MONITORING WELL INSTALLATION
AND POTENTIAL CAPTURE WELL CONVERSION NEAR WELL 6M
PPL MONTANA'S COLSTRIP STEAM ELECTRIC STATION – PLANT SITE

INTERIM RESPONSE ACTION WORK PLAN OUTLINE

AREA: *Plant Site*

LAND USE AND OWNERSHIP: *Industrial. PPL Montana, LLC*

MEDIA: Soil

Surface Water (identify water body):_____

Groundwater

Alluvial McKay/Rosebud Sub-McKay Other

LEVEL OF IMPACTS:

Well 6M (4/4/2013)

Parameter	Result
Bromide (mg/L)	*2*
Specific Conductance (μmhos/cm)	*4,530*
Boron (mg/L)	*1.1*
Chloride (mg/L)	*93*
Sulfate (mg/L)	*2840*
Ca:Mg	*0.95*

PROJECT SCOPE & OBJECTIVE: Investigation Capture

SITE ASSESSMENT HISTORY *(List reports/summary of work done in area in chronological order)*:

DATE	INVESTIGATION/REPORT	SCOPE	FINDINGS/RESULTS
June 1978	*Characteristics and Potential Impact of Wastewaters from a Coal-Fired Power Plant at Colstrip, Montana, Westech*	*Evaluation of potential impacts from process water associated with the Colstrip SES*	*Well completion details, aquifer testing results, and early water quality analysis for wells in the project area. Water quality at well 6M (9/20/1977): SC = 3,040 μmhos/cm; chloride = 18 mg/L; sulfate = 1,590 mg/L; boron < 1 mg/L.*
January 9, 1995	*Investigation of the Quality of Groundwater and Surface Water in the Colstrip Plant Site and 1&2 Evaporation Pond Areas, Hydrometrics, Inc.*	*Investigation of Plant Site Groundwater conditions*	*A groundwater divide was present near the center of the plant in both the McKay and shallower units. Several cross sections and potentiometric maps were constructed*

DATE	INVESTIGATION/REPORT	SCOPE	FINDINGS/RESULTS
April 1999	*MPC Capture System Installation Report, Hydrometrics, Inc.*	*The Wash Tray Pond, Units 3&4 Bottom Ash Pond, and the Sediment Retention Pond Areas were studied. Well 6M was converted for capture and started.*	*A hydrologic divide trending northeast-southwest was identified near the Wash Tray pond and Units 3&4 Bottom Ash Ponds. Water quality at well 9M improved. Water in 6M was interpreted to be affected by pond water and was converted to a capture well.*

NEAREST DOMESTIC OR STOCK WELL(S)*: (indicate direction, distance, and completion zone)

Well ID/GWIC ID	Distance from 6M	Direction	Formation of Completion / (Depth)
NPRR /11992	*2500 feet*	*west*	*Coal/Ft. Union Bedrock (55feet)*
NPRR /11993	*1900 feet*	*south*	*Coal/Ft. Union Bedrock (120 feet)*
NPRR /11994	*2600 feet*	*south*	*Fort Union Bedrock (518.5 feet)*
Snider, J./269	*3400 feet*	*east*	*Alluvium (20 feet)*

DISTANCE FROM PROPERTY BOUNDARY: *Project area is at south end of PPL Plant Site property. Closest proposed new well is Less than 100 feet from property boundary.*

PROPOSED ACTION: *This Interim Response Action is intended to further investigate groundwater quality and flow patterns in spoils, Rosebud coal, and the McKay coal surrounding Pond C and the Wash Tray Pond. Investigative measures include:*

- *Installation of three groundwater monitoring wells;*
- *Groundwater quality sample collection and analysis at each new well; and*
- *Aquifer testing.*

Recommendations for additional evaluation and/or groundwater capture, if necessary, will be made following completion of the Interim Response Actions.

MAPS/FIGURES:

- *Figure 1: Project Location Map*
- *Figure 2: Existing Well Network.*
- *Figure 3: Geologic Cross Section of Project Area*
- *Figure 4. Potentiometric Surface Map of Shallow Interval*
- *Figure 5. Potentiometric Surface Map of McKay Coal*
- *Figure 6. SC Iso-contour Map in Shallow Interval*
- *Figure 7. SC Iso-contour Map of McKay Coal Interval*
- *Figure 8. Proposed New Well Locations*
- *Figure 9. Typical Capture System Construction Details*
- *Figure 10. Schedule*

SCHEDULE

The proposed timeline to complete the scope of work outlined above is included in Figure 10. Work described in this plan will begin within 60 days. Monitoring well installation and groundwater quality sampling is expected to be completed within 90 days. As noted above, an interim report will be submitted within 60 days of well completion; but the final evaluation report may not be submitted until all sampling and testing results are compiled.

REFERENCES

Hydrometrics, Inc. (April, 1999). *1999. The Montana Power Company Groundwater Capture System Installation Summary Report. .*

Hydrometrics, Inc. (January 1995). *Investigation of the Quality of Groundwater and Surface Water in the Colstrip Plant Site and 1&2 Evaporation Pond Areas.*

Westech Environmental Services. (June, 1978). *Characteristics and Potential Impact of Wastewaters from a Coal-Fired Power Plant at Colstrip, MT.*

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Executive Summary

This Work Plan was prepared as an Interim Response Action in accordance with the Administrative Order on Consent (AOC) Regarding Impacts Related to Wastewater Facilities Comprising the Closed-Loop System at Colstrip Steam Electric Station, Colstrip, Montana between PPL Montana as Operator of the Colstrip Steam Electric Station and the Montana Department of Environmental Quality. This Work Plan addresses groundwater at the southern extent of the Colstrip-SES Plant Site. Process or wastewater facilities in closest proximity to the area addressed in this Work Plan include the Units 1&2 Cooling Tower Blowdown Pond C (North Pond & South Pond) and the Units 3&4 Wash Tray Pond (WTP). Iso-contour maps of typical process water indicator parameters and potentiometric surface maps of the area are presented in this report and are suggestive of various locations surrounding Pond C and the WTP where flow paths of groundwater potentially impacted by process pond water may exist. Further, results of groundwater capture analyses derived from a transient, three-dimensional, numerical groundwater flow model (AMEC, 2012) also suggested the possibility of a groundwater flowpath to the south and east of the WTP. Ten new well installations are proposed for this Interim Response Action to investigate groundwater quality around Pond C and the WTP. Paired monitoring wells, installed in first groundwater and the McKay coal, will be installed at four drilling locations. Single shallow wells will be installed at two other locations. Proposed well locations and the justification for each are included in the Work Plan. A Scope of Work for well installation, sampling, testing, and possible conversion to capture wells is included in this Work Plan.

Introduction

This Work Plan was prepared as an Interim Response Action in accordance with the Administrative Order on Consent (AOC) Regarding Impacts Related to Wastewater Facilities Comprising the Closed-Loop System at Colstrip Steam Electric Station, Colstrip, Montana between PPL Montana as Operator of the Colstrip Steam Electric Station and Montana Department of Environmental Quality. While the AOC provides for work to be done as an Interim Response Action, the examples provided in the AOC are not exhaustive, and the prompt action described in the following Work Plan is to respond to the circumstances identified hereafter and not because of an acute threat to human health or a recent spill.

