, I have prepared this work plan to perform geotechnical investigations and analyses for the Colstrip Power Plant's Unit 3 & 4 EHP Main Dam. The investigations and analyses proposed herein address the site-specific corrective measures recommended within GEI Consultant's ***Coal Ash Impoundment - Specific Site Assessment Report*** (GEI Project #091330, Dated July 2009). We appreciate the opportunity to propose these services.

Project description

According to GEI's assessment report, the Unit 3 & 4 Main Dam lacks an abutment and shell instrumentation program to analyze slope stability and seepage conditions within the abutment sandstone and adjacent embankment shell. Typical instrumentation would involve installation and monitoring of electronic piezometers and inclinometers. Such instruments are required to regularly assess the embankment stability. Section 12.1.4 Units 3 & 4 Main Dam of the GEI report recommends augmenting the existing instrumentation program and performing dam slope stability and seepage analyses. Lastly, the stability and seepage conditions should be monitored and evaluated semi-annually.

Scope of services

We propose site-specific exploration, instrumentation, laboratory analysis and engineering analysis services to address GEI's recommended corrective measures for this structure. The services are detailed as follows:

Review:

The existing data base is quite extensive and will require review. The reviewed documents will include the GEI Consultants *Coal Ash Impoundment - Specific Site Assessment Report* (GEI Project #091330, Dated July 2009), associated figures and exhibits, along with additional site-specific soil data, construction drawings and design reports prepared by Bechtel and other consultants. Additional material may be gathered and reviewed as necessary. The reviewed material may require minor adjustments to this work plan in order to meet the goals of the anticipated analyses.

Exploratory Field Work:

The primary geotechnical concern is assessment of the existing seepage within the abutment sandstone layer and its' impact to the stability of the Main Dam's exterior embankment shell. A detailed instrumentation and sampling program is required. Such a program includes exploratory field work to install vibrating wire electronic piezometers (to locate water and measure water pressures), slope inclinometer casings (to monitor movement) and the sampling of the sandstone layer and embankment shell to define the stability and seepage calculation input parameters.

We propose to install electronic piezometers at approximately seven locations. The number and location of the borings scoped herein may be adjusted to correspond to the actual field conditions. The instrumentation will be placed within the dam core, shell and adjacent sandstone abutments downstream of the cutoff wall and core. The piezometer borings are anticipated to be taken to depths ranging from approximately 70-feet to 140-feet. The boring depth should be sufficient to provide adequate sampling of the embankment fill and sandstone abutments. The embankment fill and foundation material properties will be required for the site-specific slope stability and seepage analyses.

The existing piezometer labeled 637P has failed and will be replaced. The vibrating wire piezometers will sample pore pressures in the dam core and foundation. These instruments will serve dual purposes – to aid in addressing the current EPA comments and for pore pressure measurement during the 2010-11 embankment raising project.

EPA also requested piezometers in the sandstone abutments downstream of the core. We propose to install at least two standpipe piezometers in the abutments. The standpipes will be drilled on each side of the dam and will extend down to the base of the sandstone. We anticipate drilling these standpipes to approximately 70-feet in depth.

In addition, two slope inclinometer casings will be installed on opposite sides of the cutoff wall. The inclinometer borings will be drilled from the embankment top down into the dam

foundation. This instrumentation will aid in the detection of movement within the dam on both upstream and downstream faces. Inclinometers will require regular monitoring.

The holes on the top of the dam will be drilled using a truck-mounted hollow stem auger rig equipped to perform geotechnical sampling and coring. The borings on the abutment and exterior shell slope areas will be installed using an all-terrain track mounted rig that will be lowered to each location using an anchored winch system and placed on leveling cribbing. Standard Penetration Tests (SPT) will be performed at intervals sufficient to determine the material properties. A geologist or engineer from this office will be on-site during placement of the piezometers, standpipes, and inclinometers, and for logging the borehole samples. Thin-wall tubes and split-spoons will be used collected the fine-grained soil samples..

As recommended in the GEI report, water pressures at the piezometers will be read by PPL staff semi-annually. The inclinometers will be read by WAI. If sufficient changes are noted, further stability analyses will be required to assess embankment safety.

