APPENDIX A

GEOLOGY DATA

A-1. REGIONAL GEOLOGY

A-2. REMEDIAL INVESTIGATION BORING LOGS AND WELL CONSTRUCTION

A-3. GROUNDWATER GRADIENT AND TRANSPORT CALCULATIONS

APPENDIX A-1

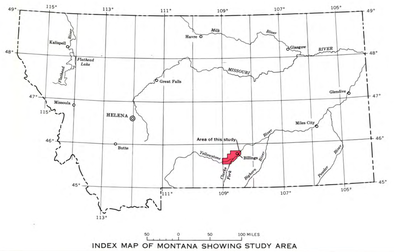
REGIONAL GEOLOGY

INTRODUCTION

The Yellowstone River, which flows from Yellowstone National Park in Wyoming to the Missouri River near Williston, North Dakota, makes the Yellowstone River valley one of the few water-rich areas of eastern Montana. About 15 percent of the State's population lives along the river between Billings and Park City. Billings (population 61,600) is one of the State's largest cities and its population may increase to 120,000–150,000 by 1990 (Clark, Coleman, and Rupeiks, Inc., 1968, p. 21).

The purpose of this study is to inventory the water resources of the Yellowstone River valley from Park City to Billings with particular emphasis on the adequacy and suitability of the water supply for the projected growth of the greater Billings area.

This study describes a 35-mile-long section of the river valley (see index map), which averages 3 miles in width but ranges from 1 to 7 miles wide.


Area of this study
HELENA
Great Falls
Billings
Miles City
Glendive
Butte
Livingston
Cody
Yellowstone
Bighorn
Tongue
Powder
Little Missouri
Musselshell
Milk
Marias
Sun
Teton
Dearborn
Flathead Lake
Kalispell
Flathead
Clark Fork
Bitterroot
Jocko
Blackfoot
Big Hole
Beaverhead
Madison
Gallatin
Shoshone
Clarks Fork
Stillwater
Rosebud
Powder River
Little Missouri
Cheyenne
Belle Fourche
Grand
Little Missouri
Knife
Heart
Cannonball
Yellowstone
Big Dry

PREPARED IN COOPERATION WITH
THE MONTANA BUREAU OF MINES AND GEOLOGY

GROUND WATER

WATER RESOURCES

GROUND WATER

The largest quantity of good quality ground water in the study area is found in the unconsolidated deposits. Wells drilled into the Cretaceous rocks yield only small quantities of poor quality water, except for the Judith River Formation and the Eagle Sandstone, which yield small quantities of water of fair quality.

The unconsolidated deposits are about 50 feet thick in the central part of the valley floor and increase to about 120 feet thick along the north border. The thickness of these deposits at any point can be estimated by subtracting the altitude of the base of the alluvium as shown on the hydrologic map from the altitude of land surface.

The depth to water in the unconsolidated deposits can be estimated by subtracting the altitude of the water-table contours shown on the hydrologic map from the altitude of the land surface. The contours are representative of a period of high water levels; the water table is lower during winter and spring. The water table fluctuates according to the season and fluctuations are greatest near irrigation canals as is shown by the well hydrographs.

Ground water moves down the hydraulic gradient. Water-table contours show that ground water in the unconsolidated deposits moves toward the Yellowstone River and contributes to the flow of the river. Some of the ground water discharges into streams, springs, and drainage ditches and is carried to the Yellowstone River as surface flow.

In some areas the water table coincides with the land surface forming marshes or waterlogged land. Where waterlogging interferes with farming, a system of drainage ditches are dug to lower the water table. Waterlogged areas or areas of high water table are common along the Yellowstone River especially along the north edge of terrace 2 between Park City and Billings and from 2 to 5 miles west of Billings along Grand Avenue. Drainage-ditch systems are used extensively in these areas. The drainage system and those areas where waterlogging is a problem are shown on the hydrologic map.

Storage

The quantity of water stored in the unconsolidated deposits during August 1968 was estimated to be about 180,000 acre-feet. This estimate was made by calculating the volume of saturated alluvium and multiplying by assumed specific yields of 0.12 for gravel, 0.08 for sand, and 0.05 for silt. Annual fluctuations of the water table are estimated to cause a change in storage of about 30,000 acre-feet.

Well Yield From Unconsolidated Deposits

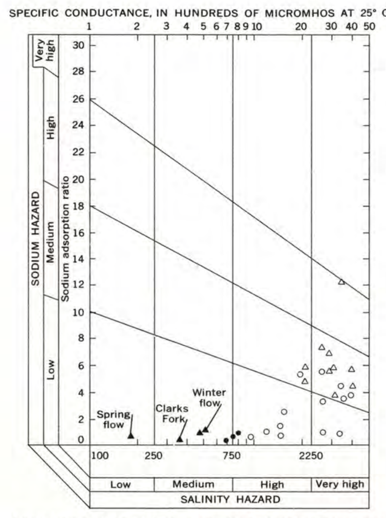
The amount of water that can be pumped from the unconsolidated deposits is determined largely by the type and thickness of saturated material tapped by the well. Gravel yields water to wells at a faster rate than sand, and sand yields water to wells at a much faster rate than does silt or silty clay. Results of pumping tests made during the study are summarized in tabular form.

Quality

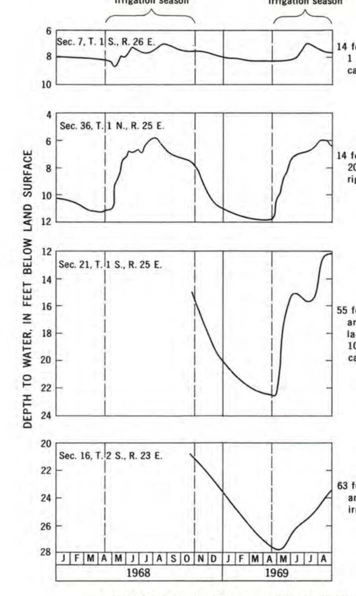
The chemical quality governs the utility of the water. Except in small areas, ground water is too highly mineralized to be suitable for human consumption, but the water can be used for livestock. The areal variation of water quality is shown on the hydrologic map by the conductivity data. The majority of residents outside service areas of the municipal water systems of Billings and Laurel haul city water for domestic purposes. Ground water that contains less than 1,500 mg/l (milligrams per liter) dissolved solids generally is satisfactory for domestic uses; the best ground-water supply in the area contains 300 to 800 mg/l dissolved solids. Water having concentrations above 1,500 mg/l is used by some residents, but water that has a dissolved-solids concentration greater than 2,500 mg/l is seldom used by area residents.

The ground water of the study area is characterized by very high concentrations of sulfate and sodium (see ground water-quality table).

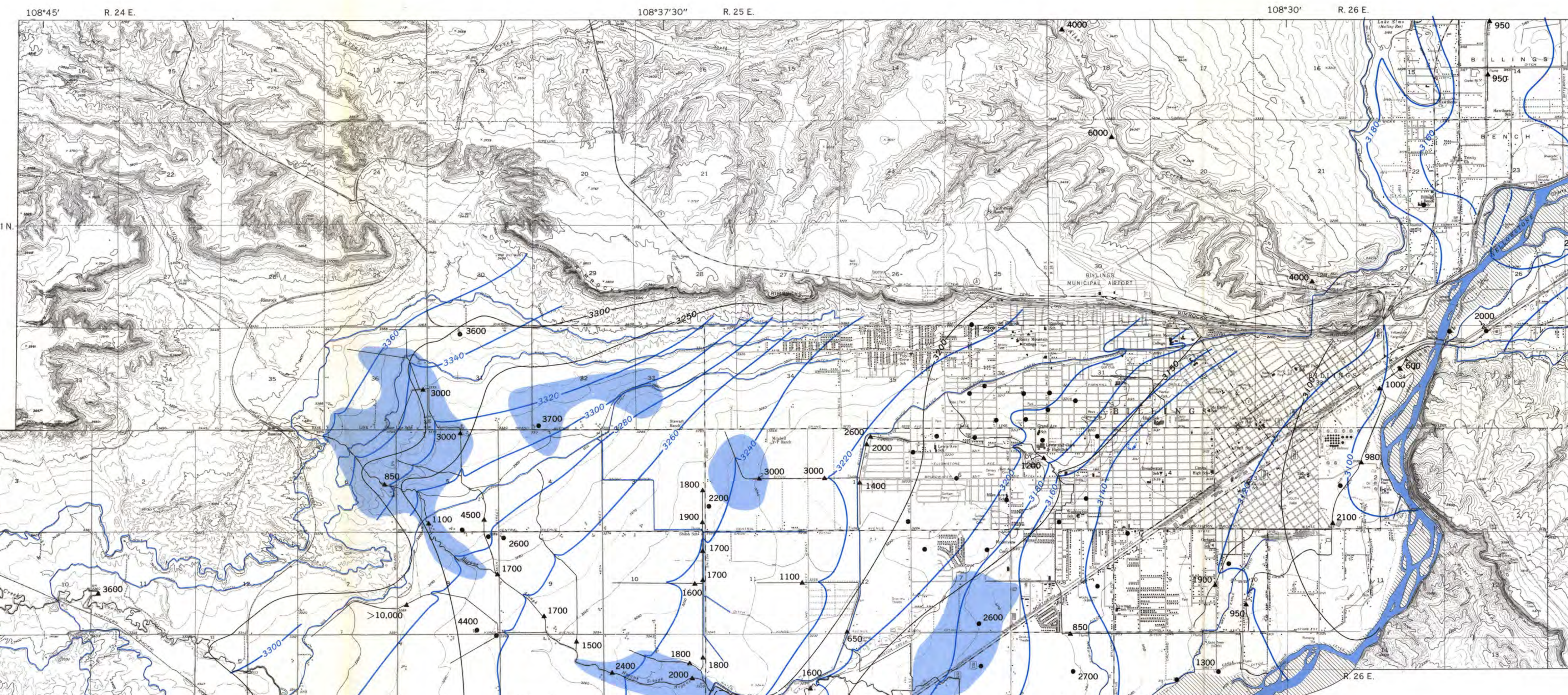
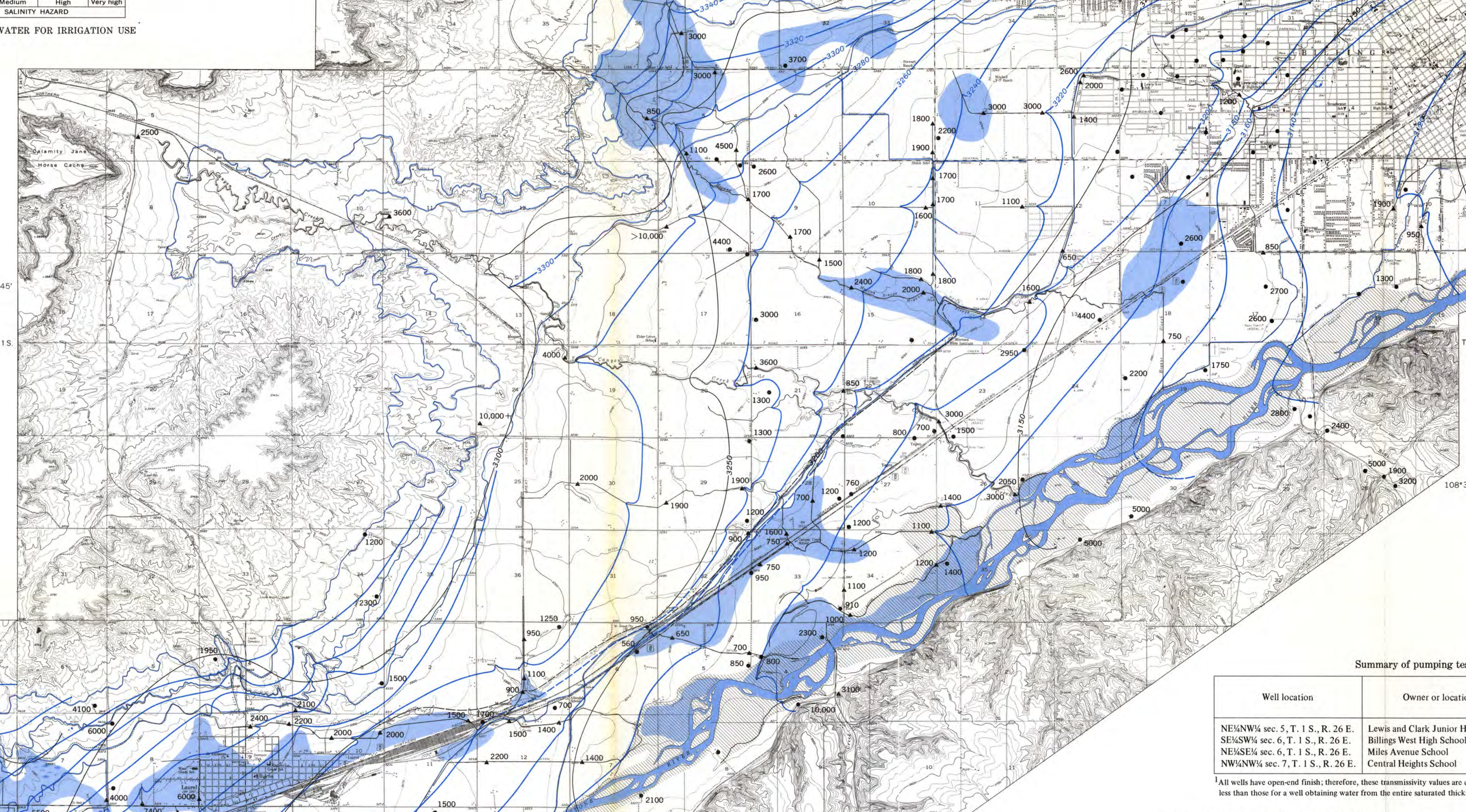
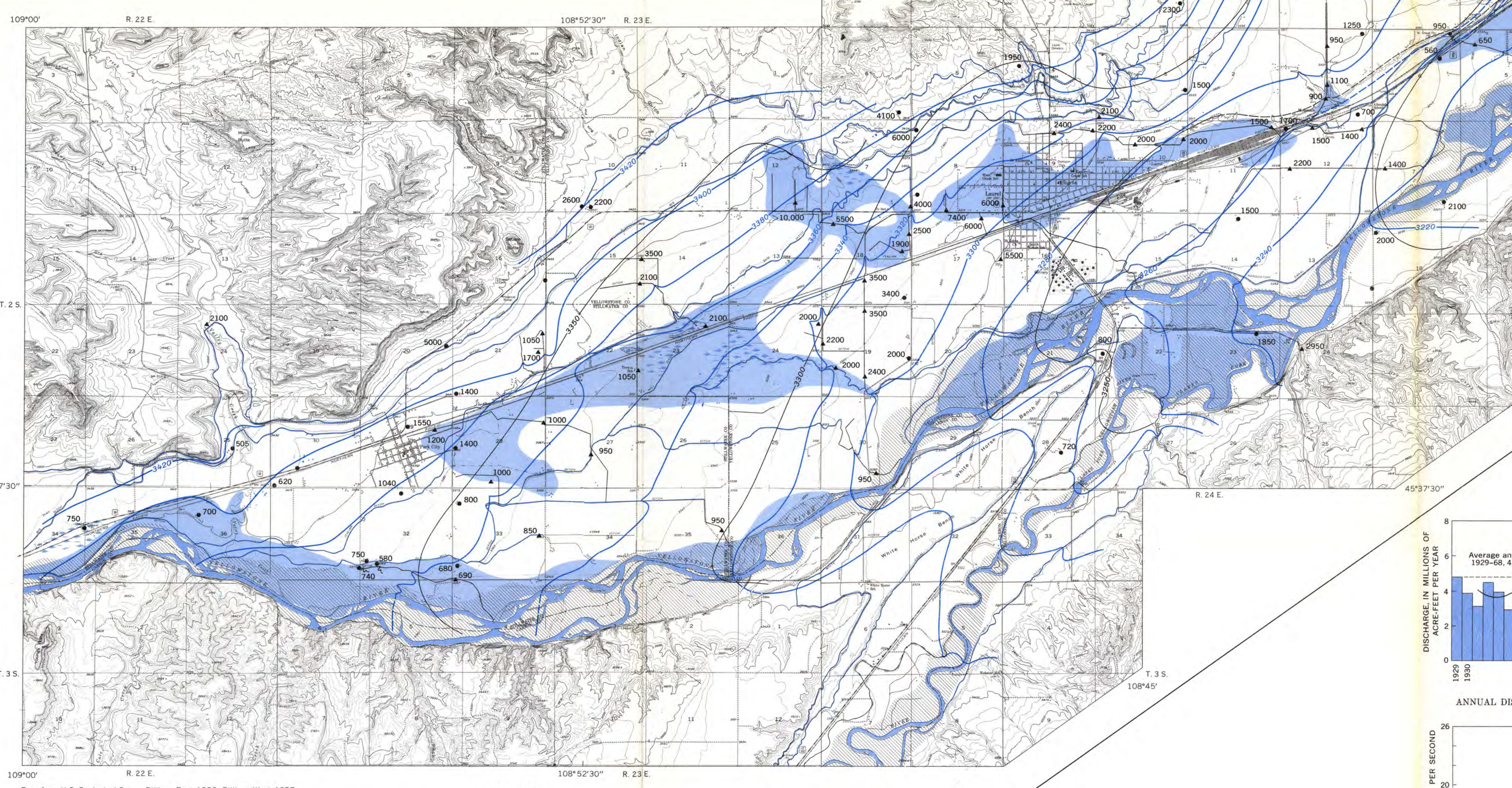
The suitability of water for irrigation according to its specific conductance and sodium adsorption ratio is shown on the diagram classifying water for irrigation use. Most ground water from wells near the river could be used for irrigation. Water from the deposits beneath the second and third terraces contains abundant sodium and dissolved solids and is marginal for irrigation use. However, it is not expected that ground water would be used for irrigation because of the large supply available from the Yellowstone River.