PPL Montana, LLC (PPL) monitors groundwater at the Colstrip Steam Electric Station (Colstrip–SES) to detect inconsistencies in water quality that may be attributable to impacts from process water. As monitoring data become indicative of potential impacts, PPL installs groundwater capture systems or converts monitoring wells to recovery wells to mitigate the influence of process water on local groundwater. PPL has also aggressively implemented Best Management Practices (BMP's) and operational changes to reduce potential future losses of process water, and/or to assist in groundwater mitigation. These have included worker training and education, construction and operation of paste plants for fly ash processing, and lining of process water ponds or cells.

This work plan addresses groundwater at the southern extent of the Colstrip-SES Plant Site. Process or wastewater facilities in closest proximity to the area addressed in this work plan include the Units 1&2 Cooling Tower Blowdown Pond C (Pond C) and the Units 3&4 Wash Tray Pond (WTP). Pond C originally received cooling tower blowdown. In 1987, the pond was split into two sections (North Pond and South Pond); and a portion of the South Pond that had been damaged by waves was relined with clay and geotextile material overlain by scoria. In 1999, monitoring well 6M was converted to a groundwater capture system well at the south end of this pond. Well 6M is actually completed in the shallower Rosebud Coal and not the McKay Coal, as its "M" designation suggests. With approval from MDEQ, the north pond began receiving groundwater collection water (Brine Pond and 10S/10M collection systems) to be used

for a highway construction project in 2004. Currently, the north and south ponds are used to store stormwater runoff.

The Units 3&4 WTP was constructed in 1983 and served as a scrubber wash tray loop until 1995. In 1988, geotextile with a clinker cover was placed on the bank on the southern half of the pond as a repair for wind erosion. Use of the clay-lined pond was discontinued in 1995 but the pond was not backfilled. At present, the pond contains residual fly ash and occasional water from precipitation runoff. The general project area is presented in Figure 1 and the capture/monitoring well network is presented in Figure 2.

The lithology beneath Pond C and the WTP consists primarily of mine spoils, overburden, and/or clinker, overlaying remnants of Rosebud Coal, interburden, and deeper McKay Coal. Rosebud Coal was mined from the area east of the Units 1&2 Cooling Tower Blowdown Pond C. The area directly east of the pond was mined initially by Northern Pacific to provide coal for railroad engines in the period between 1924 and the mid-1950's. Further eastward, the area was mined by Western Energy. A geologic cross section of the area, oriented approximately perpendicular to the groundwater flow direction, is included in Figure 3. First groundwater is encountered in the spoils or Rosebud Coal, if present. Deeper hydrostratigraphic intervals coincide with McKay Coal and sub-McKay sandstones. Based on measured water levels of paired wells, a weak downward gradient exists from the shallow intervals to the sub-McKay.

Historically, the WTP and Pond C were situated atop a groundwater divide in both the shallow and the McKay potentiometric surfaces. The divide is mapped in the report *Investigation of the Quality of Groundwater and Surface Water in the Colstrip Plant Site and 1&2 Evaporation Pond Areas* (Hydrometrics, Inc., January 1995). The groundwater divide in the shallow hydrostratigraphic interval (i.e. spoils and Rosebud) appears to have been largely attributable to mounding from ponds at the plant site which were adjacent to spoil that were not fully recharged following mining. However, based on a more recent map of the potentiometric surface (Figure 4), the shallow groundwater divide has since shifted southward—resulting in the majority of groundwater flow to the northwest. The shift in the shallow groundwater divide is likely the result of decreased pond operation in the area, increased groundwater capture efforts in the area,

and higher water levels in the adjacent spoil reflecting the longer recharge period. The groundwater divide in the McKay Coal does not appear to be present in the updated potentiometric surface map of the plant site. The prevailing direction of groundwater flow in the current map is to the northwest; however, it is possible that the divide is still present and has shifted even further south of the plant site. A more recent McKay coal potentiometric surface map is presented in Figure 5.

Based on long-term monitoring results at several wells south of the plant site process ponds, groundwater quality in the spoils is both highly temporally and spatially variable. For example, no process water impacts and very little change in water quality have been observed at well 17S, located on the east side of the WTP, from 1983 to present. In contrast, water quality has varied at well 9S, located on the west side of the WTP. TDS concentrations as high as 7500 mg/L and as low as 2500 mg/L have been observed. At present, the TDS concentration in 9S is approximately 6000 mg/L. Variability of shallow groundwater quality is attributed to heterogeneous distribution of spoils mineralogy, specifically the unpredictable dispersal of soluble salts in reworked mine spoils. Groundwater quality in the Rosebud Coal at well 6M (capture well) exhibits some of the abrupt variability observed in the spoils; and a long-term trend of declining water quality has also been observed at this well since it was completed in 1975.

Iso-contour maps of specific conductance (SC) for the shallow and McKay hydrostratigraphic intervals are included as Figures 6 and 7. The iso-contour maps, coupled with potentiometric surface maps, are suggestive of various locations surrounding Pond C and the WTP where flow paths of groundwater potentially impacted by process pond water may exist. Results of capture analyses derived from a transient, three-dimensional, numerical groundwater flow model also suggested the possibility of an impacted groundwater flowpath to the south and east of the WTP. A complete discussion of the groundwater flow model is included in the report *Plant Site Groundwater Model Redesign and Calibration, Colstrip Steam Electric Station* (AMEC, 2012).

The purpose of this Interim Response Action is to investigate groundwater conditions at the southern extent of the plant site to further define local flow patterns and water quality. Methods

selected for this evaluation and justification for specific areas of targeted by this Interim Response Action are presented in the following Scope of Work.

Scope of Work

The Scope of Work proposed for this Interim Response Action includes the following five tasks:

- Task 1 –Well Installation;
  - Ten monitoring wells will be installed in the project area.
- Task 2 – Groundwater Quality Sampling;
  - Water quality samples will be collected from each of the new wells and analyzed for PPL's typical parameter list.
- Task 3 – Pumping and/or Slug Testing;
  - A pumping test or slug test will be performed at each of the new wells.
- Task 4 – Capture Well Conversion; and
  - If necessary, some or all of the new monitoring wells will be converted to groundwater collection wells. Conversion will take place pending review of groundwater quality analytical results and well yields.
- Task 5 – Data Analysis and Reporting.
  - Results of well installation and groundwater quality analyses will be summarized in an Interim Report. If results are indicative of process water impacts at a given well or wells, recommendations for capture well conversion will be included in the Interim Report.
  - Further evaluation will be conducted and a Final Report of results will be submitted. If necessary, the Final Report will include capture well construction details, an evaluation of capture well startup, and a preliminary review of capture system effectiveness.

Methodology of each of the five tasks listed above is detailed herein.