Laboratory testing:

Laboratory testing will include the following, depending upon the soil types encountered on site:

1. moisture content
2. bulk density
3. grain size analysis
4. Atterberg limits
5. shear strength

Engineering services:

Field and laboratory data will be analyzed, and a geotechnical report will be prepared which will include the Unit 3 & 4 Main Dam slope stability and seepage analyses along with associated recommendations for improvements, if necessary. Data in the report will include a drill hole and test pit location plan, logs, laboratory results, penetrometer, inclinometer and piezometer results, geological observations, and cross-sections. Logs and subsurface profiles will be presented graphically.

The slope stability analyses will be performed using the limited equilibrium program within Slope/W. The seepage analyses will be performed using Seep/W. The embankment geometry will be based on field observations and design cross-sections.

**Recommendations and analyses** in the report shall include:

1. Slope stability analyses for the finished grade and measured pore pressure conditions.

2. Seismicity: acceleration appropriate for the area will be provided per USGS.

3. Report of monitoring results for piezometers. This information will be updated semi-annually.

4. Seepage analyses, including evaluation of piping potential.

5. Recommendations for remediation, if necessary.

All engineering services will be conducted by or under the direct supervision of a Montana registered Professional Engineer.

Safety:

WAI's work at PPL Montana is consistently performed using health and safety procedures adopted by Hydrometrics. Our personnel have many years' experience at the PPL facility.

Schedule:

The boreholes will be drilled at PPL's convenience, which we assume may be in October and November 2009. Laboratory testing of the soil samples will require about 4-weeks. Assuming the aforementioned schedule, the draft report should be ready for your review around early-December 2009 with the final report issued prior to the end of December 2009. After the final report has been submitted, we anticipate at least one follow-up meeting with PPL and the various reviewing agencies – such as EPA and MTDEQ.

Experience and Personnel

WAI has performed many site investigations in the vicinity, including the investigation for the existing Paste Plant, embankment dams, and other structures. Our personnel are very familiar with local geology, seismicity, and geotechnical conditions. Ray Womack, P.E., P.G., will be responsible for the work. Other technical specialists from our office will be involved as needed. Randy Schrauder, PE in particular will be involved at the site. Randy will provide drilling oversight, monitoring of instrumentation, slope stability analysis, and geotechnical reporting. Frank Greguras, P.E., G.E., a highly experienced geotechnical engineer who has provided consulting and review services at the EHP in the past, is proposed as Senior Review Engineer. Brief resumes follow.

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abroad. Our work has consisted of a mix of commercial, residential, and industrial projects. We have provided geotechnical consulting services for many hotels, schools, roads, and high-end residences. Our industrial experience has been gained from work on large mine structures, railroads and cleanups at contaminated industrial sites, including many CERCLA (Superfund) projects. We have particular expertise in evaluation of slope stability and seismicity. WAI has installed numerous boreholes and instrumentation at this site. Existing post-construction borehole data at the Stage 3&4 site was collected by staff of WAI and our sister firm Hydrometrics.

At present the staff consists of two geotechnical engineers, two geologists, and one drafter. Although we are a small firm, we have been involved in many large, complex projects, and we believe our background and experience prepare us very well to address the problems that occur at complex sites.

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slope instability, foundations, retaining walls, and environmental hazard assessments. Mr. Rolfe led the exploration effort for the new Jackson Hole aerial tram, including rock slope assessments for heavily loaded foundations adjacent to cliff faces. He is an ACI Grade I Concrete Field Technician, a member of the Geological Society of America, and Secretary of the Geologists of Jackson Hole.

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**Francis R. Greguras, P.E., G.E.,** is a graduate of the University of Nebraska at Omaha with a B.S. in Civil Engineering. He has more than 30 years experience in Geotechnical Engineering throughout the US. He is licensed as a P.E. in more than a dozen states, with a Geotechnical Engineering specialty in California. During his lengthy career, he has been an employee of Dames & Moore and URS Corp, where he currently manages geotechnical efforts in San Francisco. Mr. Greguras worked with Hydrometrics and WAI on the Asarco Tacoma Smelter Superfund site and has evaluated potential grouting solutions to seepage problems at the EHP.