CLASSIFICATION OF WATER FOR IRRIGATION USE



HYDROGRAPHS OF SELECTED WELLS IN UNCONSOLIDATED DEPOSITS

EXPLANATION

——3300——
Water-table contour
Shows altitude of water table for August 1968; dashed where approximately located. Contour interval 20 feet. Datum is mean sea level

——3250——
Generalized bedrock contour
Shows altitude of bedrock surface; dashed where approximately located. Contour interval 50 feet. Datum is mean sea level

Line of ground-water discharge
Drainage ditch, natural drain, irrigation return flow ditch, or storm sewer.

Irrigation canal

●2050 ▲1100
Water conductivity
Conductivity of ground water in micromhos at 25° C. Circle, well; triangle, point of natural discharge, such as drainage ditch or gaining stream

Well

Spring

Marsh area

Area of potential flood hazard
Based on projected stage of 50-year flood, about 72,000 cubic feet per second for Yellowstone River at Billings and about 12,000 (cfs) for Clarks Fork near mouth. (Compiled by M. V. Johnson and R. J. Omang)

Waterlogged areas
Area where the water table rises to land surface or to within 5 feet of land surface each year during the irrigation season

Base from U.S. Geological Survey Billings East, 1956; Billings West, 1957; Laurel, 1956; Montaqua, 1956; Mossmain, 1956; Park City, 1956; Rimrock, 1956; Silesia, 1956; Two Pine School, 1956; and Yegan 1956

SCALE 1:48 000
1 ½ 0 1 2 3 MILES
1 .5 0 1 2 3 KILOMETERS

CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

TRUE NORTH / MAGNETIC NORTH 17°
APPROXIMATE MEAN DECLINATION, 1973

HYDROLOGIC MAP

Summary of pumping tests of wells finished in gravel

Well location	Owner or location	Pumping rate (gpm)	Pumping rate (cfs)	Drawdown (feet)	Time (minutes)	Transmissivity[1] (square feet per day)
NE¼NW¼ sec. 5, T. 1 S., R. 26 E.	Lewis and Clark Junior High School	264	0.589	1.59	200	3,600
SE¼SW¼ sec. 6, T. 1 S., R. 26 E.	Billings West High School	122	.272	1.36	100	3,200
NE¼SE¼ sec. 6, T. 1 S., R. 26 E.	Miles Avenue School	52	.116	.71	200	2,500
NW¼NW¼ sec. 7, T. 1 S., R. 26 E.	Central Heights School	161	.359	None	100	....

[1]All wells have open-end finish; therefore, these transmissivity values are considerably less than those for a well obtaining water from the entire saturated thickness.

Summary of analyses of ground water from wells in alluvium

[Analyses by Montana State Board of Health]

	Concentrations in milligrams per liter									
	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids[2]	Total hardness ($CaCO_3$)
Average for 20 samples	190	117	209	354	1,020	30	1.2	19	1,900	857
NW¼NW¼ sec. 8, T. 2 S., R. 24 E. high dissolved solids	465	300	630	435	3,230	30	1.2	1.4	5,330	2,400
NW¼SE¼ sec. 25, T. 2 S., R. 22 E. low dissolved solids	56	26	26	238	78	16	1.0	1.0	298	245
Recommended limit for drinking water[1]	-----	-----	-----	-----	500	250	[3]1.3	45	500	......

[1]U.S. Public Health Service drinking water standards, 1962.
[2]Calculated.
[3]Recommended upper limit for an annual average maximum air temperature of 58.4–63.8°F.

WATER USE

WATER REQUIREMENTS

The annual water requirement of water users in the study area ranges from 200,000 to almost 400,000 acre-feet per year. Agricultural consumption is 180,000 to 360,000 acre-feet per year, municipal consumption is about 20,000 acre-feet per year, and industrial and commercial consumption is about 5,000 acre-feet per year. The Yellowstone River supplies about 98 percent of water used; the remaining 2 percent is supplied from ground water.

IRRIGATION USE

The greatest use of water in the study area is for irrigation. Water to irrigate 61,000 acres is diverted from the Yellowstone River and the Clarks Fork of the Yellowstone within the study area. However, only 46,000 acres of the irrigated land lie within the boundaries of the study.

Five large irrigation companies and 12 small irrigation companies distribute water within the study area. The main canals of these companies can deliver 2,000 cfs from the Yellowstone River; however, only about 1,500 cfs is delivered during the peak irrigation season in an average year. About one-third of this water is used to irrigate land downstream, east of the study area.

The irrigation companies normally begin diversion in late April and end diversion about November 1. The requirement for irrigation varies from year to year, depending on the amount and distribution of rainfall and the air temperature during the growing season. The largest quantity of irrigation water is usually diverted in July and August. Rainfall in June is usually sufficient to sustain crops. Diversions during May, September, and October are about one-third of the peak requirement. Diversions in the study area range from 180,000 to 360,000 acre-feet per year. If 70 percent of the diversion is consumed, streamflow would be reduced by 130,000 to 250,000 acre-feet annually.

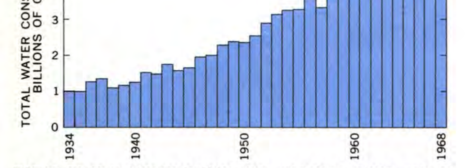
There is a trend toward reducing the total irrigated acreage as less profitable farmland is abandoned and as urban expansion infringes upon cultivated fields. As all irrigable land within the study area has been under cultivation at one time or another, it is not expected that the irrigation water requirement will be increased above the present level.

MUNICIPAL WATER CONSUMPTION

There are three water-treatment facilities in the study area. Billings and Laurel are supplied by water pumped from the river for treatment. The Lockwood suburban area east of Billings pumps water for municipal supply from three wells adjacent to the river. The Billings Bench area, the suburban expansion north and east of Billings, was supplied by individual wells until recently when the area was connected to the Billings water system. The residents of Park City are supplied from individual wells. Most of the farm residents in the valley use cisterns and haul water.

Municipal water supplied to Billings annually has increased from 1.1 billion gallons in 1934 to 4.6 billion gallons (14,100 acre-feet) in 1968 (see graph showing water consumption). The Billings municipal water system treats about 4 million gallons of water per day (6 cfs) during the winter and spring. It operates at capacity, 29 million gallons per day (44 cfs), during the lawn-watering season. This is a small part of the total flow of the Yellowstone River. Total municipal consumption is only about 10 percent of agricultural use. Residential consumption accounts for about 65 percent, industrial about 20 percent, and commercial about 15 percent of the municipal supply.

Billings is growing steadily and the population may exceed 100,000 in the 1980's. The water requirement of the city is not expected to rise above 30,000 acre-feet per year in the foreseeable future. Per capita water consumption in Billings was 40,000 gallons per year in 1949 and increased to about 45,000 gallons per year in 1968.



TOTAL WATER CONSUMPTION FOR BILLINGS, MONT., 1934-68
DATA FROM BILLINGS WATER TREATMENT PLANT

SURFACE WATER

SURFACE WATER

The Yellowstone River at Billings drains 11,795 square miles. The U.S. Geological Survey maintains one streamflow station in the study area at Billings. The average annual discharge at Billings was 4,840,000 acre-feet per year for 1929–68 (see annual-discharge hydrograph).

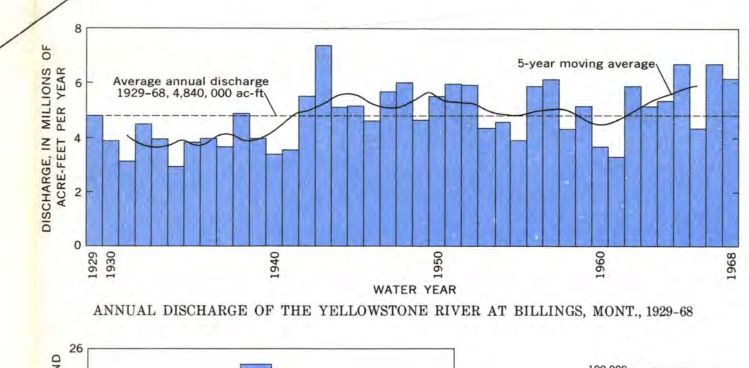
The principal tributary to the Yellowstone River in the study area is the Clarks Fork of the Yellowstone. Its basin comprises about 24 percent of the drainage area of the Yellowstone River at Billings. The Clarks Fork was gaged from 1921–69 at Edgar, 27 miles from the mouth. The stream is now (1970) gaged at Silesia, 22 miles from the mouth. The Clarks Fork contributes about 18 percent of the total annual flow, 21 percent of total low flow, and 18 percent of total high flow of the Yellowstone River.

Six small perennial streams join the Yellowstone River in the study area. These streams are not gaged, therefore, no stream-flow data are available.

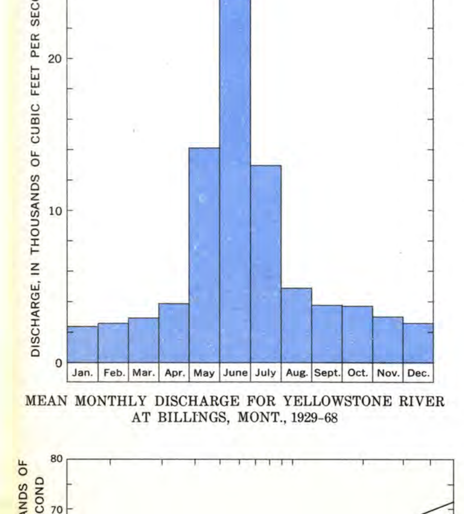
The major contribution to the flow of the Yellowstone River from August through April is ground-water inflow along the entire length of the river. From May through July, the flow at Billings is 10 times greater than low flow (see mean-monthly discharge graph). The high flow is the result of runoff from rain and from snowmelt at higher altitudes in the Yellowstone Park area.

Flood frequency analysis for the Yellowstone River at Billings shows that the peak flow of record, 66,100 cfs on June 16, 1967, was a 25-year high-water event. Recurrence intervals for floods of varying discharges are shown on the flood-frequency curve.

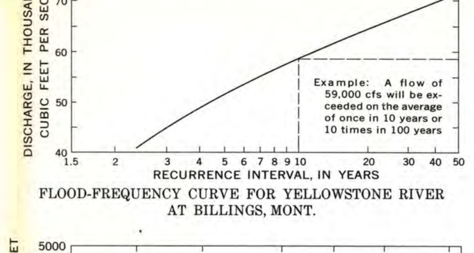
The flow-duration curve for the Yellowstone River at Billings shows the distribution of different magnitudes of daily flow during the period of record. The flow at Billings has exceeded 500 cfs 99.99 percent of the days. An analysis of the annual 1-day, 7-day, and 30-day periods of minimum flow is shown by the low-flow frequency curves. Low-flow periods occur in winter, usually in January or February, when subzero temperatures cause freezing of the river.