Task 1 -- Monitoring Well Installation

Proposed well locations are presented in Figure 8. A pair of wells is proposed for each of drilling locations one through four. Paired wells at each of these locations will target first

groundwater in spoils or the Rosebud coal and deeper groundwater in the McKay coal interval. Single wells at drilling locations five and six will target first groundwater. The justification for each well location is as follows:

1. Two wells are proposed at drilling location #1, which is about 150 feet from the southeast corner of Pond C and approximately 500 feet east of capture well 6M. This location was chosen to further define the extent of impacts that are apparent in the shallow subsurface at neighboring wells 6M, 9S (9M), 16SP, and 33S. The shallow well may also provide a location to augment capture south of Pond C. The well completed in the McKay coal at this target will fill a gap in the deeper monitoring well network that exists between wells 38M and 16M. Concentrations of dissolved constituents have increased above background and remained elevated at well 16M. Conversely, process water impacts are not evident at well 38M, which may have historically been on the opposite side of a groundwater divide from the ponds and/or upgradient of the ponds. All new drilling targets south and southeast of Pond C will help refine the location of the groundwater divide, if a divide is still present.
2. Wells proposed at drilling location #2 in shallow groundwater and in the McKay coal will specifically address particle tracking analyses performed via the numerical flow model (AMEC, December 2012) that were suggestive of a flow path to the south and east of the WTP. The proposed drilling site is situated in the gap between existing wells already south and east of the WTP.
3. Drilling location #3 was chosen because it is downgradient of impacted well 6M, based on the current understanding of the potentiometric surface in the area south of the Plant Site. Also, this location is on or near the mapped areal extent of groundwater exceeding baseline screening levels (BSLs) for boron, chloride, sulfate, or specific conductance that were developed from numerical model simulations (AMEC, December 2012). Wells completed in shallow and McKay groundwater at this location will provide data to refine the existing groundwater model. If necessary, the wells will be converted to capture points to help mitigate groundwater quality impacts.
4. Drilling location #4 is farther downgradient of known impacts at the south end of Pond C but is also located within the areal extent of simulated BSL exceedances (AMEC, December 2012). Location #4 will bridge a gap in the monitoring well network that

exists downgradient of Pond C, yet upgradient of the capture well network southwest of the Units 1&2 A/B Flyash Pond. This capture well network includes shallow wells SRP-8, 10S, 68A, 114S, and McKay capture wells 10M, 59M, 98M, and 113M (See Figure 2).

5. Drilling location #5 is proposed southeast of monitoring well 38SP. Monitoring well 38SP had high levels of process water indicator parameters (except boron); however, the groundwater level elevation in this well is higher than wells to the north (e.g. 6S and 6M), suggesting that it is upgradient of the source of process water impacts. Groundwater potential measured at the new well at location #5 will help delineate the groundwater divide south of the Plant Site.
6. Drilling location #6 is proposed southwest of monitoring well 38SP. This proposed drilling location is expected to be upgradient of known process water impacts and will be used to help refine the location of the groundwater divide.

The monitoring well boreholes will be advanced using air-rotary methods. If necessary, 8-inch diameter steel casing will be advanced through incompetent surface intervals (clinker, spoils, fill, sloughing alluvium/ colluvium, etc.) using drill and drive methods. In such an instance, 4.5-inch PVC casing will be installed through the steel casing. The hydrostratigraphic interval of interest will be screened with 0.020-inch or 0.025-inch slot, four-and-one–half-inch diameter PVC screen. A filter pack, consisting of 10-20 silica sand, will be placed across the entire length of the screened interval. Bentonite chips will be used to create an annular seal from the top of the silica sand to ground surface. Steel casing will be pulled back to expose the slotted section of PVC. A minimum of five feet of eight-inch steel surface casing will be left in the completed boreholes (approximately two feet of steel will extend above ground). In addition to the bentonite seal, a concrete pad will be poured around the eight-inch steel surface casing. A locking steel lid will be installed at the wellhead.

Cuttings from each boring will be logged for lithology, including texture, color, relative moisture, and origin (alluvium, colluvium, bedrock, etc.) by a geologist, hydrogeologist, or engineer. A log of borehole lithology and well completion will be prepared for each well and will be submitted to PPL and the Montana Board of Water Well contractors.

Monitoring wells will be developed using air-lift methods or bailing. Air-lift development involves forcing compressed air into the completed well to purge water, cuttings, fines, and debris from the casing. Providing the well makes sufficient water, development will continue until sufficient fines have been removed from the well to allow pumping using a submersible pump. Bailing involves repeatedly removing water from the well with a steel bailer (with check valve) until the well has been adequately purged. Field parameters (specific conductance, pH, temperature) will be measured and recorded during development.

Task 2 – Groundwater Quality Sampling

Groundwater quality will be evaluated at each of the three monitoring wells installed as part of this work plan. Groundwater samples will be collected using methods commonly used by PPL for operational monitoring.

The samples will be collected using either a submersible sampling pump or a bailer. Field parameters (specific conductance, pH, temperature) will be measured and recorded during sampling. Samples will be submitted to Energy Laboratories in Billings, Montana for analysis of the parameters listed in Table 1.

Task 3 – Aquifer Testing

A pumping test and/or slug test will be conducted on each well installed as part of this work plan. A pumping test will be conducted if preliminary observations made during development indicate sustainable yield from the well in excess of two gallons per minute. If applicable, the pumping test will consist of 100 minutes of pumping followed by a recovery period. Water levels will be measured during the pumping and recovery phases of the test using pressure transducers with data loggers and/or electronic water level probes.

Slug tests will be conducted at wells with insufficient groundwater for pump testing. The slug test will be conducted by displacing water from the well casing using a “slug” and measuring groundwater recovery following slug injection and withdrawal. Water levels will be measured in the well using submersible electronic pressure transducers and/or electronic water level probes.

TABLE 1. New Monitoring Well Analytical Parameters

- **Physical properties**
  - pH
  - Specific Conductance
  - Total Dissolved Solids
- **Common Ions**
  - Alkalinity, Total as $CaCO_3$
  - Bicarbonate as HCO_3
  - Carbonate as CO_3
  - Chloride
  - Sulfate
  - Magnesium
  - Calcium
  - Potassium
  - Sodium
  - Bromide
- **Nutrients**
  - Nitrate plus nitrite
- **Dissolved Metals**
  - Boron
  - Selenium
  - Mercury

Pump test and/or slug test data will be entered into Aqtesolv® computer program for analysis. At a minimum, test results will be used to estimate hydraulic conductivity and transmissivity of targeted formations. Where appropriate observation wells exist, storativity values will also be calculated.

Task 4 – Capture Well Conversion

The new monitoring wells will only be converted if they have apparent process water impacts. Process water impacts will be evaluated upon receipt of water quality results. Conversion of any new impacted wells, if necessary, will be completed according to PPL's commonly used and accepted procedure, as follows.

- The existing monument and concrete pad will be removed and the area around the wells will be excavated to an approximate depth of five feet below ground surface with a backhoe or track excavator.