WAI provides site investigation and design services for earthworks, dams, roads, railways, and other structures. Many of our projects have involved landslides and other slope stability problems. Monitoring instruments, including extensometers, tiltmeters, and slope indicators have frequently been installed. In seismically active areas, we have analyzed seismicity and liquefaction potential for sensitive structures.

If unusual or unexpected conditions are encountered during the investigation, we will notify you before proceeding with additional work. If the proposal is acceptable, please sign and return a copy to this office.

Womack & Associates, Inc.,

Ray Womack, P.E.

Client Signature _____ Date_____

Womack & Associates, Inc.
Geotechnical Engineering and Geology

September 29, 2009

Mr. Gordon Criswell
Environmental Engineering Department
PPL Montana, LLC
Colstrip Power Plant
P.O. Box 38
Colstrip, MT 59323-0038

**RE: WORK PLAN FOR GEOTECHNICAL INVESTIGATIONS & ANALYSES FOR THE EPA RECOMMENDED CORRECTIVE MEASURES AT THE COLSTRIP POWER PLANT - UNITS 3 & 4 EHP SADDLE DAM**

Dear Gordon:

At your request, I have prepared this work plan to perform geotechnical investigations and analyses for the Colstrip Power Plant's Unit 3 & 4 EHP Saddle Dam. The investigations and analyses proposed herein address the site-specific corrective measures recommended within GEI Consultant's ***Coal Ash Impoundment - Specific Site Assessment Report*** (GEI Project #091330, Dated August 2009, DRAFT FINAL Version 1.0), specifically the final paragraph within Section 12.1.5. We appreciate the opportunity to propose these services.

Project description

PPL Montana has installed about twenty standpipe piezometers on or near the Units 3 & 4 EHP Saddle Dam. Two of the piezometers (SD-00-P1 and SD-00-P2) are in-board of the dam's foundation cut-off wall. These two piezometers have consistent readings at approximately the same water level as the adjacent Cell "G", which is impounded by the saddle dam. The remaining piezometers were installed out-board of the dam's foundation cut-off wall and consistently report readings considerably below the water level in Cell "G" – which are expected due to the presence and functionality of the cut-off wall.

Piezometers SD-00-P1 and SD-00-P2 are expected to report readings lower than the water level in Cell "G" due to the presence of a paste layer that has been constructed on the in-board face of the embankment. The purpose for the placement of the paste was to create a lower permeability layer that would increase the overall length of water travel, normal to the dam, prior to reaching the dam's core. The increased travel length would theoretically reduce the dam's clay core pore pressures and reduce seepage. However, the readings indicate little to no headloss through the in-board paste layer and embankment shell.

Our preliminary review indicates that the source and flow direction of the seepage is not inherently conclusive. However, the primary seepage path likely occurs within the baked shale dam foundation layer upstream from the concrete cutoff wall and downstream from the paste layer. The seepage may be sourced from Cell "C," which has water levels considerably higher than the piezometer readings, thus creating enough head pressure to cause the water to travel between the cells via continuity of the baked shale layer. The conditions contributing to the two piezometers' high-water level readings, nevertheless, require further evaluation.

Scope of services

We propose site-specific exploration, instrumentation and engineering analysis services to address GEI's concerns and locate the source and flow direction of the seepage. The services are detailed as follows:

Review:

The existing data base is quite extensive and will require review and evaluation prior to finalizing a specific field work plan. The reviewed documents will include the GEI Consultants *Coal Ash Impoundment - Specific Site Assessment Report* (GEI Project #091330, dated August 2009) along with the associated figures and exhibits. In addition, we will review the surrounding geology, site-specific borehole data, construction drawings, the piezometric readings from adjacent observation wells and design reports prepared by Bechtel and other consultants. Additional material may be gathered and reviewed as necessary. The reviewed material may require minor adjustments to this work plan in order to meet the goals of the anticipated analyses.

Exploratory Field Work:

The primary geotechnical concern is assessment of the existing seepage source and flow direction within the Saddle Dam's baked shale layer. Additional instrumentation and a sampling program may be required if the review of existing information and data proves inconclusive. Such a program may involve exploratory field work to install standpipe piezometers (to locate water and measure water pressures) within the adjacent upstream paste and baked shale layers.