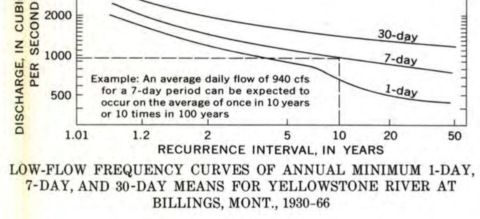
ANNUAL DISCHARGE OF THE YELLOWSTONE RIVER AT BILLINGS, MONT., 1929–68



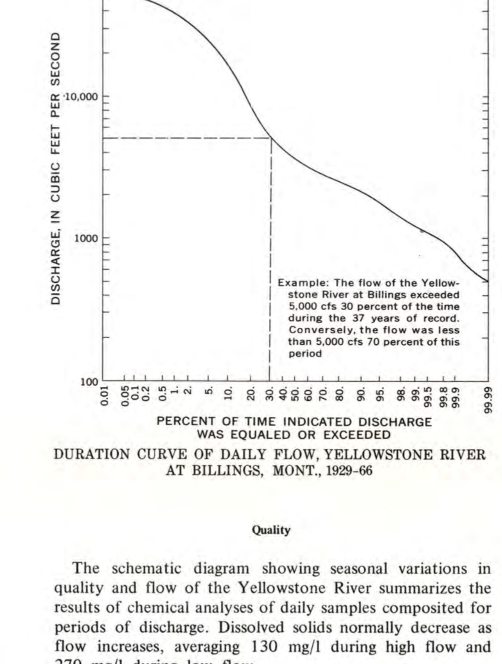
MEAN MONTHLY DISCHARGE FOR YELLOWSTONE RIVER AT BILLINGS, MONT., 1929–68



FLOOD-FREQUENCY CURVE FOR YELLOWSTONE RIVER AT BILLINGS, MONT.



LOW-FLOW FREQUENCY CURVES OF ANNUAL MINIMUM 1-DAY, 7-DAY, AND 30-DAY MEANS FOR YELLOWSTONE RIVER AT BILLINGS, MONT., 1930–66



DURATION CURVE OF DAILY FLOW, YELLOWSTONE RIVER AT BILLINGS, MONT., 1929–66

Summary of water quality of the Yellowstone River at Billings — summary of daily sampling for the periods 1951-58 and 1964-67

[Data from published records of the U.S. Geological Survey]

	Concentrations in milligrams per liter											
	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness ($CaCO_3$)
Record high[1]	26	107	55	62	6.2	322	383	25	1.9	3.4	868	316
Record low[1]	6	14	1	6	1.1	50	12	.0	.0	.0	87	52
Normal annual range	12–20	17–45	4–18	6–38	1.5–4.5	70–210	20–160	2–12	.1–.7	.2–3.0	95–380	60–210
Average	14	27	7.7	17	2.5	110	45	4	.3	1.0	180	104

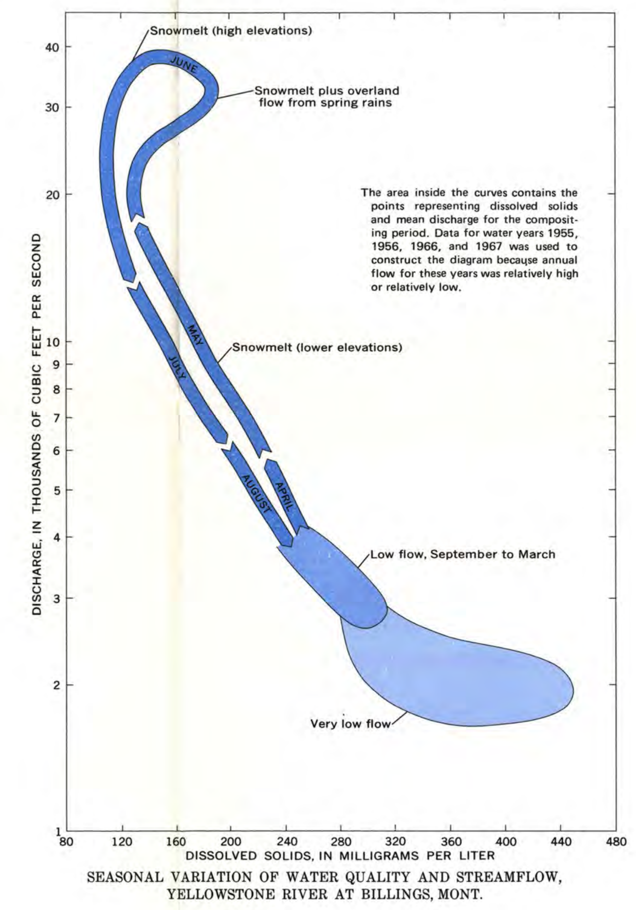
[1]Highest and lowest values for individual constituents during the period of record.

Quality

The schematic diagram showing seasonal variations in quality and flow of the Yellowstone River summarizes the results of chemical analyses of daily samples composited for periods of discharge. Dissolved solids normally decrease as flow increases, averaging 130 mg/l during high flow and 270 mg/l during low flow.

The water quality of the Yellowstone River is summarized in the table. The quality of the river water even during very low-flow periods is better than most of the ground water in the valley. The water is a calcium bicarbonate sodium sulfate type.

A 34-year record of daily water temperature (Aagaard, 1969) shows that the mean monthly water temperature varies from 0°C (32°F) in winter up to 19.5°C (67°F) in summer. The highest recorded water temperature at Billings is 24.5°C (76°F). The water temperature data indicate the suitability of the Yellowstone River water for use in cooling in industrial processes and the ability of the river to support trout or other game fish.



SEASONAL VARIATION OF WATER QUALITY AND STREAMFLOW, YELLOWSTONE RIVER AT BILLINGS, MONT.

CONCLUSIONS

The Yellowstone River valley is abundantly supplied by water from the Yellowstone River. The ground-water resources of the study area are adequate for domestic and stock supplies; however, in many areas the quality of ground water is marginal for these uses. The Yellowstone River is capable of supplying anticipated municipal and industrial requirements.

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WATER RESOURCES OF THE YELLOWSTONE RIVER VALLEY, BILLINGS TO PARK CITY, MONTANA

By
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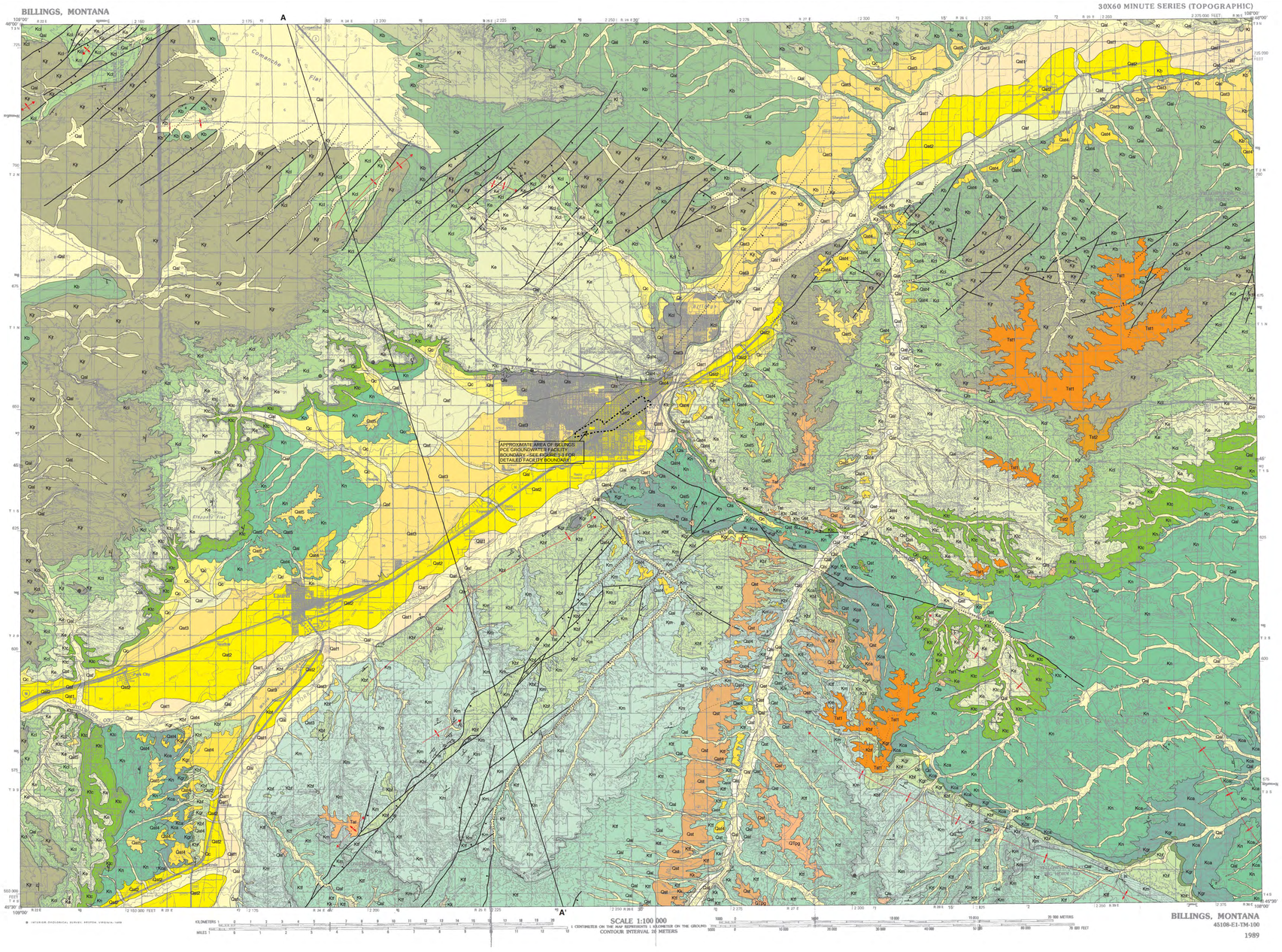
1973

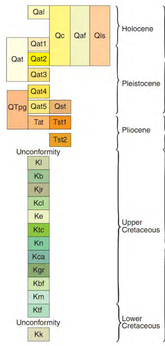
MONTANA BUREAU OF MINES AND GEOLOGY
A Department of Montana Tech of The University of Montana

Prepared in Cooperation with the U.S. Geological Survey and the U.S. Department of Energy National Petroleum Technology Office

GEOLOGIC MAP SERIES NO. 59
Billings 30' x 60' Quadrangle, Lopez 2000



CORRELATION OF MAP UNITS



MAP SYMBOLS

Contact: Dashed where approximately located, dotted where concealed

Fault: Dashed where approximately located, dotted where concealed. Ball and bar on downthrown side. Several faults have been reactivated at different times and show vertical and strike-slip displacements

Horizontal beds

Strike and dip of inclined beds

Anticline: Showing trace of axial plane and direction of plunge, dotted where concealed

Syncline: Showing trace of axial plane and direction of plunge, dotted where concealed

Monocline: Showing axial plane trace of anticlinal flexure and direction of plunge; dashed where approximately located, dotted where concealed; shorter arrow on more steeply dipping limb

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DESCRIPTION OF MAP UNITS

Qal **Alluvium** (Holocene): Gravel, sand, silt, and clay along active channels of rivers, creeks, and tributaries. Coarse, well-rounded gravel restricted mainly to Pryor Creek and Yellowstone River drainages. Most sediment in tributary drainages is sand, silt, and clay derived from local Cretaceous sandstone and shale bedrock.

Qc **Colluvium** (Holocene and Pleistocene): Locally derived slope-wash deposits mainly of sand, silt, and clay. Typically thin veneer concealing bedrock, but locally as thick as 30 feet. Commonly grades into Qal. Locally contains well-rounded cobbles derived from alluvial terrace gravel.

Qaf **Alluvial fan deposits** (Holocene and Pleistocene): Gravel, sand, silt, and clay deposited in fans being formed by modern streams along major valley margins. Display characteristic fan-shaped map pattern and convex upward profile. Typically grade upstream into Qal. Thickness ranges from very thin at toes to as much as 50 feet at heads of fans.

Qls **Landslide deposits** (Holocene and Pleistocene): Unconsolidated mixture of soil and blocks of bedrock transported down steep slopes by mass wasting, locally consist of internally cohesive, rotated slump blocks. Characteristic hummocky surface with concentric swales and ridges near downslope limits. Common along steep slopes beneath the Eagle Sandstone, Judith River Formation, and along steep slopes underlain by Cretaceous shales, but can occur where slope and moisture content produce unstable conditions. Numerous small slides and some with minor amounts of downslope displacement (R.B. Colton, U.S. Geological Survey, 1995, written communication) are not shown because of bedrock emphasis of this map.

QTpg **Pediment gravel deposits** (Pleistocene and Pliocene?): Angular and subangular coarse gravel derived from local bedrock, mostly limestone, form smooth surfaces sloping away from the Pryor and Big Horn mountains. About 10 to 30 feet thick.

—**ALLUVIAL TERRACE GRAVELS**—

Qat1 **Alluvial gravel, terrace level 1** (Holocene and Pleistocene): Gravel underlying terraces about 10 to 20 feet above present altitude of Yellowstone River. Mostly cobbles and pebbles with minor amounts of sand and silt. Clasts are mainly granitic igneous rocks, granitic gneiss, schist, and quartzite, with much less limestone and sandstone. Forty to 60 feet thick (Gosling and Pashley, 1973).

Qat2 **Alluvial gravel, terrace level 2** (Pleistocene): Gravel underlying terraces about 20 to 40 feet above present elevation of Yellowstone River. Mostly cobbles and pebbles with minor amounts of sand and silt. Clasts are mainly granitic igneous rocks, granitic gneiss, schist, and quartzite, with much less limestone and sandstone. Forty to 60 feet thick (Gosling and Pashley, 1973).

Qat3 **Alluvial gravel, terrace level 3** (Pleistocene): Gravel underlying terraces about 50 to 90 feet above present altitude of Yellowstone River. Mostly cobbles and pebbles with minor amounts of sand and silt. Clasts are mainly granitic igneous rocks, granitic gneiss, schist, and quartzite, with much less limestone and sandstone. This deposit grades from about 20 to 30 feet at its southern edge to about five feet at its northern limit (Gosling and Pashley, 1973), where it is overlain by colluvium and alluvial fan deposits of silty clay.

Qat4 **Alluvial gravel, terrace level 4** (Pleistocene): Gravel underlying terraces about 200 to 300 feet above present altitude of Yellowstone River. These terraces locally exhibit a relatively steep gradient toward the Yellowstone River valley and may actually include several levels of terraces that are difficult to distinguish. Cobble- and pebble-size clasts are mainly granite, granitic gneiss, schist, and quartzite. Thickness up to about 20 feet.