- The excavations will be of sufficient width to place a six-foot diameter Corrugated Metal Pipe (CMP) over the existing wellheads.
- Excavated materials will be backfilled around the CMPs and mounded at the surface to promote drainage from the capture wells.
- Washed gravel will be placed in the bottom of the CMPs at an approximate thickness of one-foot.
- Existing PVC well casing will be cut off so that it extends just above the washed gravel in the bottom of the CMP vaults.
- Hinged metal lids will be installed at the top of the CMPs.
- Aluminum ladders will be secured to the inside of the CMPs for access/egress into and out of the culverts.
- A submersible pump, sized for the well, will be installed in each well at total depth.
- Submersible pumps will be hung in the wells by schedule 80 PVC threaded drop pipe with brass couplings.
- Drop pipe will extend from the pump to fittings that will be located on the floor of each vault.
- Necessary pipe fittings (i.e. unions, tees, valves, and sample port) will be plumbed into the discharge pipeline in each vault; and connected to existing or new HDPE pipelines that will convey water to either the Plant Site ponds or the VSEP treatment plant.
- Redundant check valves will be installed both immediately above the pump and inside the vault to prevent backflow to the wells.
- Electrical controls, an hour meter, and automated pump protection (i.e. pumptec) will be installed in a secure electrical enclosure adjacent to each wellhead.

Captured groundwater from the new wells will be routed to the nearest practicable existing HDPE collection system pipeline in the project Area. A typical capture well construction diagram is presented in Figure 9. Note that pump and pipeline sizing may vary from those shown on Figure 9 depending on the hydrologic conditions encountered.

Task 5 – Data Analysis and Reporting

An interim report, including a narrative of monitoring well installation and construction, will be written for submittal to the Montana Department of Environmental Quality (MT-DEQ). Per requirements of the Administrative Order On Consent Regarding Impacts Related to Wastewater Facilities Comprising the Closed-Loop System and Colstrip Steam Electric Station, Colstrip, Montana, the interim report will be submitted within 60 days of completing the new wells. The interim report will include well completion details, and if available, water quality sample results, aquifer test results, and a detailed evaluation of said results. However, the final evaluation report will not be submitted until results of the groundwater quality samples and aquifer tests are complete. This may require submittal of a second final report, which will be submitted within 120 days of well completion.

Schedule

The proposed timeline to complete the scope of work outlined above is included in Figure 10. Work described in this plan will begin within 60 days. Monitoring well installation and groundwater quality sampling is expected to be completed within 90 days. As noted above, an interim report will be submitted within 60 days of well completion; but the final evaluation report may not be submitted until all sampling and testing results are compiled. The expected deadline of the final report is not more than 120 days after the new wells are completed or not more than 180 days after submittal of this work plan.

Reference

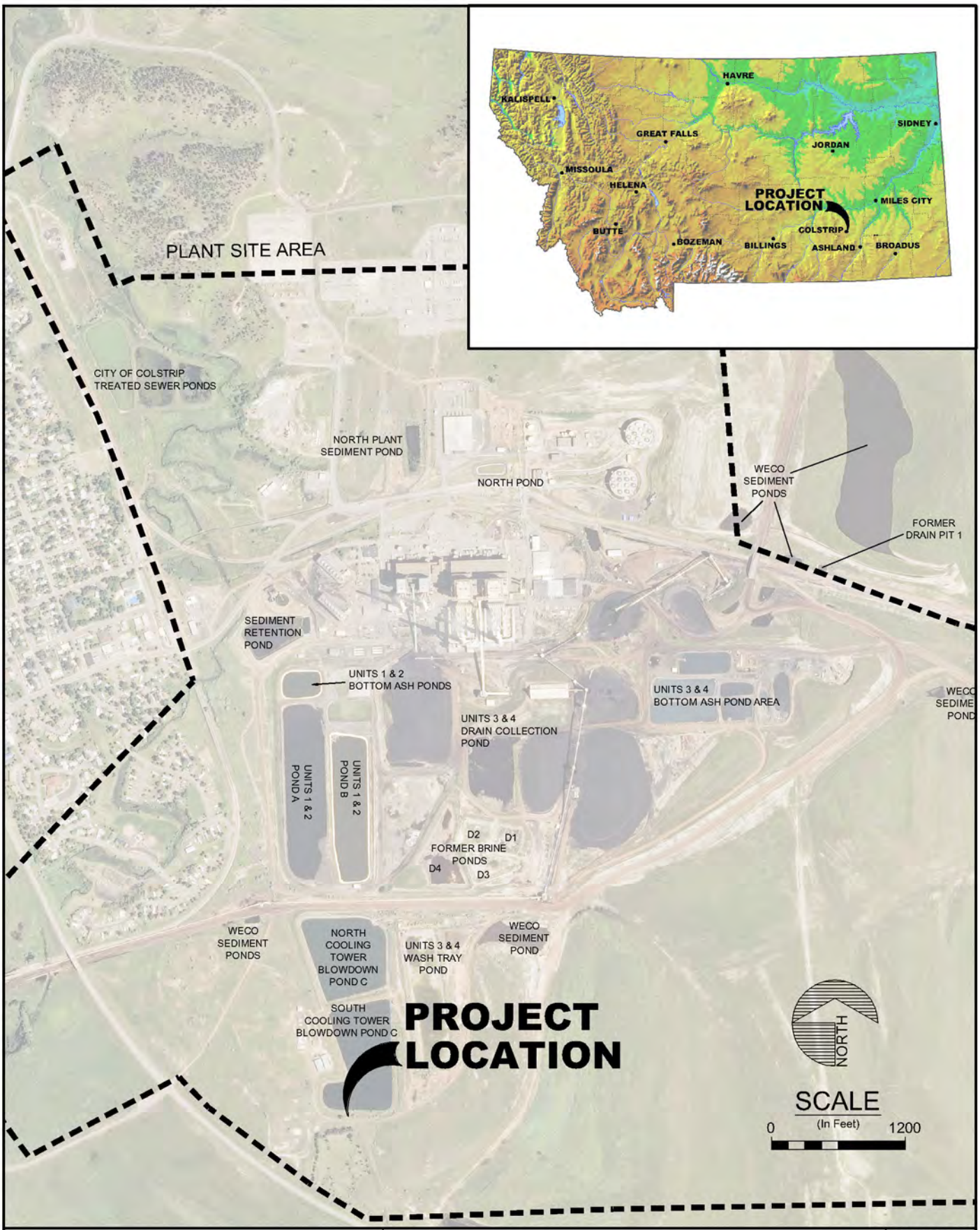
AMEC . (December 2012). *Plant Site Groundwater Model Redesign and Calibration, Colstrip Steam Electric Station.* AMEC Environment & Infrastructure, Inc.