We may install the standpipe piezometers at approximately six locations. Most of the piezometers are likely to be installed in the southern end of the Saddle Dam towards the junction of Cells "C" and "G." Other piezometers may be installed north of the Saddle Dam – towards the area of the Main Dam. The instrumentation will be placed upstream of the cutoff wall, down into the baked shale layer. The piezometer borings are anticipated to be taken to depths ranging from approximately 40-feet to 75-feet. The piezometer locations will likely provide adequate monitoring information whereby a more definitive seepage gradient can be identified within the baked shale layer.

The holes on the top of the dam will be drilled using a truck-mounted hollow stem auger rig equipped to perform geotechnical sampling and coring. The borings in the paste areas will be installed using an all-terrain track mounted rig that will be lowered to each location using an anchored winch system and placed on leveling cribbing. A geologist or engineer from this office will be on-site during placement of the piezometers and for logging the borehole samples.

Elevations of the existing measuring points (MP) on the existing adjacent monitoring wells will all be surveyed the same day along with cell water levels and piezometer reading. As recommended in the GEI report, water pressures at the piezometers will be read by PPL staff semi-annually. If sufficient changes are noted, further analyses will be required to assess source and flow direction of the seepage.

Laboratory testing:

Laboratory testing within this work plan is not anticipated.

Engineering services:

Field and laboratory data will be analyzed, and a geotechnical report will be prepared which will include the Unit 3 & 4 Saddle Dam seepage analyses, seepage source, flow gradient along with associated recommendations for improvements, if necessary. Data in the report will include a bore hole location plan, logs, penetrometer and piezometer results, geological observations, and piezometric surface cross-sections. Logs and subsurface profiles will be presented graphically. A composite map illustrating the piezometric surface inside of the cut-off wall will be created to identify the source of the seepage and flow direction.

**Recommendations and analyses** in the report shall include:

1. Seepage analyses for the finished grade and measured pore pressure conditions.

2. Report of monitoring results for piezometers. This information will be updated semi-annually.

3. Recommendations for remediation, if necessary.

All engineering services will be conducted by or under the direct supervision of a Montana registered Professional Engineer.

Safety:

WAI's work at PPL Montana is consistently performed using health and safety procedures adopted by Hydrometrics. Our personnel have many years' experience at the PPL facility.

Schedule:

The boreholes will be drilled at PPL's convenience, which we assume may be in October and November 2009. Assuming the aforementioned schedule, the draft report should be ready for your review around early-December 2009 with the final report issued prior to the end of December 2009. After the final report has been submitted, we anticipate at least one follow-up meeting with PPL and the various reviewing agencies – such as EPA and MTDEQ.

Experience and Personnel

WAI has performed many site investigations in the vicinity, including the investigation for the existing Paste Plant, embankment dams, and other structures. Our personnel are very familiar with local geology, seismicity, and geotechnical conditions. Ray Womack, P.E., P.G., will be responsible for the work. Other technical specialists from our office will be involved as needed. Randy Schrauder, PE in particular will be involved at the site. Randy will provide drilling oversight, monitoring of instrumentation, slope stability analysis, and geotechnical reporting. Frank Greguras, P.E., G.E., a highly experienced geotechnical engineer who has provided consulting and review services at the EHP in the past, is proposed as Senior Review Engineer. Brief resumes follow.

Ray Womack established a consulting practice in Billings in 1982 which grew into Womack & Associates, Inc. (WAI). The firm is now located in Jackson, Wyoming, and specializes in geotechnical engineering, engineering geology, and geomorphology. We work in a large geographical area, routinely performing projects throughout the western United States and abroad. Our work has consisted of a mix of commercial, residential, and industrial projects. We have provided geotechnical consulting services for many hotels, schools, roads, and high-end residences. Our industrial experience has been gained from work on large mine structures, railroads and cleanups at contaminated industrial sites, including many CERCLA (Superfund) projects. We have particular expertise in evaluation of slope stability and seismicity. WAI has installed numerous boreholes and instrumentation at this site. Existing post-construction borehole data at the Stage 3&4 site was collected by staff of WAI and our sister firm Hydrometrics.