Qat5 **Alluvial gravel, terrace level 5** (Pleistocene): Gravel underlying terraces about 400 to 500 feet above present altitude of Yellowstone River. Occur mainly as small, discontinuous erosional remnants. Cobble- and pebble-size clasts are mainly granite, granitic gneiss, schist, and quartzite. Calcite cement locally present, especially at base. Thickness ranges from a very thin remnant to about 20 feet.

Qat **Alluvial gravel undivided** (Holocene and Pleistocene?): Gravel, sand, silt, and clay underlying terraces about 20 to 200 feet above present altitude of modern streams and rivers. Equivalent to Qat1-Qat4. Mapped only in Pryor Creek drainage. Clasts are mainly andesite, with much less limestone, quartzite, and sandstone. Much of gravel apparently derived from within present Pryor Creek drainage and from reworking of higher level terrace gravel.

Tat **Alluvial gravel, terrace level 6** (Pliocene?): Gravel underlying remnant of terrace about 900 feet above present altitude of Yellowstone River. Composed mainly of well-rounded cobbles of granitic gneiss, schist, and quartzite. Locally contains high but variable percentage of rounded to subrounded cobbles and smaller clasts of quartzite and silicous siltstone and mudstone apparently derived from the Mowry Shale. Scattered cobbles at these higher levels are common, indicating terrace was once much more widespread. Assumed to be Pliocene because terrace gravel of similar altitude in Pryor Creek drainage contains radiometrically dated Pliocene ash bed (see Tst). About 30 to 40 feet thick.

—**ALLUVIAL TERRACES OF THE ANCESTRAL SHOSHONE RIVER**—

Qst **Ancestral Shoshone River gravel, terrace level 1** (Pleistocene): Gravel and sand underlying terraces about 400 feet above present altitude of Pryor Creek in its lower reaches. But because of the much steeper gradient of present day Pryor Creek, near the Pryor Mountains this terrace is below the level of Pryor Creek. Transported by ancestral Shoshone River that flowed through Pryor Gap (Mackin, 1937). Commonly calcite-cemented near base. Clasts are mainly cobbles and pebbles of dark-colored andesitic rocks (Absaroka Volcanics), and lesser amounts limestone and quartzite. Age estimated to be about 1.4 m.y. (Reheis, 1985). Ten to 50 feet thick in map area.

Tst1 **Ancestral Shosone River gravel, terrace level 2** (Pliocene): Gravel and sand underlying terraces about 650 feet above present altitude of Pryor Creek (about 900 feet above the present Yellowstone River). Cobbles and smaller clasts are mostly andesite (Absaroka Volcanics), with lesser amounts of limestone and quartzite. Locally calcite-cemented at base. Pliocene age established from ash bed dated 2.02 m.y. (Huckleberry Ridge Ash) in this terrace gravel in T. 3 S., R. 26 E., section 7 (Izett and Wilcox, 1982). Thickness is 20 to 30 feet.

Tst2 **Ancestral Shoshone River gravel, terrace level 3** (Pliocene): Gravel and sand underlying terraces about 750 feet above present day Pryor Creek (1,000 feet above the present day Yellowstone River). Cobbles and gravel are similar to Tst1, except for the presence of at least 25% granitic cobbles. These granitic cobbles were probably derived from the Clarks Fork drainage in the Beartooth Mountains, which is thought to have been a tributary of the Ancestral Shoshone River before being captured by the Yellowstone River drainage system (Mackin, 1937). About 20 to 30 feet thick.

—**BEDROCK MAP UNITS**—

Kl **Lance Formation** (Upper Cretaceous): Interbedded light-brownish gray, cliff and ledge-forming, fine-grained, thick-bedded to massive sandstone, medium-gray fissile shale, and a few thin beds of coal. Sandstone beds support growths of pine trees. In the Pompey's Pillar area, a thin section of Fox Hills Sandstone is included at the base of the Lance (Edith Wilde, Montana Bureau of Mines and Geology, 1996, personal communication). Along the north-central margin of the quadrangle, beds mapped as Lance resemble the Hell Creek of other areas (Edith Wilde, Montana Bureau of Mines and Geology, 1996, personal communication). Total thickness of the formation is about 350 feet.

Kb **Bearpaw Shale** (Upper Cretaceous): Dark-gray shale, commonly weathering dark brownish-gray, fissile, fossiliferous, brownish-gray calcareous concretions and nodules are common. Middle part of formation contains numerous thin mostly greenish-gray bentonite beds; thin sandstone beds are common near the top. The thickness is about 800 feet but thins westward to 200 to 300 feet.

Kjr **Judith River Formation** (Upper Cretaceous): Interbedded brownish-gray sandy shale and light-brown to pale yellowish-brown argillaceous, very fine to fine-grained lenticular sandstone in beds up to 10 ft thick. Locally a massive cliff-forming sandstone, resembling those in the Eagle Sandstone, occurs at the base and is commonly correlated with the Parkman Sandstone. Sandstones friable to moderately well indurated, cross-bedded, and burrowed to bioturbated and support growths of pine trees. In the western part of the quadrangle, greenish-gray and pale maroon-gray mudstones and easily eroded sandstones occur near the top of the formation. The thickness ranges from 250 to 350 feet because of lenticularity of the sandstones and eastward regional thinning.

Kcl **Claggett Shale** (Upper Cretaceous): Brownish-gray fissile shale with minor interbeds of light brownish-gray, very argillaceous sandstone. Light brownish-gray to light-brown, calcareous concretions common, usually fossiliferous. The upper contact is gradational and conformable and is placed at the change to ledge-forming sandstones of the Judith River Formation. Thickness of the formation is 100 to 400 feet thinning westward.

Ke **Eagle Sandstone** (Upper Cretaceous): Light brownish-gray to very pale-orange very fine to fine-grained, cross-bedded sandstone, burrowed to bioturbated in part. Locally contains calcareous, light-brown sandstone concretions up to 15 feet in diameter. Up to four sandstone intervals 10 to 50 feet thick can be present with intervening sandy shale as thick as 50 feet. Ranges from 100 to 350 feet because of lensing of sandstone intervals.

Klc **Telegraph Creek Formation** (Upper Cretaceous): Shale and sandy shale, brownish-gray to medium dark-gray with thin, interbedded sandstone. Dusky-red concretions common near base. Sandstone beds thicker and more abundant upward, grading into Eagle Sandstone. Contact with Eagle is placed at the base of the first cliff-forming sandstone. Maximum thickness about 150 feet.

Kn **Niobrara Shale** (Upper Cretaceous): Shale, olive-gray and dark brownish-gray, fissile, and contains abundant thin bentonite beds. Upper half calcareous, containing few very thin bentonite beds, and near top contains thin beds of very calcareous-laminated sandstone, siltstone, and sandy limestone. Concretions medium light-gray to pale yellowish-brown and from a few inches to one or two feet in diameter commonly present. Inoceramus prisms common. Upper contact placed at change from calcareous shales to non-calcareous shales of Telegraph Creek. Zone of dusky-red concretions in Telegraph Creek just above contact also helps establish its position. Basal contact is placed below ledge-forming zone of closely spaced, fossiliferous gray septarian concretions with veins brown calcite. In the Billings area about 700 feet thick.

Kca **Carlile Shale** (Upper Cretaceous): Shale, dark-gray to dark bluish-gray fissile. Interval about mid-section contains laminae and thin beds of argillaceous, platy, light brownish-gray to light olive-gray sandstone that locally supports growth of pine trees, but otherwise nearly bare of soil and vegetation. Septarian nodules and concretions common, ranging from light gray to dark yellowish-orange. Approximately 250 to 300 feet thick.

Kgr **Greenhorn Formation** (Upper Cretaceous): Shale, dark bluish-gray, calcareous, fossiliferous. Typically poorly exposed, but forms very light brownish-gray soil upon weathering. Locally, the lower contact is marked by zone of closely spaced, gray, calcareous, septarian concretions at the base of the Greenhorn. Upper contact marked by change to non-calcareous shale. Thickness 50 to 75 feet.

Kbf **Belle Fourche Shale** (Upper Cretaceous): Shale, dark-gray, fissile, containing several thick bentonite beds in lower part. Thin sandstone bed commonly containing small chert pebbles, and zone of very dusky-purple to glossy grayish-black, ironstone concretions near base. Light-gray, brownish-gray concretions 6 in. to 1 foot in diameter and large (as much as four feet in diameter) light-brown to dark yellowish-orange concretions characteristic. "Frontier-like" sandstone present in upper part that is fine- to medium-grained, salt-and-pepper sandstone, and very thin to absent in eastern part of map area and about 1 to 2 feet thick in west. Upper contact marked by abrupt change to very calcareous shale above a very light greenish-gray bentonite bed about two feet thick at the top of the Belle Fourche Shale. Thickness is 350 to 400 feet.

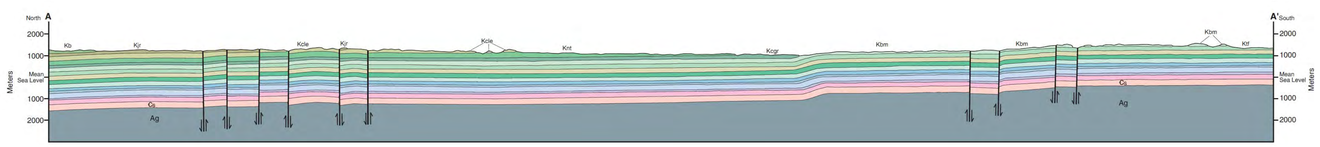
Km **Mowry Shale** (Upper Cretaceous): Interbedded, siliceous, very fine- to fine-grained sandstone, siltstone, and shale. Sandstones and siltstones mostly light-gray to medium-gray, with a silvery sheen. Some sandstone beds in Billings area are highly silicified, very hard quartzite. Shales are fissile, and mainly medium dark-gray. Bentonite beds common, 1 to 4 feet thick, including prominent beds at base and near top. Fish scales on bedding planes of sandstones and siltstones are characteristic of the formation. Thin, coarse lag deposit containing fish bones, fish teeth, and chert pebbles near the middle of the section. Upper contact of Mowry marked by thick bentonite above last fish scale-bearing sandstone. Basal contact placed at change from dark-gray fissile Thermopolis Shale to characteristic silvery sandstone and siltstone of Mowry containing fish scales. Thickness about 250 feet.

Krf **Thermopolis Shale and Fall River Sandstone Undivided** (Lower Cretaceous): Upper 50 feet shale, dark-gray fissile, with few thin bentonite beds. Interval below this is dark-gray to brownish-gray and olive-gray, fissile shale with thin interbeds and laminae of olive-gray and light olive-gray, argillaceous sandstone. Common bentonite beds and zones of iridescent very dusky-purple to grayish-black, ironstone concretions. The Fall River Sandstone at the base of the Thermopolis is an upward coarsening sequence of interbedded medium dark-gray, fissile shale and fine-grained, quartzose, light brownish-gray to moderate yellowish-brown sandstone. Sandstone coarsens and beds thicken slightly up section, commonly rippled, burrowed to bioturbated, and moderately to heavily limonite and hematite stained. Total thickness of the Thermopolis and Fall River Sandstone is about 600 to 650 feet.

Kk **Kootenai Formation** (Lower Cretaceous): Mostly reddish-brown, olive-gray, and dusky-purple mudstones with interbedded, lenticular, fine- to coarse-grained sandstones. Locally thick, lenticular, fluvial, fine-grained sandstone, the Greybull Sandstone, is present at the top. The basal Pryor Conglomerate Member is brown conglomerate and pebbly coarse-grained sandstone and is 20 to 60 feet thick. The total thickness of the Kootenai Formation is 200 to 250 feet.

Adjacent 30' x 60' maps

Harlowton	Roundup	Hysham
Big Timber	Billings	Hardin
Red Lodge	Bridger	Lodge Grass

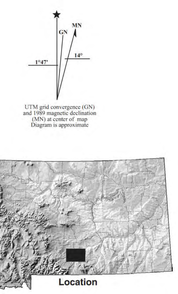


Cross Section A–A'

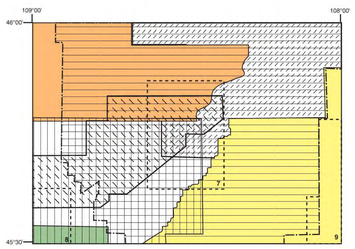
Scale (Vertical and Horizontal) 1:100,000
Surficial deposits not shown

- **Kb** Bearpaw Shale
- **Kjr** Judith River Formation
- **Kcle** Claggett Shale & Eagle Sandstone*
- **Knt** Niobrara & Telegraph Creek Formations*
- **Kcgr** Carlile Shale & Greenhorn Formation*
- **Kbm** Belle Fourche & Mowry Shales*
- **Krf** Thermopolis Shale & Fall River Sandstone
- **KJkm** Kootenai & Morrison Formations*
- **Je** Ellis Group, undivided
- **Tc** Chugwater Formation
- **Pt** Tensleep Sandstone
- **PMa** Amsden Formation
- **Mm** Madison Group, undivided
- **Dj** Jefferson Formation
- **Ob** Bighorn Dolomite
- **Cs** Cambrian sedimentary rocks, undivided
- **Ag** Granitic gneiss, hornblende schist, and biotite schist

* Units combined on cross section only



INDEX OF PREVIOUS GEOLOGIC MAPPING



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Geologic Map of the Billings 30' x 60' Quadrangle, Montana

by
David A. Lopez
2000

Maps may be obtained from
Publications Office
Montana Bureau of Mines and Geology
1300 West Park Street, Butte, Montana 59701-8997
Phone: (406) 496-4167 or (406) 496-4174
Fax: (406) 496-4451
http://mbmgsun.mtech.edu

015 26E 03 ACAA

MONTANA WELL LOG REPORT

Form No. 603 R2-04

Well ID# _____

This log reports the activities of a licensed Montana well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered. **This form is to be completed by the driller and filed with MBMG within 60 days of completion of the work.** **Acquiring Water Rights is the well owner's responsibility and is not accomplished by the filing of this report.**

Well log information is stored in the Groundwater Information Center at the Montana Bureau of Mines and Geology (Butte) and water right information is stored in the Water Rights Bureau records (Helena).

For fields that are not applicable, enter NA. Optional fields have a grayed background. Record additional information in the REMARKS section.