Hydrometrics, Inc. (April 2013). *Evaluation of 2012 Hydrologic Monitoring Data from Colstrip Units 1 through 4 Process Pond System Colstrip Steam Electric Station .*

Hydrometrics, Inc. (January 1995). *Investigation of the Quality of Groundwater and Surface Water in the Colstrip Plant Site and 1&2 Evaporation Pond Areas.*

Figures

Figure 1. General Project Location
Figure 2. Project Area Monitoring and Capture Well Network
Figure 3. Geologic Cross Section of Project Area
Figure 4. Potentiometric Surface Map of Shallow Groundwater
Figure 5. Potentiometric Surface Map of McKay Coal
Figure 6. Iso-contour Map of Specific Conductance (SC) for the Shallow Groundwater Interval
Figure 7. Iso-contour Map of Specific Conductance (SC) for the McKay Coal Groundwater Interval
Figure 8. Proposed New Well Locations
Figure 9. Typical Capture Well Conversion Diagram
Figure 10. Schedule



INTERIM RESPONSE ACTION MONITORING WELL INSTALLATION AND POTENTIAL CAPTURE WELL CONVERSION NEAR WELL 6M PPL MONTANA'S COLSTRIP STEAM ELECTRIC STATION - PLANT SITE	GENERAL PROJECT LOCATION	FIGURE 1

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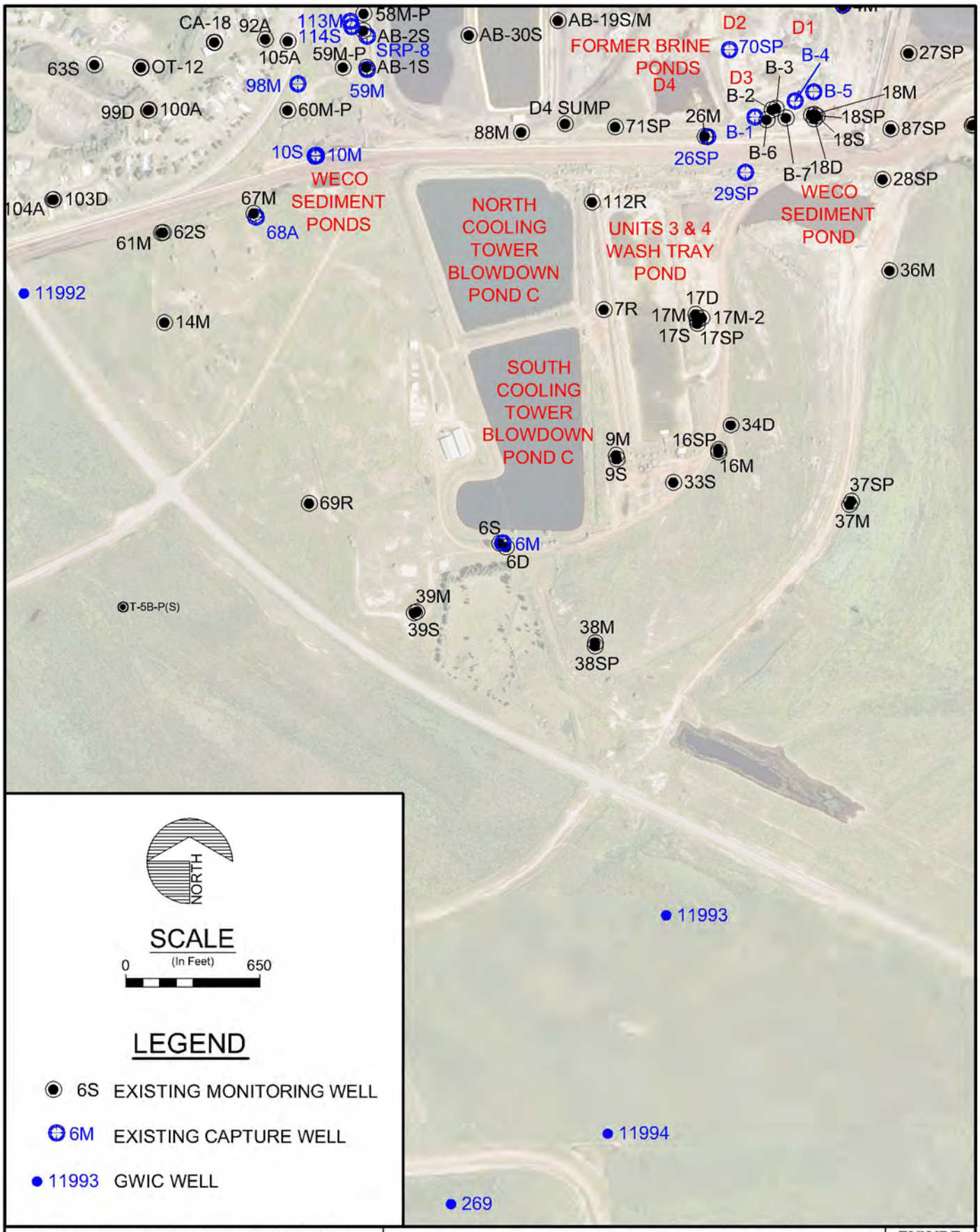
Hydrometrics, Inc.
Consulting Scientists and Engineers



INTERIM RESPONSE ACTION MONITORING WELL INSTALLATION AND POTENTIAL CAPTURE WELL CONVERSION NEAR WELL 6M PPL MONTANA'S COLSTRIP STEAM ELECTRIC STATION - PLANT SITE	**PROJECT AREA MONITORING AND CAPTURE WELL NETWORK**	FIGURE **2**

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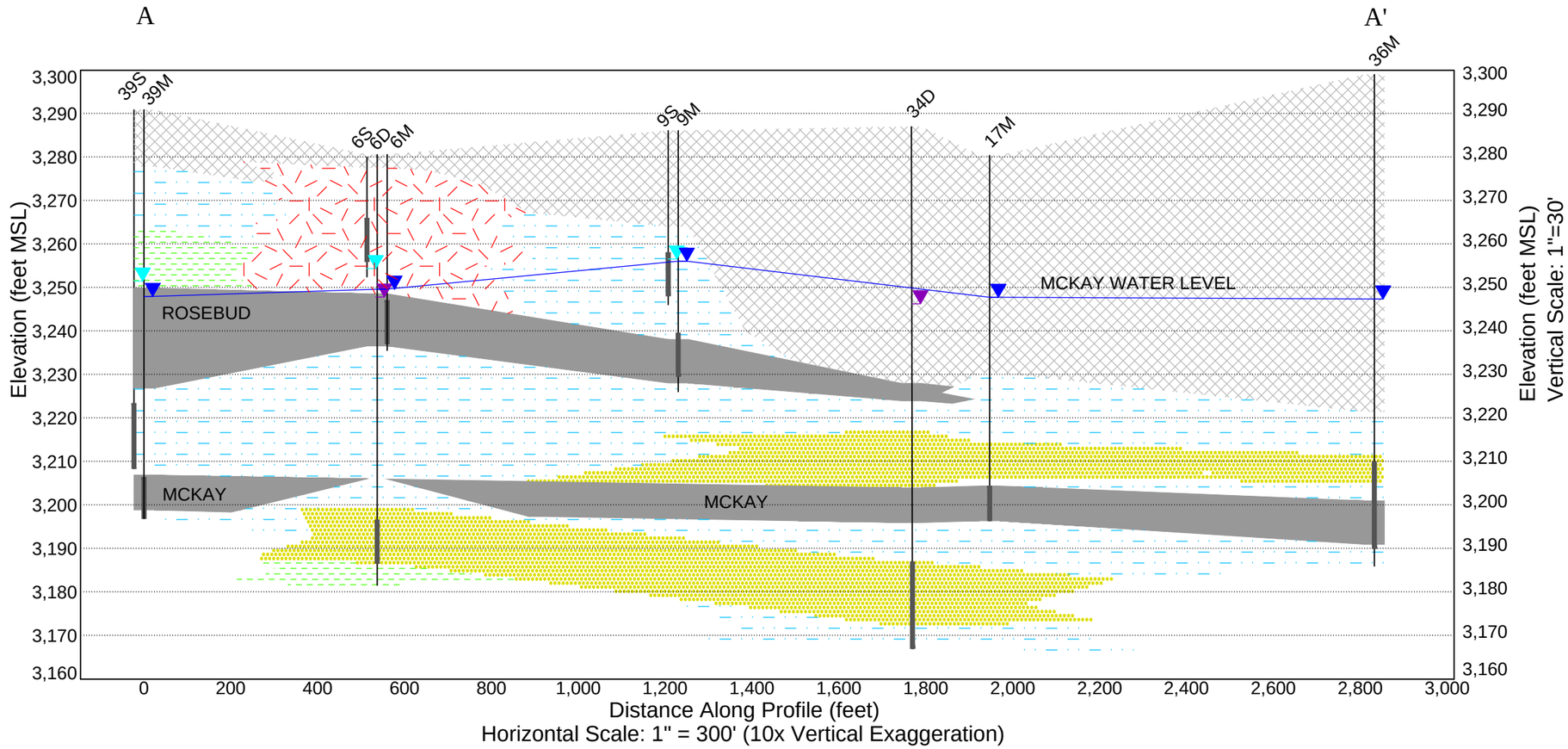