At present the staff consists of two geotechnical engineers, two geologists, and one drafter. Although we are a small firm, we have been involved in many large, complex projects, and we believe our background and experience prepare us very well to address the problems that occur at complex sites.

**Ray Womack, P.E., P.G.,** President and Principal Engineer, has more than 30-years experience as a geotechnical engineer and geoscientist. Mr. Womack holds degrees from Virginia Polytechnic Institute (BS-geophysics and geology) and Colorado State University (MS-geology). He is registered as a Professional Engineer in six states and as a Professional Geologist. He is a member of the Association of Engineering Geologists and the American Society of Civil Engineers. Mr. Womack has written papers and presented technical courses dealing with landslides, geological hazards, and river mechanics.

Mr. Womack has conducted foundation investigations, stability analyses, and geologic hazards evaluations in 17 states, including most of the Rocky Mountain states. He has worked extensively in South Africa, as well as Malawi, Swaziland, Kenya, Uganda, Haiti, Guatemala, Costa Rica, Kazakhstan, and the Republic of Georgia. He has prepared foundation reports for hundreds of structures, and has been responsible for investigation of many landslides affecting mines, railroads, hotels, schools, and other structures. He has led geotechnical efforts at numerous environmental projects, including Asarco CERCLA projects in Tacoma, Washington; East Helena, Montana; Murray, Utah, and elsewhere.

**Randy Schrauder, P.E.**, has nearly 15-years professional experience, primarily as a general civil engineer. He is a graduate of the University of Pittsburgh (B.S., Civil Engineering). Prior to Womack & Associates, he was the founder and principal engineer for Summit Consulting Group where he focused on a broad-spectrum of civil designs and construction management. With Womack & Associates, Randy has worked on projects involving slope stability, roadway design, foundation design and construction observation.

**Jason Rolfe, P.G.,** graduated from the University of California at Santa Barbara in 2000 with a B.S. in Geological Sciences. Mr. Rolfe worked for Cotton Shires & Associates in the South Bay Area of California on projects involving landslide investigation and mitigation, neotectonics, and expansive soils. Since 2001, Mr. Rolfe has worked in Jackson on projects including soil science, slope instability, foundations, retaining walls, and environmental hazard assessments. Mr. Rolfe led the exploration effort for the new Jackson Hole aerial tram, including rock slope assessments for heavily loaded foundations adjacent to cliff faces. He is an ACI Grade I Concrete Field Technician, a member of the Geological Society of America, and Secretary of the Geologists of Jackson Hole.

**Dominique Schmid**, engineering geologist, graduated from The University of Texas at Austin with high honors in 2005 with a B.S. in Geological Sciences. She worked for the Park Service in Yellowstone National Park for four seasons where she created and maintained multiple GIS projects. Ms. Schmid joined Womack & Associates in 2007 and has worked on projects that involve foundation design, roadway design, soil mechanics testing, and construction observation.

**Francis R. Greguras, P.E., G.E.,** is a graduate of the University of Nebraska at Omaha with a B.S. in Civil Engineering. He has more than 30 years experience in Geotechnical Engineering

throughout the US. He is licensed as a P.E. in more than a dozen states, with a Geotechnical Engineering specialty in California. During his lengthy career, he has been an employee of Dames & Moore and URS Corp, where he currently manages geotechnical efforts in San Francisco. Mr. Greguras worked with Hydrometrics and WAI on the Asarco Tacoma Smelter Superfund site and has evaluated potential grouting solutions to seepage problems at the EHP.

WAI provides site investigation and design services for earthworks, dams, roads, railways, and other structures. Many of our projects have involved landslides and other slope stability problems. Monitoring instruments, including extensometers, tiltmeters, and slope indicators have frequently been installed. In seismically active areas, we have analyzed seismicity and liquefaction potential for sensitive structures.

If unusual or unexpected conditions are encountered during the investigation, we will notify you before proceeding with additional work. If the proposal is acceptable, please sign and return a copy to this office.

Womack & Associates, Inc.,

Ray Womack, P.E.

Client Signature _____ Date _____