1. WELL OWNER:
Name Peering Clinic
Mailing address 1235 S. 27th
Billings MT 59101

2. WELL LOCATION: List ¼ from smallest to largest
NW ¼ NW ¼ SW ¼ NW ¼, Section 3
Township 2 N/S Range 26 E/W County Yellowstone
Lot ____, Tract/Blk ____ Subdivision Name
Well Address 1235 S. 27th Bgs. MT
GPS ☐ Yes ☒ No
Ok Latitude _____ Longitude _____
Error as reported by GPS locator (± feet) _____
Horizontal datum ☐ NAD27 ☐ WGS84

3. PROPOSED USE: ☐ Domestic ☐ Stock ☒ Irrigation
☐ Public water supply ☐ Monitoring Well ☐ Other:

4. TYPE OF WORK:
☒ New well ☐ Deepen existing well ☐ Abandon existing well
Method: ☐ Cable ☒ Rotary ☐ Other: _____

5. WELL CONSTRUCTION DETAILS:

Borehole:
Dia. 6 in. from 0 ft. to 40 ft.
Dia. ____ in. from ____ ft. to ____ ft.
Dia. ____ in. from ____ ft. to ____ ft.

Casing:
Steel: Wall thickness .250 ☐ Threaded ☒ Welded
Dia. 6 5/8 in. from +1'6" ft. to 35 ft.
Dia. ____ in. from ____ ft. to ____ ft.

Plastic: Pressure Rating ____ lbs. ☐ Threaded ☐ Welded
Dia. ____ in. from ____ ft. to ____ ft.

Perforations/Slotted Pipe:
Type of perforator used Air Perforator
Size of perforations/slots 1/4 in. by 1 in.
4 Rows no. of perforations/slots from 19 ft. to 24 ft.
____ no. of perforations/slots from ____ ft. to ____ ft.

Screens: ☐ Yes ☒ No
Material _____
Dia. ____ Slot size ____ from ____ ft. to ____ ft.
Dia. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel Packed: ☐ Yes ☒ No
Size of gravel _____
Gravel placed from ____ ft. to ____ ft.

Packer: ☐ Yes ☒ No
Type _____ Depth(s) _____

Grout: Material used 8 Casing Seal
Depth from 0 ft. to 35 ft. OR ☒ Continuous feed

6. WELL TEST DATA:
A well test is required for all wells. (*See details on well log report cover.*)
☒ Static water level 18'2½" ft. below top of casing **or**
☐ Closed-in artesian pressure ____ psi.
How was test flow measured:
bucket/stopwatch, weir, flume, flowmeter, etc _____
Yellowstone Controlled Groundwater Area - Water Temperature 55 °F
☐ AQUIFER TEST DATA FORM ATTACHED

Test - 1 hour minimum
Drawdown is the amount water level is lowered below static level.
All depth measurements shall be from the top of the well casing.
Time of recovery is hours/minutes since pumping stopped.

Air test*
48 gpm with drill stem set at 35 ft. for 2½ hours
Time of recovery 35 hrs/min Recovery water level ____ ft. 18'2½"

OR Bailer test*
____ gpm with ____ ft. of drawdown after ____ hours
Time of recovery ____ hrs/min. Recovery water level ____ ft.

OR Pump test*
Depth pump set for test 31 ft.
53 gpm pump rate with 2 ft. of drawdown after 3 hrs pumping
Time of recovery 24 hrs/min Recovery water level ____ ft. 18'2½"

OR Flowing Artesian*
____ gpm for ____ hours
Flow controlled by _____

**During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the resevoir of the well casing.*

7. WELL LOG: HD

Depth, Feet From	Depth, Feet To	Material: color/rock and type/descriptor (example: blue/shale/hard, or brown/gravel/water, or brown/sand/heaving)
0	1	Topsoil
2	7	Dense / Tan Clay
7	18	Sand
18	19	Clay
19	24	Gravel with lots of Sand and Silts
24	31	Blue Shale
31	37	Black Siltstone with Blue Clay lens 1"-4" thick
37	40	Super Hard Black Siltstone

RECEIVED
OCT 03 2005
M.B.M.G.

☐ ADDITIONAL SHEETS ATTACHED

8. DATE WELL COMPLETED: Aug 27. 2005

9. REMARKS: _____

10. DRILLER/CONTRACTOR'S CERTIFICATION:
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.
Name, firm, or corporation (print) A-1 Drilling
Address 830 Yellowstone Ave S. Cowbel, MT
Signature [signature]
Date 8-27-05 License no. MWWC #532

Montana Bureau of Mines & Geology
The University of Montana
1300 West Park Street
Butte, MT 59701

MBMG ID# 222943

111 01S 26E 10 DDAD

MONTANA BUREAU OF MINES AND GEOLOGY
WELL DATA SHEET

022223

TOWNSHIP 01 N ☐ S ☒ RANGE 26 E ☒ W ☐ SECTION 10 TRACT ddad SEQUENCE NO. __

COUNTY Yellowstone CODE 111

Original owner: State of Montana Address: Overpass on Sugar Ave

Owner (1962 yr.): Resident (if not owner):

Addition (if in subdivision): Block: Lot: Other:

USGS 7.5' map: Lat. ° ′ ″ N; Lon ° ′ ″ W

Altitude of Land Surface(L.S.) @ well: 3123.85 Ft.

REPORTED DATA

Total depth of well below L.S.: 34.6 Ft.

Pumping water level below L.S.: Ft.

Static water level below* L.S.: 3.0 Ft.

Yield in gallons per minute:

How tested: hours:

If flowing, shut-in pressure in PSI:

CASING

From (Ft.)	To (Ft.)	Dia.(in.)	Type

PERFS

From (Ft.)	To (Ft.)	Description

Pump type: Size (HP):

Well seal type:

Well seal depth: from Ft. to Ft.

Water use:

Date well completed: 12 day 01 mo. 1962 year

How drilled:

By whom: Swanson Licence no.:

SOURCE

Well appropriation: ☐ MBMG: ☐

Driller: ☐ Owner: ☐ USGS: ☐

SCS: ☐ Other (specify): Highway Dept

FIELD DATA

Has well location been field verified?: ☐ yes ☐ no

By whom: Agency:

Date verified: day mo. year

Location of measuring point:

		DATE MEASURED DAY	MO.	YEAR
Measuring point** L.S.:	Ft.			
Total depth of well below L.S.:	Ft.			
Pumping water level below L.S.:	Ft.			
Static water level below* L.S.:	Ft.			
pH:				
Water temperature:	°C			
Specific conductivity @ 25°C:				
Yield in gallons per minute:				

How measured: hours:

FILED DATA

MBMG water well no.(key): Q

MBMG water quality no.(key):

MBMG aquifer test: ☐ yes ☐ no Project no.:

MBMG static water level file: ☐ yes ☐ no

DNRC WR number(key): Geophysics logs: ☐ yes ☐ no

USGS groundwater station ID no.:

REMARKS

Core # 418

* If well is flowing, place a (+) here. If the discharge height above land surface is known, place that value here and precede it by a (+).

** Above (+), below (−) L.S.

LITHOLOGIC LOG

(Ft.) From	(Ft.) To	Lithologic Descriptions
0	2.8	soft brown sandy silt
2.8	7.1	Loose fine brown silty sand
7.1	18.8	Fine to medium dense sandy gravel
18.8	20.7	Contact - Very hard gray clayey shale
20.7	24.0	Soft strata 2'9" thick
24	34.6	Very hard gray sandy shale with stratas of firm sandy Clay Bottomed hole in hard gray sandy Shale with stratas of firm sandy Clay

Aquifer: Code:

SKETCH MAP

Date this form completed: DAY MO. YEAR

By: M:94066

Lab. Form 30
Revised 11-22-55

MONTANA HIGHWAY COMMISSION

Helena, Montana

(D-1-26) 10 dd a d

Core Log No. 418 Project No. I-IG-90-8 (5) Hole No. 7
Termini Billings Date Taken July 12, 1962
Location 37' Rt. Sta. 773+86 Structure Overpass on Sugar Avenue
Party Chief Swanson Others Lincoln, McLenegan

Stratification Elev.	Depth	Legend	Description of Materials Type, Color & Consistency
3123.85'	2.8		Soft brown sandy silt.
	7.1		Loose fine brown silty sand.
	18.8		Fine to medium dense sandy gravel.
	20.7		Contact-Very hard gray clayey shale. Soft strata-2.9' thick.
	24.0		Very hard gray sandy shale with stratas of firm sandy clay.
	34.6		Bottomed Hole in hard gray sandy shale, with stratas of firm sandy clay.

Miscellaneous Data
Depth of Hole 34.6 Ft.
Rock
Wt. of Hammer 140# & 300#
Average Fall of Hammer 30"
Elev. of Ground Water. 3.0'

Remarks

Total BX Casing - 20.4 Ft.

Casing Blows	Penet-ration	Rotary Drilling	
Standard 2" Dry Sample Tube Test - 140# Hammer			
1/ 1/ 1	1.5	@	1.5 to 3.0'
1/ 1/ 1	1.5	@	3.0 to 4.5
1/ 1/	1.5	@	4.5 to 6.0
1/12/20	1.5	@	6.0 to 7.5
43/39/33	1.5	@	9.5 to 11.0
38/50/ R	1.0	@	14.5 to 15.5
50/ R	0.3	@	19.0 to 19.3
BX Casing Drive Count - 300# Hammer			
26	1.0	@	8.0 to 9.0'
45	1.0	@	11.0 to 12.0
26	1.0	@	13.0 to 14.0
40	1.0	@	16.0 to 17.0
50	0.8	@	18.0 to 18.8

Rotary Drilling Data - Started Core @ 19.3'

Draw	@	24.6'	60% Recovery
Draw	@	33.1'	40% Recovery
Draw	@	34.6'	30% Recovery

Elevation Data

Ref. Point. - Top of hub @ Sta. 775+95-Elev. 3124.50

BM	BS	HI	FS	CE
3124.50	4.65	3129.15	5.30	3123.85

15,286
10/11
1/100 S
2,000'S
Sugar Ave.

111 01S 26E 09 BBAD

MONTANA BUREAU OF MINES AND GEOLOGY
WELL DATA SHEET

022221

TOWNSHIP 01 N ☐ S ☒ RANGE 26 E ☒ W ☐ SECTION 09 TRACT BBAD SEQUENCE NO. __

COUNTY Yellowstone CODE 111

Original owner: State of Montana Address: Overpass on N.P.R.R.

Owner (1956 yr.): Resident (if not owner):

Addition (if in subdivision): Block: Lot: Other:

USGS 7.5' map: Lat. __ ° __ ′ __ ″ N; Lon __ ° __ ′ __ ″ W

Altitude of Land Surface(L.S.) @ well: 3146.31 Ft.

REPORTED DATA

Total depth of well below L.S.: 61 Ft.

Pumping water level below L.S.: Ft.

Static water level below* L.S.: 11.2 Ft.

Yield in gallons per minute:

How tested: hours:

If flowing, shut-in pressure in PSI:

CASING

From (Ft.)	To (Ft.)	Dia.(in.)	Type

PERFS

From (Ft.)	To (Ft.)	Description

Pump type: Size (HP):

Well seal type:

Well seal depth: from Ft. to Ft.

Water use:

Date well completed: 21 day 05 mo. 1956 year

How drilled:

By whom: Albrecht Licence no.:

SOURCE

Well appropriation: ☐ MBMG: ☐

Driller: ☐ Owner: ☐ USGS: ☐

SCS: ☐ Other (specify): Highway Dept

FIELD DATA

Has well location been field verified?: ☒ yes ☐ no

By whom: JRS Agency: USGS

Date verified: 06 day 12 mo. 1979 year

Location of measuring point:

		DATE MEASURED DAY	MO.	YEAR
Measuring point** L.S.:	Ft.			
Total depth of well below L.S.:	Ft.			
Pumping water level below L.S.:	Ft.			
Static water level below* L.S.:	Ft.			
pH:				
Water temperature:	°C			
Specific conductivity @ 25°C:				
Yield in gallons per minute:				

How measured: hours:

FILE DATA

MBMG water well no.(key): Q

MBMG water quality no.(key):

MBMG aquifer test: ☐ yes ☐ no Project no.:

MBMG static water level file: ☐ yes ☐ no

DNRC WR number(key): Geophysics logs: ☐ yes ☐ no

USGS groundwater station ID no.:

REMARKS

Core log 125

* If well is flowing, place a (+) here. If the discharge height above land surface is known, place that value here and precede it by a (+).

** Above (+), below (−) L.S.

LITHOLOGIC LOG

(Ft.) From	(Ft.) To	Lithologic Descriptions
0	10.6	Soft tan to brown Clay
10.6	32.3	Contact on fine gravel
32.3	33.10	Contact Blue grey clay
33.10	34	Contact on Colorado shale Dark grey to Black Colorado Shale
34	35.8	Aprox Contact grey Sandy clay
35.8	61	Contact on silt stone Strata 4" thick changing to Colorado Shale
		Bottomed Hole in Colorado Shale

Aquifer: Code:

SKETCH MAP

M:93965

Date this form completed: __ DAY __ MO. ____ YEAR

By:

Lab. Form 30
Revised 11-22-55

MONTANA HIGHWAY COMMISSION

Helena, Montana

Top Bc

~~[illegible] 9 [illegible]~~

01S26E09BBAD
12-06-79 JRS

Core Log No. 125 Project No. F-FG 225(13) Hole No. 9

Termini Billings - Laurel Date Taken May 18 & 21, 1956

Location 4'-0" Rt. of South ℄ Sta 692+84 Structure Overpass on N.P.R.R.