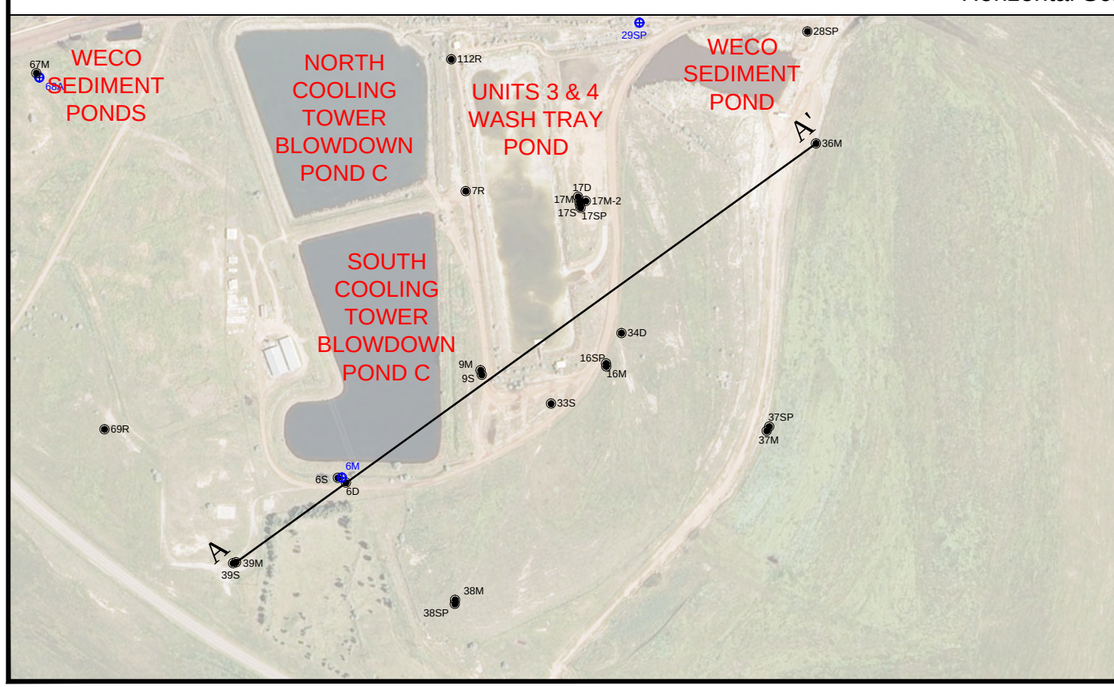

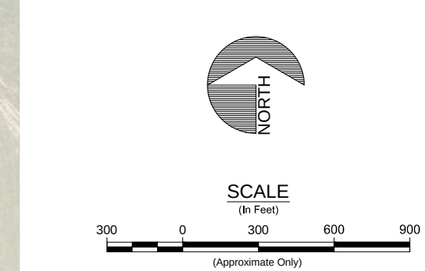

A — A' CROSS SECTION LINE

6M MONITORING WELL

6D CAPTURE WELL

LEGEND

- SPOIL
- CLINKER
- SANDSTONE
- COAL
- SILTSTONE
- SHALE
- OCTOBER 2012 SHALLOW WATER LEVEL
- OCTOBER 2012 MCKAY WATER LEVEL
- OCTOBER 2012 DEEP WATER LEVEL

6M — WELL DESIGNATION

MONITOR WELL

OCTOBER 2012 MCKAY WATER LEVEL

SCREENED INTERVAL

TOTAL DEPTH OF HOLE

Hydrometrics, Inc.
Consulting Scientists and Engineers
Billings, Montana 59106
5602 Hesper Road
(406) 656-1172

INTERIM RESPONSE ACTION MONITORING WELL INSTALLATION AND POTENTIAL CAPTURE WELL CONVERSION NEAR WELL 6M PPL MONTANA'S COLSTRIP STEAM ELECTRIC STATION - PLANT SITE

GEOLOGIC CROSS SECTION A-A'

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AUTOCAD 2000 DRAWING (DWG)
FIGURE
3

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INTERIM RESPONSE ACTION MONITORING WELL INSTALLATION AND POTENTIAL CAPTURE WELL CONVERSION NEAR WELL 6M
PPL MONTANA'S COLSTRIP STEAM ELECTRIC STATION - PLANT SITE

OCTOBER 2012
SHALLOW UNITS
POTENTIOMETRIC SURFACE

DRAWING FILE NUMBER
1306013B003
AUTOCAD 2000 DRAWING (DWG)
FIGURE
4

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INTERIM RESPONSE ACTION MONITORING WELL
INSTALLATION AND POTENTIAL CAPTURE WELL
CONVERSION NEAR WELL 6M
PPL MONTANA'S COLSTRIP STEAM ELECTRIC
STATION - PLANT SITE

OCTOBER 2012
MCKAY COAL
POTENTIOMETRIC SURFACE

DRAWING FILE NUMBER
1306013B003
AUTOCAD 2000 DRAWING (DWG)
FIGURE
5

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INTERIM RESPONSE ACTION MONITORING WELL INSTALLATION AND POTENTIAL CAPTURE WELL CONVERSION NEAR WELL 6M PPL MONTANA'S COLSTRIP STEAM ELECTRIC STATION - PLANT SITE

MAY 2012
SHALLOW UNITS SPECIFIC CONDUCTANCE ISOCONTOUR MAP

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1306013B004
AUTOCAD 2000 DRAWING (DWG)
FIGURE
6

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INTERIM RESPONSE ACTION MONITORING WELL INSTALLATION AND POTENTIAL CAPTURE WELL CONVERSION NEAR WELL 6M PPL MONTANA'S COLSTRIP STEAM ELECTRIC STATION - PLANT SITE

MAY 2012
MCKAY COAL SPECIFIC CONDUCTANCE ISOCONTOUR MAP

DRAWING FILE NUMBER
1306013B004
AUTOCAD 2000 DRAWING (DWG)
FIGURE
7

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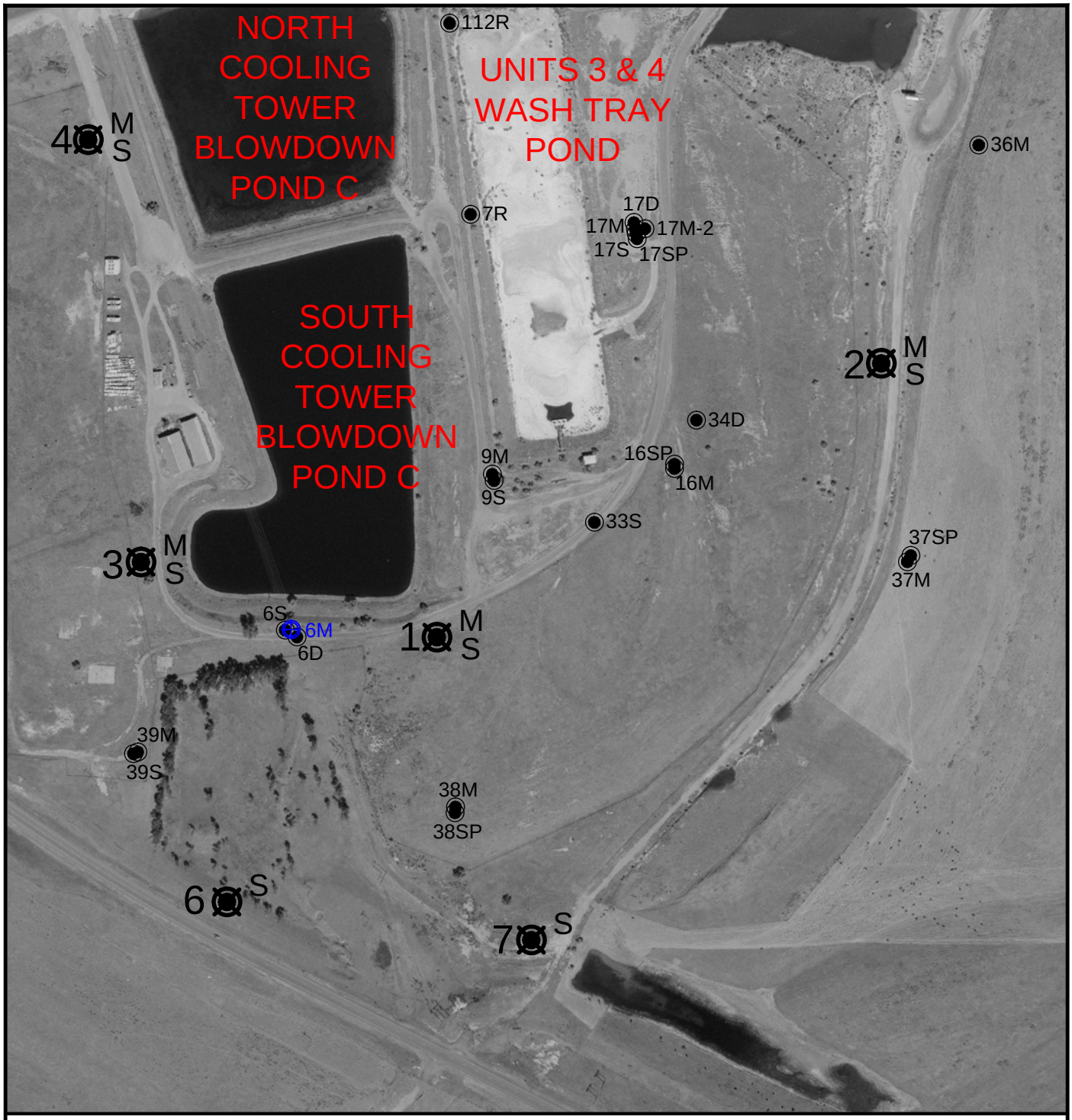

LEGEND

M S PROPOSED MCKAY MONITORING WELL
PROPOSED SHALLOW MONITORING WELL

1 SITE NUMBER

33S EXISTING MONITORING WELL

6M EXISTING CAPTURE WELL

NORTH

SCALE (In Feet) 0 400

INTERIM RESPONSE ACTION MONITORING WELL INSTALLATION AND POTENTIAL CAPTURE WELL CONVERSION NEAR WELL 6M PPL MONTANA'S COLSTRIP STEAM ELECTRIC STATION - PLANT SITE	**PROPOSED NEW MONITORING WELL LOCATIONS**	FIGURE **8**