Party Chief Albright Others Swanson & Larson

Stratification Elev.	Depth	Legend	Description of Materials Type, Color & Consistency	Casing Blows	Casing Penetration	Rotary Drilling	Miscellaneous Data / Remarks
							Depth of Hole 61'-0"
							Rock
							Wt. of Hammer 300#
							Average Fall of Hammer 24"
							Elev. of Ground Water 11.2 Ft.
3146.31 Ft. →			Soft tan to brown Clay.				Total 3" Casing 35'-11"
	10'-6"		Contact on Fine Gravel				
							10 - 32 / 34
			Data Plotted				
	32'-3"		Contact - Blue grey clay.	50	1½"	@ 34'-6"	
	33'-10		Contact on Colorado Shale	50	1½"	@ 35'-0"	Started core - 33'-10"
			Dark grey to Black Colorado Shale.				
							Draw 46'-0
	54'-0"		Aprox Contact - grey sandy clay.				
	55'-8"		Contact on sill stone strata 4" thick changing to Colorado Shale				Draw 56'-0"
	61'-0"		Bottomed Hole in Colorado Shale				Draw 61'-0"

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number: **BPGP24B**	TDD Name/Number: **Billings PCE Site TO-0605-09**	Site Location:
Boring Depth (ft) X Diameter (in): **40.0 x 2.125**		Drilling Method: **Geoprobe**
Well Contractor Name: **UOS**		Logged by: **JN**
Ground Surface Elevation (ft): **3150.89**	Top of Casing Elevation (ft): **3150.89**	Lat. 45.7699830722222 Long. -108.53393555 / Northing (ft) 169385.7 Easting (ft) 675113.94
Date Started: **12/1/06**	Date Completed: **12/1/06**	Additional Comments: **cores not collected - bedrock well**

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample Type *	Sample Recovery	FID (ppm)	PCE (mg/kg)
			0	benonite granules - PVC blank and outer casing				
				bentonite granules				
			5					
			10					
			▼ 15					
			20	bentonite coated pellets				
			25	10/20 sand				
				.5' slotted PVC				
				coated bentonite pellets				
			30	slough				

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:		**12/3/2006**			
Static Water Level (from TOC)	Level:		▼ **15.32**			
Static Water Level (ASL)	Level:		**3135.57**			

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Number:	Site Location:
BPGP24B	**Billings PCE Site** **TO-0605-09**	

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample Type *	Sample Recovery	FID (ppm)	PCE (mg/kg)
			35 40	0.5 slotted PVC screen				

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

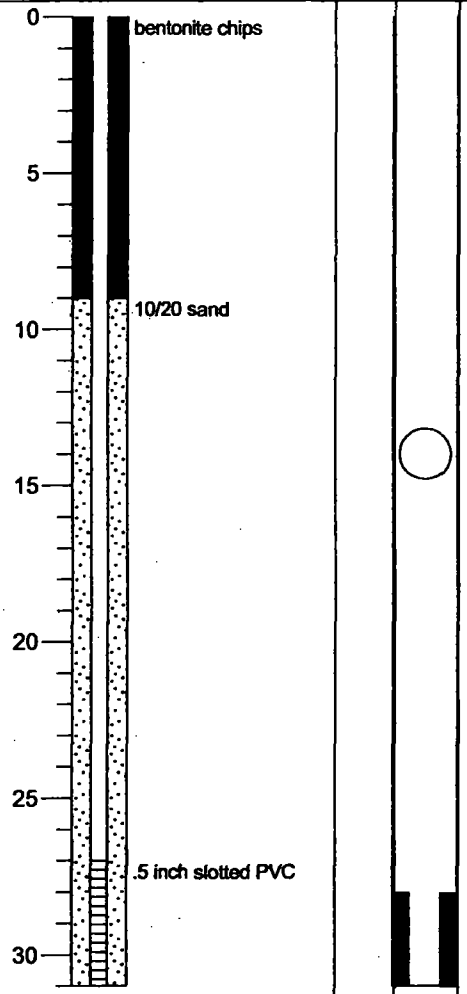
Observations	Date:		**12/3/2006**			
Static Water Level (from TOC)	Level:		▼ **15.32**			
Static Water Level (ASL)	Level:		**3135.57**			

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number: **BPGP26B**	TDD Name/Number: **Billings PCE Site TO-0605-09**	Site Location:
Boring Depth (ft) X Diameter (in): **31.0 x 2.125**		Drilling Method: **PowerProbe**
Well Contractor Name: **UOS**		Logged by: **JN**
Ground Surface Elevation (ft): **3150.17**	Top of Casing Elevation (ft): **3150.17**	Lat. 45.7697490361111 Long. -108.533899508333 / Northing (ft) 169359.73 Easting (ft) 675116.06
Date Started: **4/14/08**	Date Completed:	Additional Comments:

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample Type *	Sample Recovery	FID (ppm)	PCE (mg/kg)
Silty sandy gravel grey/brown, weathered shale in matrix	GW GM		0–30	bentonite chips; 10/20 sand; .5 inch slotted PVC				
Shale grey, weathered, refusal at approx 31' bgs								



* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:					
Static Water Level (from TOC)	Level:					
Static Water Level (ASL)	Level:					

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number: **BPGP33B**	TDD Name/Number: **Billings PCE Site** **TO-0605-09**	Site Location:
Boring Depth (ft) X Diameter (in): **32.0 x 2.125**		Drilling Method: **Geoprobe**
Well Contractor Name: **UOS**		Logged by: **JN**
Ground Surface Elevation (ft): **3150.18**	Top of Casing Elevation (ft): **3150.18**	Lat. 45.7699247111111 Long. -108.533512916667 / Northing (ft) 169379.63 Easting (ft) 675146.88
Date Started: **12/2/06**	Date Completed: **12/2/06**	Additional Comments: **bedrock well**

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample Type *	Sample Recovery	FID (ppm)	PCE (mg/kg)
Silt	ML		0	bentonite granules				
Silty Clay brn., soft, massive, sl. cohesive, low plastic	CL ML		5					
Clayey Silt brn., soft, low plasitc	CL ML							
Silt brn., soft, massive, no FeOx	ML		10					
Clayey Silt low plastic, soft, massive	CL ML							
Silty Sand brn., v.f.g. sand, loose	SM		15 ▼					
Silty Sand as above	SM							
Sandy Gravel > 75% gravel, black rnd. pebbles, v.f.g. - m.g. sand, wet	GW		20	coated bentonite pellets				
			25	10/20 sand 0.5 slotted PVC				
			30 ▼					0.797

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:		12/3/2006	9/9/99		
Static Water Level (from TOC)	Level:		▼ 15	▼ 30		
Static Water Level (ASL)	Level:		3135.18	3120.18		

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number: **BPGP46b**	TDD Name/Number: **Billings PCE Site** **TO-0605-09**	Site Location:
Boring Depth (ft) X Diameter (in): **35.0 x 2.125**		Drilling Method: **Geoprobe**
Well Contractor Name: **UOS**		Logged by: **JN**
Ground Surface Elevation (ft): **3150.69**	Top of Casing Elevation (ft): **3150.69**	Lat. 45.770102 Long. -108.533935816667 / Northing (ft) 169398.92 Easting (ft) 675113.75
Date Started: **12/2/06**	Date Completed: **12/2/06**	Additional Comments: **bedrock well**

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample Type *	Sample Recovery	FID (ppm)	PCE (mg/kg)
Clayey Silt brn., low plasitc, soft	CL ML		0	bentonite granules				
Clay brn., massive, mod. plastic, soft, no FeOx	CH		5					
Silt brn., soft, massive, not cohesive, not plastic	ML		10					0.059
Claybrn., no FeOx, mod. - high plasitc	CH							
Silty Sand tan/brn, moist, v.f.g. sand, loose	SP SM		15					0.358
Sandy Gravel dk brn, f.g. - m.g. sand, solvent odor	GP			slough				
Sandy Gravel	GP		20					0.658
			25					
			30	0.5 slotted PVC				

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	12/3/2006	9/9/99	9/9/99	9/9/99	
Static Water Level (from TOC)	Level:	15.3	10.5	15	32	
Static Water Level (ASL)	Level:	3135.39	3140.19	3135.69	3118.69	

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Number:	Site Location:
BPGP46b	**Billings PCE Site** **TO-0605-09**	

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample Type *	Sample Recovery	FID (ppm)	PCE (mg/kg)
Shale blue/grey, weathered, friable/brittle			35					0.347

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

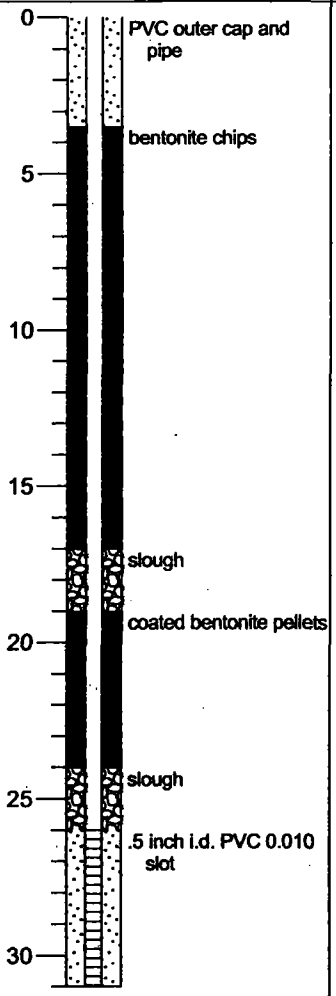
Observations	Date:	12/3/2006	9/9/99	9/9/99	9/9/99	
Static Water Level (from TOC)	Level:	▽ 15.3	▼ 10.5	▼ 15	▼ 32	
Static Water Level (ASL)	Level:	3135.39	3140.19	3135.69	3118.69	

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number: **BPGP63B**	TDD Name/Number: **Billings PCE Site** **TO-0605-09**	Site Location:
Boring Depth (ft) X Diameter (in): **31.0 x .5**		Drilling Method: **Geoprobe**
Well Contractor Name: **UOS**		Logged by: **JN**
Ground Surface Elevation (ft): **3149.5**	Top of Casing Elevation (ft): **3149.5**	Lat. / Long. / Northing (ft) 169384.02 / Easting (ft) 675172.69
Date Started: **12/10/07**	Date Completed: **12/10/07**	Additional Comments: **Upgradient well for BOS 100 pilot - approx elev**

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample Type *	Sample Recovery	FID (ppm)	PCE (mg/kg)
installed with solid expendable point - no cores, refusal at 31' - bedrock?			0	PVC outer cap and pipe				
				bentonite chips				
			5					
			10					
			15					
				slough				
				coated bentonite pellets				
			20					
				slough				
			25					
				.5 inch i.d. PVC 0.010 slot				
			30					
refual indicates bedrock								



* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	12/10/07				
Static Water Level (from TOC)	Level:					
Static Water Level (ASL)	Level:					

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number: **BPGP65B**	TDD Name/Number: **Billings PCE Site** **TO-0605-09**	Site Location:
Boring Depth (ft) X Diameter (in): **30.5 x .5**		Drilling Method: **Geoprobe**
Well Contractor Name: **UOS**		Logged by: **JN**
Ground Surface Elevation (ft): **3149.5**	Top of Casing Elevation (ft): **3149.5**	Lat. / Long. / Northing (ft) 169380.39 / Easting (ft) 675180.81
Date Started: **12/11/07**	Date Completed: **12/11/07**	Additional Comments: **SE corner of BOS 100 pilot - approx elev**

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample Type *	Sample Recovery	FID (ppm)	PCE (mg/kg)
installed with solid expendable point - no cores, refusal at 30.5 - bedrock?			0	PVC cap and outer pipe				
				bentonite chips				
			5					
			10					
			∇					
			15					
				coated bentonite pellets				
			20					
			25	.5 inch i.d. PVC 0.010 slot				
			30					
refusal indicates bedrock								

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

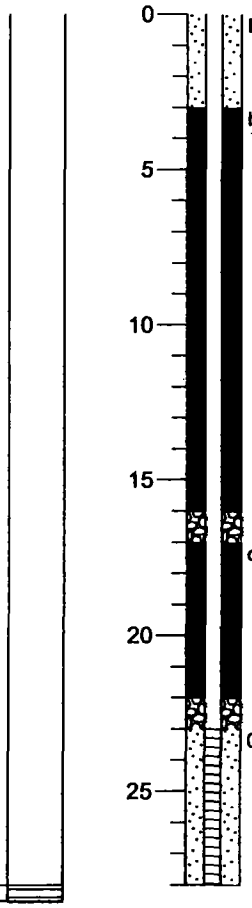
Observations	Date:	**12/11/07**				
Static Water Level (from TOC)	Level:	∇ **13.85**				
Static Water Level (ASL)	Level:	**3135.65**				

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number: **BPGP66D**	TDD Name/Number: **Billings PCE Site** **TO-0605-09**	Site Location:
Boring Depth (ft) X Diameter (in): **28.0 x .5**		Drilling Method: **Geoprobe**
Well Contractor Name: **UOS**		Logged by: **JN**
Ground Surface Elevation (ft): **3149.5**	Top of Casing Elevation (ft): **3149.5**	Lat. / Long. / Northing (ft) 169414.27 / Easting (ft) 675183.44
Date Started: **12/11/07**	Date Completed: **12/11/07**	Additional Comments: **approx elev**

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample Type *	Sample Recovery *	FID (ppm)	PCE (mg/kg)
Installed with solid expendable point - no cores collected refusal at 28' indicates bedrock			0	PVC cap and outer pipe				
				bentonite pellets				
			5					
			10					
			15					
				coated bentonite pellets				
			20					
				0.5 inch i.d. PVC 0.010 slot				
			25					
refusal at 28' indicates bedrock								



* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

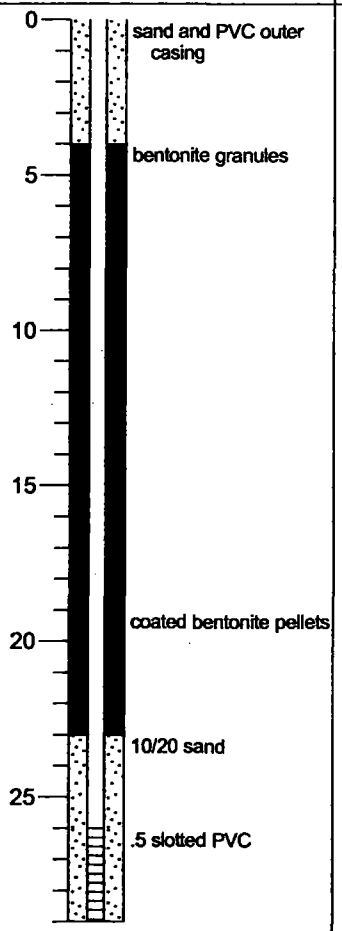
Observations	Date:					
Static Water Level (from TOC)	Level:					
Static Water Level (ASL)	Level:					

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number: **BPGP72B**	TDD Name/Number: **Billings PCE Site** **TO-0605-09**	Site Location:
Boring Depth (ft) X Diameter (in): **29.0 x 2.125**		Drilling Method: **Geoprobe**
Well Contractor Name: **UOS**		Logged by: **JN**
Ground Surface Elevation (ft): **3149.5**	Top of Casing Elevation (ft): **3149.5**	Lat. / Long. / Northing (ft) 169380.39 / Easting (ft) 675117.31
Date Started: **3/6/08**	Date Completed: **3/6/08**	Additional Comments: **deep well - not cored - approx elev**

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample Type *	Sample Recovery *	FID (ppm)	PCE (mg/kg)
refusal at 29' may indicate bedrock			0, 5, 10, 15, 20, 25	sand and PVC outer casing; bentonite granules; coated bentonite pellets; 10/20 sand; .5 slotted PVC				



* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:					
Static Water Level (from TOC)	Level:					
Static Water Level (ASL)	Level:					

APPENDIX A-2

REMEDIAL INVESTIGATION BORING LOGS AND WELL CONSTRUCTION

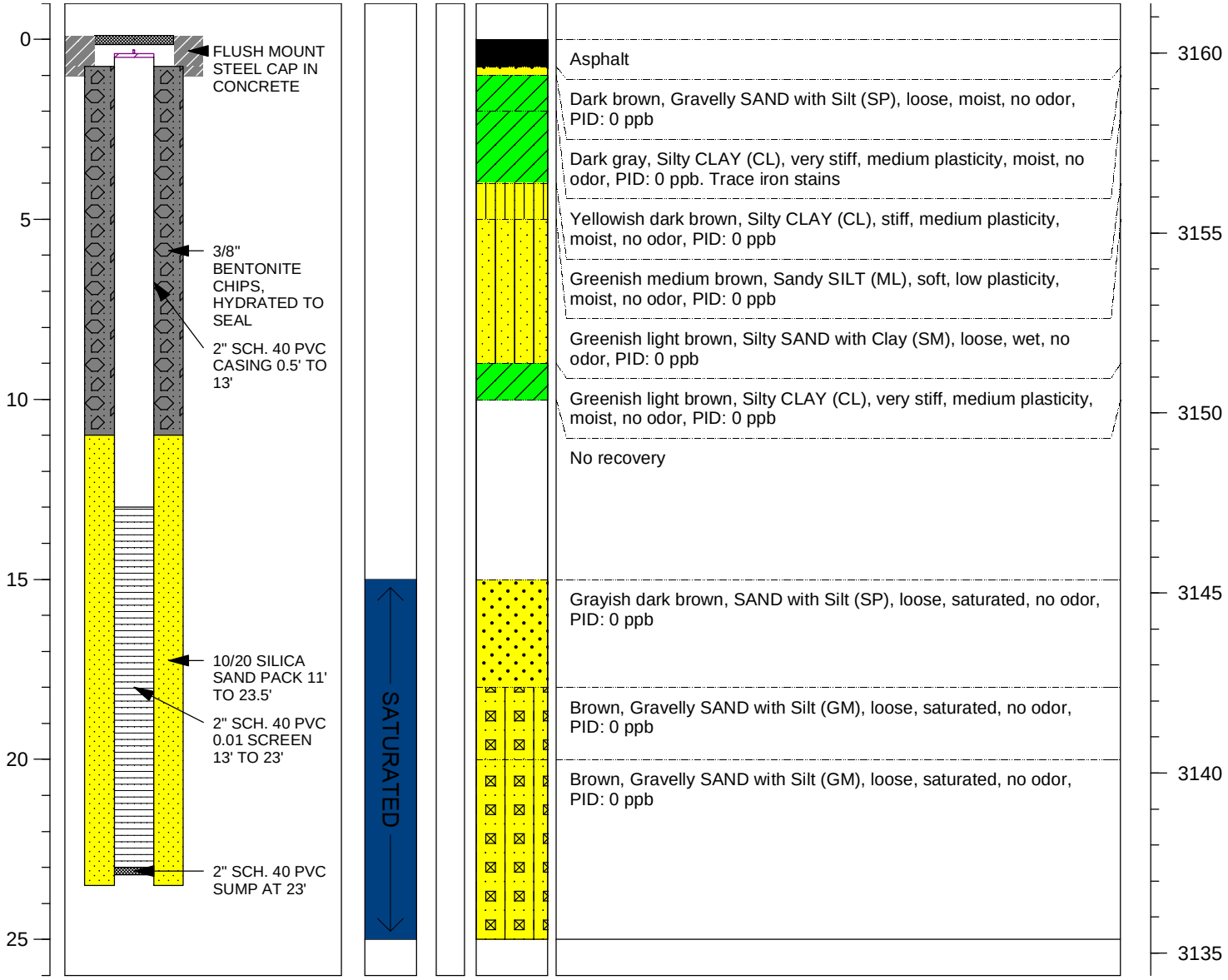
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-100

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 3/19/2018
Date Completed: 3/19/2018
Easting: 2211115.419
Northing: 555323.307
TOC Elevation: 3160.379



Trihydro Corporation
2707 Broadwater Ave
Helena, MT 59601
Phone: (406) 558-4180

Notes: Caving at 22' bgs.

Easting and northings in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

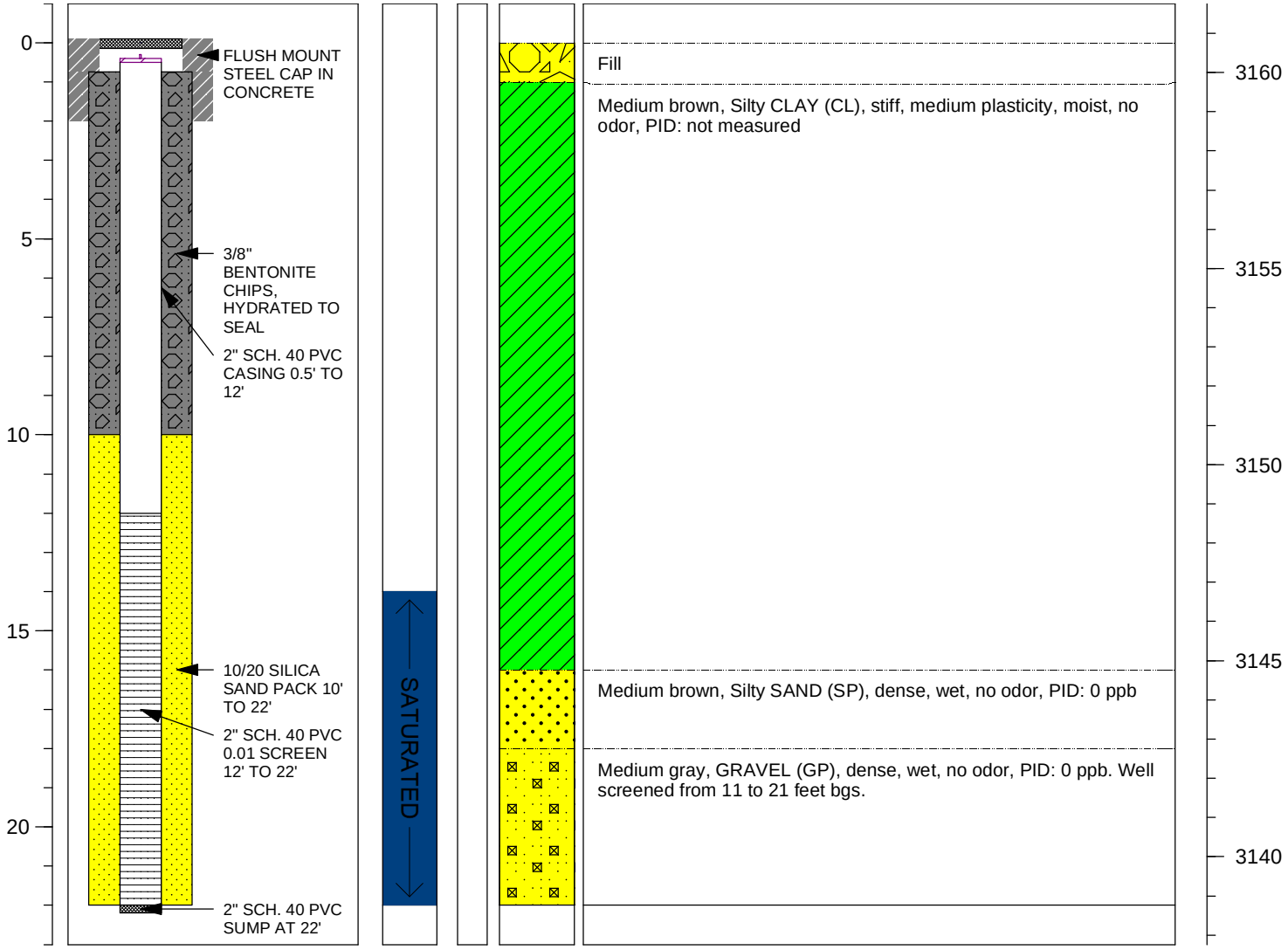
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-101

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Wallace Coles
Location: Billings, MT
Contractor: Earth Probe

Driller: Mark Taggart
Drilling Method: HSA
Borehole Diameter (in): 6.25
Total Depth (ft): 22
Sample Type: Geoprobe Acetate Tube

Date Started: 3/26/2018
Date Completed: 3/26/2018
Easting: 2211210.39
Northing: 555467.264
TOC Elevation: 3160.761



Trihydro Corporation
2707 Broadwater Ave
Helena, MT 59601
Phone: (406) 558-4180

Notes:

Easting and northings in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

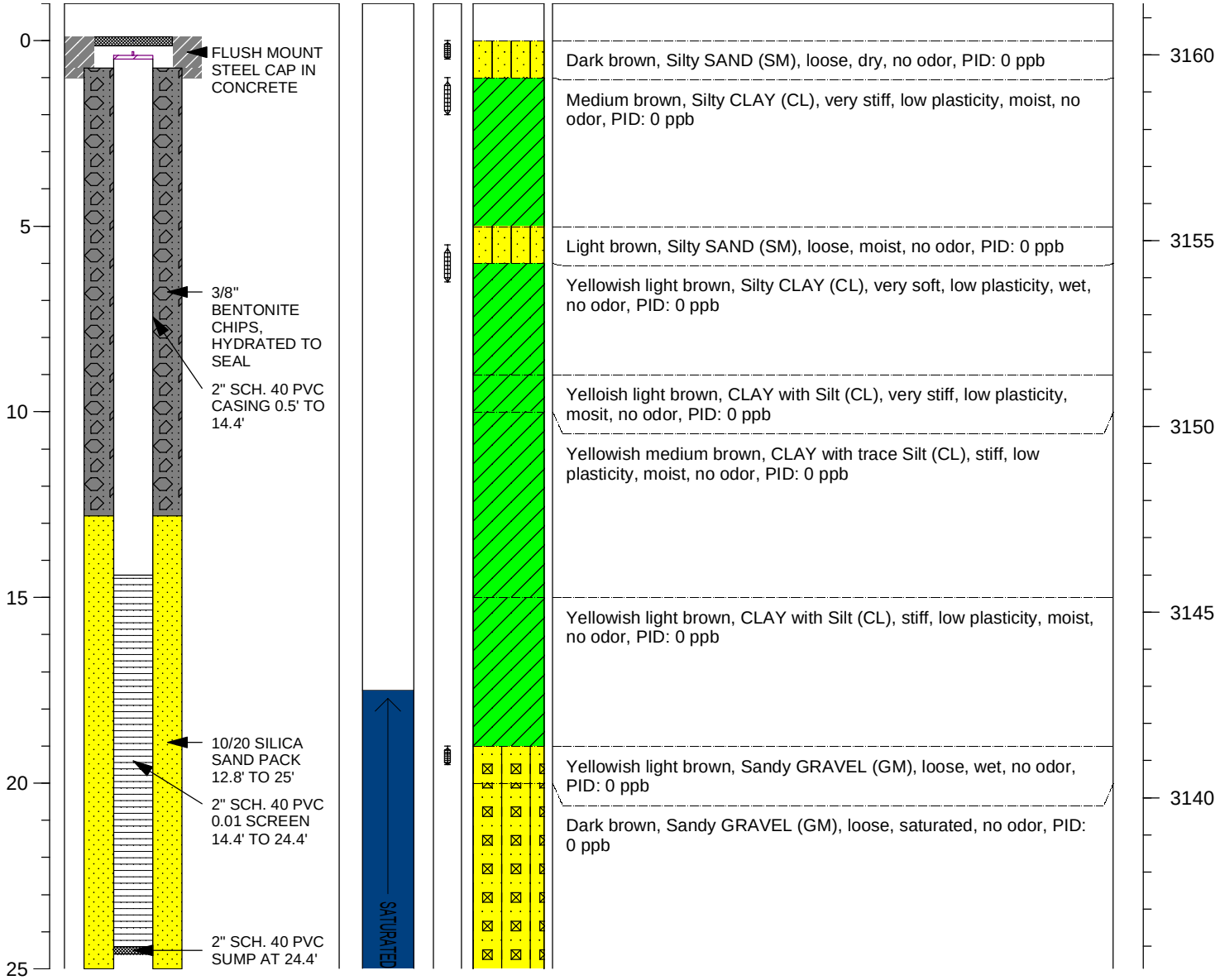
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-102

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 32.5 (CAL-MIP-9)
Sample Type: Geoprobe Acetate Tube

Date Started: 3/27/2018
Date Completed: 3/27/2018
Easting: 2211241.039
Northing: 555529.135
TOC Elevation: 3160.392



Trihydro Corporation
2707 Broadwater Ave
Helena, MT 59601
Phone: (406) 558-4180

Notes: PCE groundwater screening sample collected at 15-29 feet bgs with peristaltic pump after 1 gallon purge. Lithology and soil samples from CAL-MIP-09. MW-102 dtw=14.16' btoc.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-102

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 32.5 (CAL-MIP-9)
Sample Type: Geoprobe Acetate Tube

Date Started: 3/27/2018
Date Completed: 3/27/2018
Easting: 2211241.039
Northing: 555529.135
TOC Elevation: 3160.392

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
25		SATURATED			Yellowish medium brown, Sandy GRAVEL (GM), loose, saturated, no odor, PID: 0 ppb	3135
30					Brownish gray, SHALE, moderately weathered (MW), no odor, PID: 0 ppb	3130

Trihydro Corporation
2707 Broadwater Ave
Helena, MT 59601
Phone: (406) 558-4180

Notes: PCE groundwater screening sample collected at 15-29 feet bgs with peristaltic pump after 1 gallon purge. Lithology and soil samples from CAL-MIP-09. MW-102 dtw=14.16' btoc.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-103

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 24.5
Sample Type: Geoprobe Acetate Tube

Date Started: 3/19/2018
Date Completed: 3/19/2018
Easting: 2214604.77
Northing: 556143.583
TOC Elevation: 3150.843