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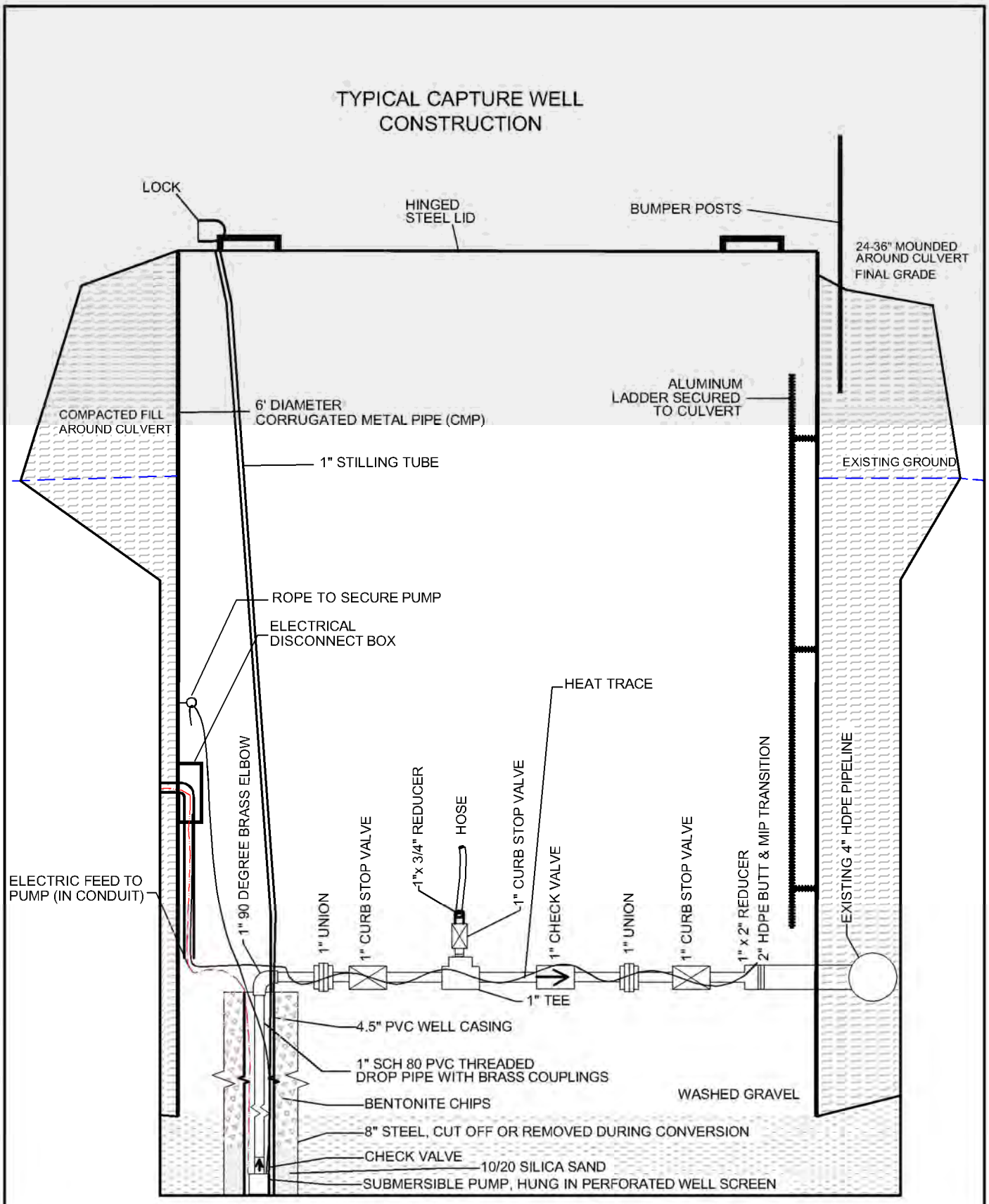

INTERIM RESPONSE ACTION MONITORING WELL INSTALLATION AND POTENTIAL CAPTURE WELL CONVERSION NEAR WELL 6M PPL MONTANA'S COLSTRIP STEAM ELECTRIC STATION - PLANT SITE	**TYPICAL CAPTURE WELL CONVERSION DETAILS**	FIGURE **9**

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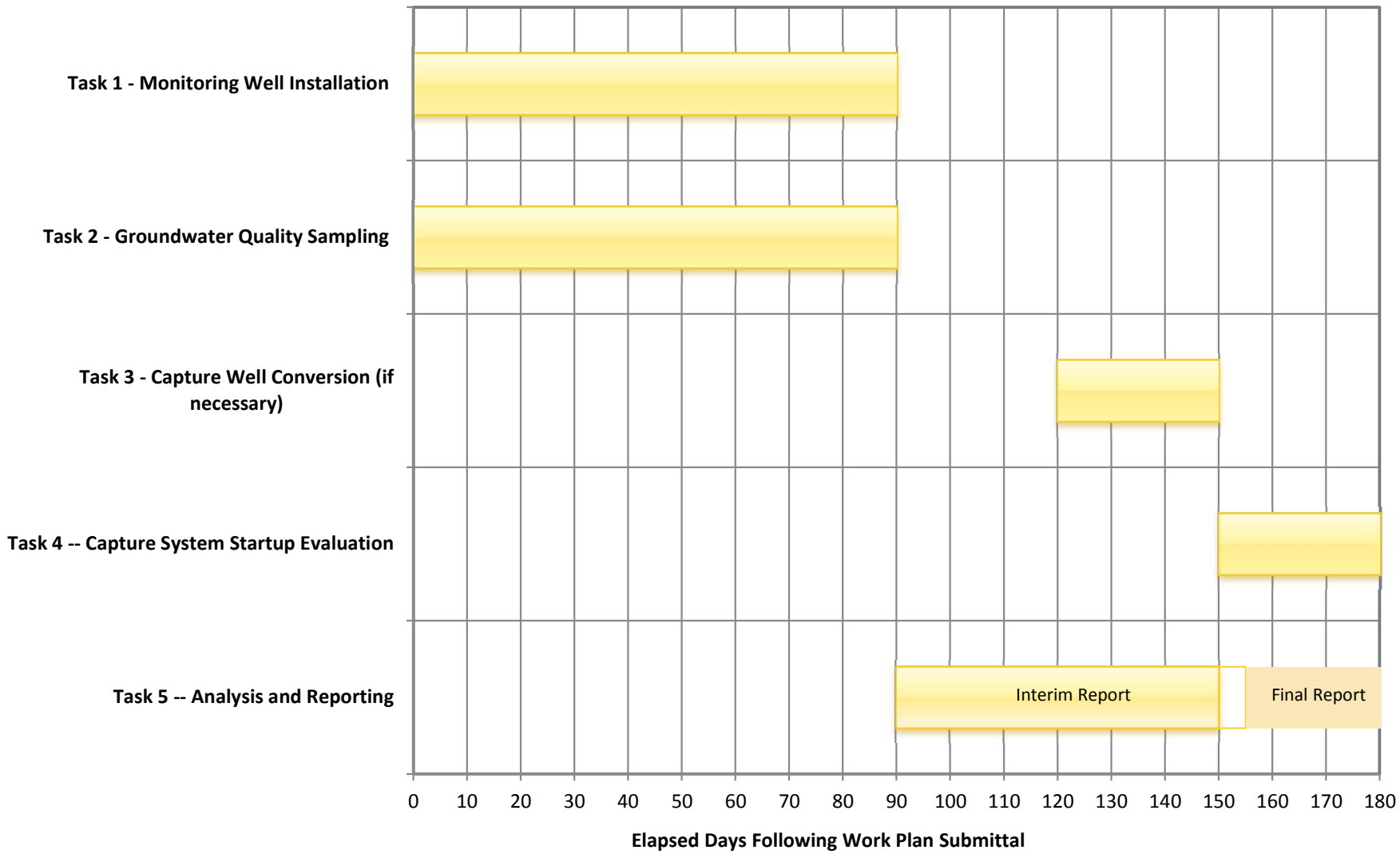
Figure 10. Schedule -- 6M Area Investigation



PPL MONTANA, LLC

COLSTRIP STEAM ELECTRIC STATION

MONITORING WELL INSTALLATION AND POTENTIAL CAPTURE WELL CONVERSION NEAR WELL 6M

Pursuant to: ADMINISTRATIVE ORDER ON CONSENT REGARDING IMPACTS RELATED TO WASTEWATER FACILITIES COMPRISING THE CLOSED-LOOP SYSTEM AT COLSTRIP STEAM ELECTRIC STATION, COLSTRIP, MONTANA SECTION XI – SUBMISSIONS

CERTIFICATION:

I, the undersigned, hereby certify that this document was prepared under my direction and to the best of my knowledge the information contained herein is correct and accurate.

Mike Holzwarth	Compliance Professional	11/8/13
Name	Title	Date