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				FILL	3150
					Dark brown, Silty CLAY (CL), medium stiffness, medium plasticity, moist, no odor, PID: 0 ppb	
					Medium brown, Silty CLAY (CL), stiff, medium plasticity, moist, no odor, PID: 0 ppb	
5	3/8" BENTONITE CHIPS, HYDRATED TO SEAL				Greenish medium brown, CLAY with Silt (CL), stiff, medium plasticity, moist, no odor, PID: 0 ppb. Trace iron staining	3145
	2" SCH. 40 PVC CASING 0.5' TO 14.5'					
10					Greenish medium brown, Silty CLAY (CL), stiff, low plasticity, moist, no odor, PID: 0 ppb	3140
					Greenish dark brown, Silty CLAY (CL), very soft, high plasticity, wet, no odor, PID: 0 ppb	
					Greenish dark brown, Silty CLAY (CL), very stiff, medium plasticity, moist, no odor, PID: 0 ppb	
15					Greenish dark brown, Silty CLAY with Sand (CL), soft, high plasticity, wet, no odor, PID: 0 ppb	3135
					Greenish medium brown, Silty CLAY (CL), medium stiffness, medium plasticitiy, moist, no odor, PID: 0 ppb	
	10/20 SILICA SAND PACK 12' TO 24.5'	SATURATED			Grayish dark brown, Sandy GRAVEL (GM), medium dense, saturated, no odor, PID: 0 ppb	
20	2" SCH. 40 PVC 0.01 SCREEN 14.5' TO 24.5'				Black, Sandy GRAVEL (GM), loose, saturated, no odor, PID: 0 ppb	3130
25	2" SCH. 40 PVC SUMP AT 24.5'					3125

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

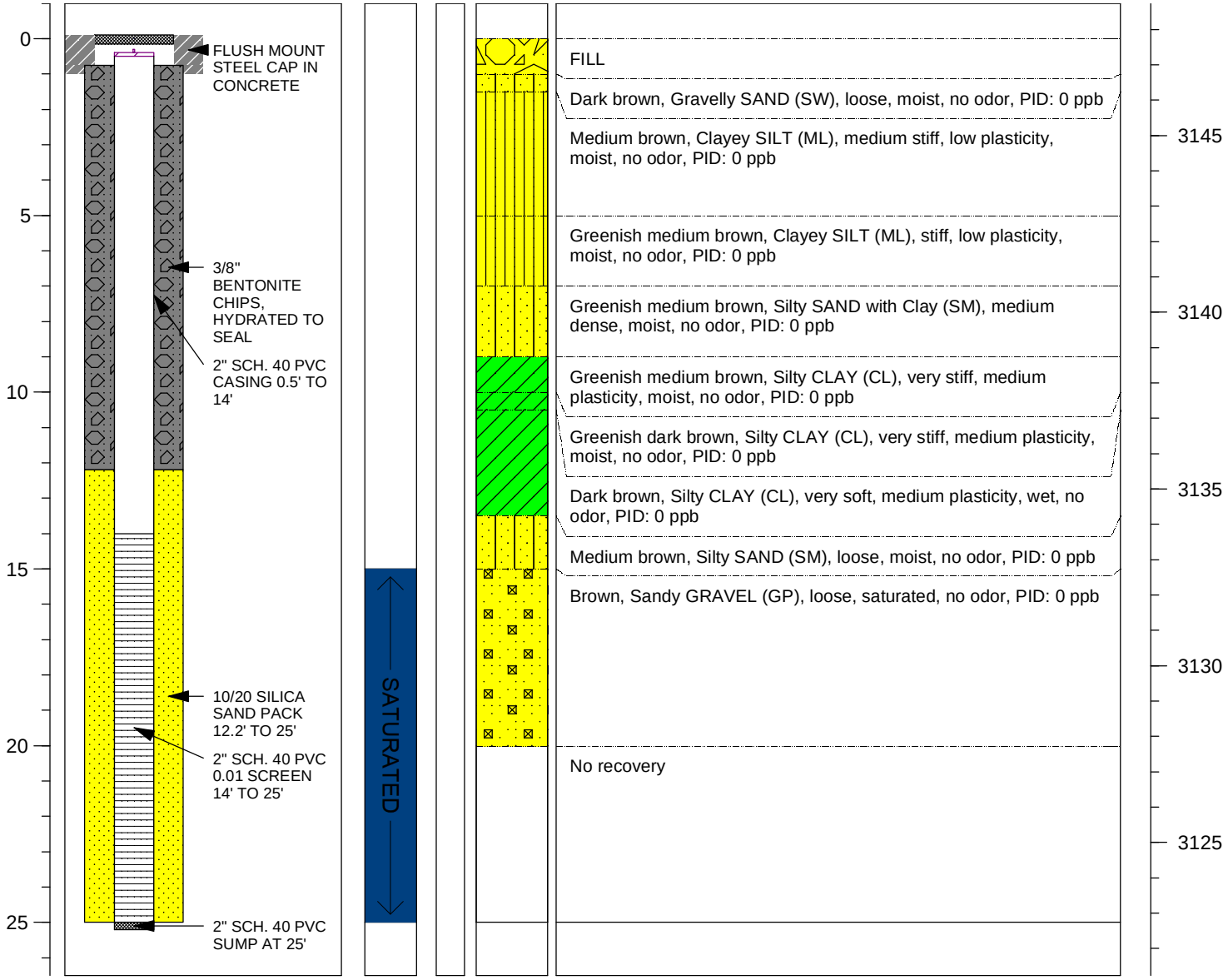
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-104

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 3/22/2018
Date Completed: 3/22/2018
Easting: 2215952.953
Northing: 555612.891
TOC Elevation: 3147.739



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Notes: Sand heave from 22' to 24' bgs.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-105

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leavey
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 4/19/2018
Date Completed: 4/19/2018
Easting: 2216794.615
Northing: 555936.192
TOC Elevation: 3144.754

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				FILL	3145
5	3/8" BENTONITE CHIPS, HYDRATED TO SEAL; 2" SCH. 40 PVC CASING 0.5' TO 14'				Yellowish dark brown, Silty CLAY (CL), stiff, low plasticity, moist, no odor, PID: 0 ppb	3140
10					Gray, Sandy GRAVEL (GM), loose, moist, no odor, PID: 0 ppn	3135
15		SATURATED			Greenish black, Silty SAND (SM), loose, wet, strong hydrocarbon odor, PID: 75.6 ppm; Gray, Sandy GRAVEL (GM), loose, saturated, moderate hydrocarbon odor, PID: 762 ppb	3130
20	10/20 SILICA SAND PACK 11.7' TO 25'; 2" SCH. 40 PVC 0.01 SCREEN 14' TO 24'				Rusty dark brown, Silty SAND (SM), loose, saturated, slight hydrocarbon odor, PID: 4,351 ppb. PID borehole: 10.7 ppm.	3125
25	2" SCH. 40 PVC SUMP AT 24'					3120

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

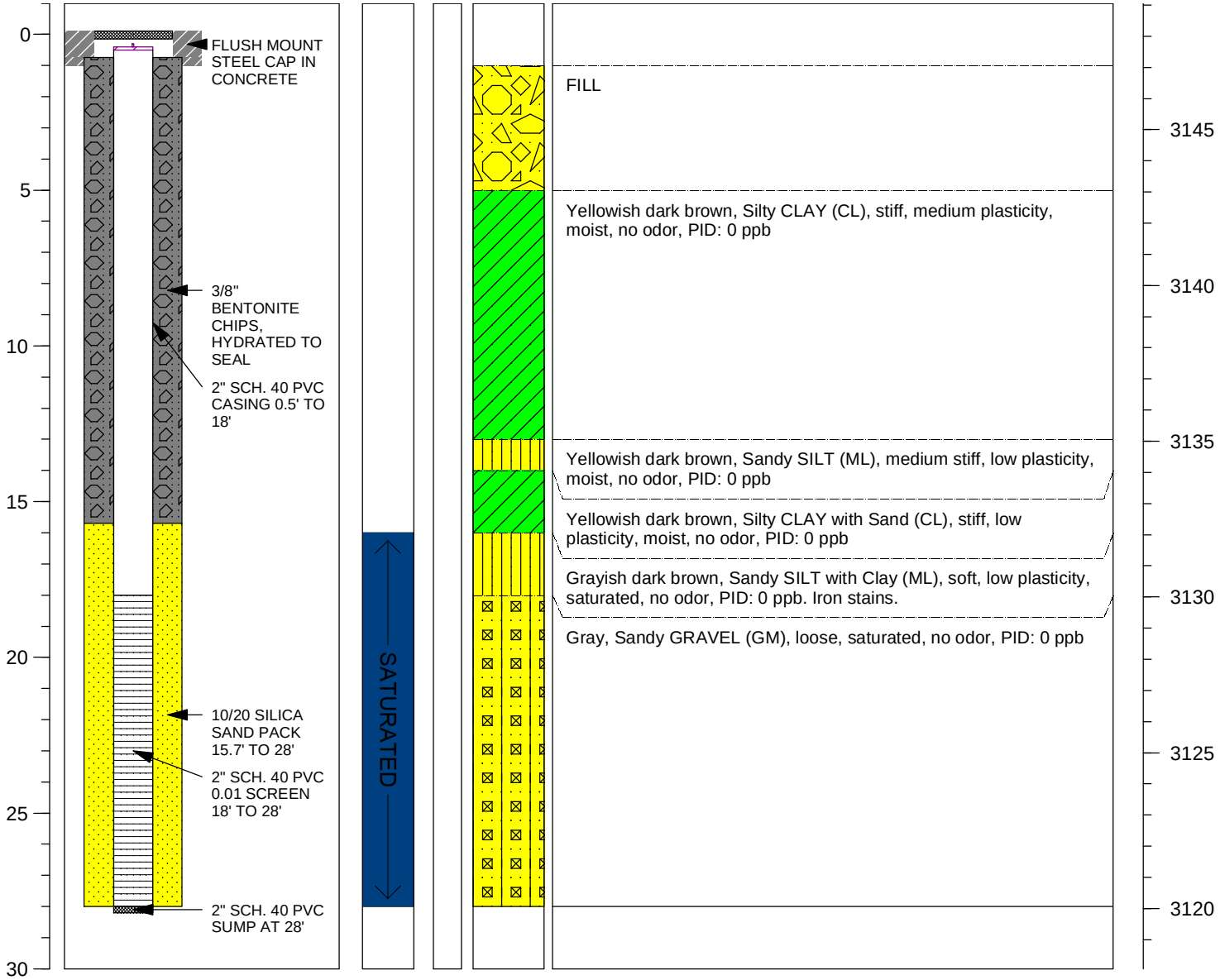
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-106

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 28
Sample Type: Geoprobe Acetate Tube

Date Started: 4/19/2018
Date Completed: 4/19/2018
Easting: 2216540.294
Northing: 555517.946
TOC Elevation: 3148.061



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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

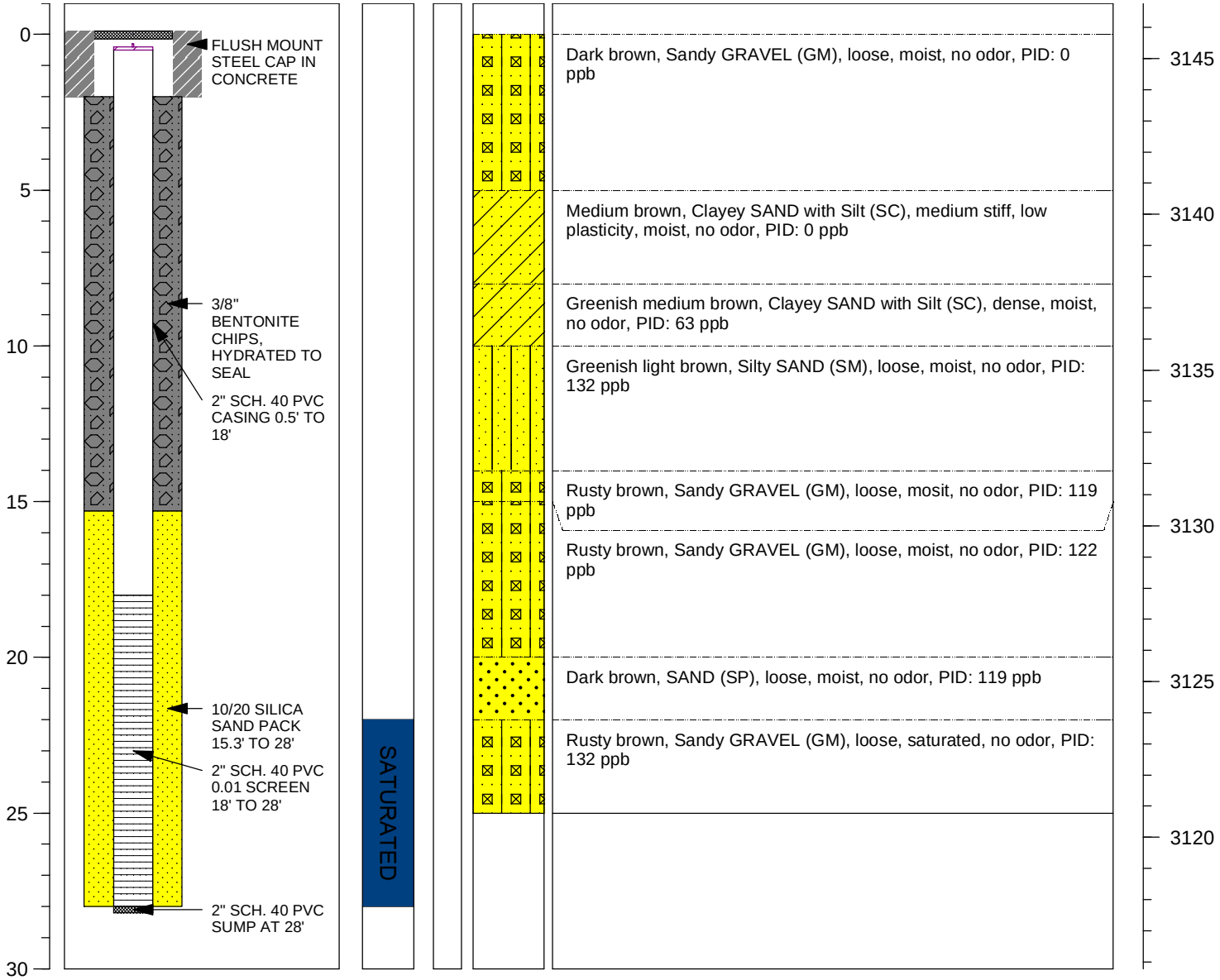
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-107

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Vicki Bierwirth/Charles VanHeuvelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 28
Sample Type: Geoprobe Acetate Tube

Date Started: 5/1/2018
Date Completed: 5/1/2018
Easting: 2217779.963
Northing: 555559.61
TOC Elevation: 3145.777



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Notes: MW-107 shares lithology from 8 feet to 28 feet bgs with 4B-GW-03. Flowing sands encountered.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

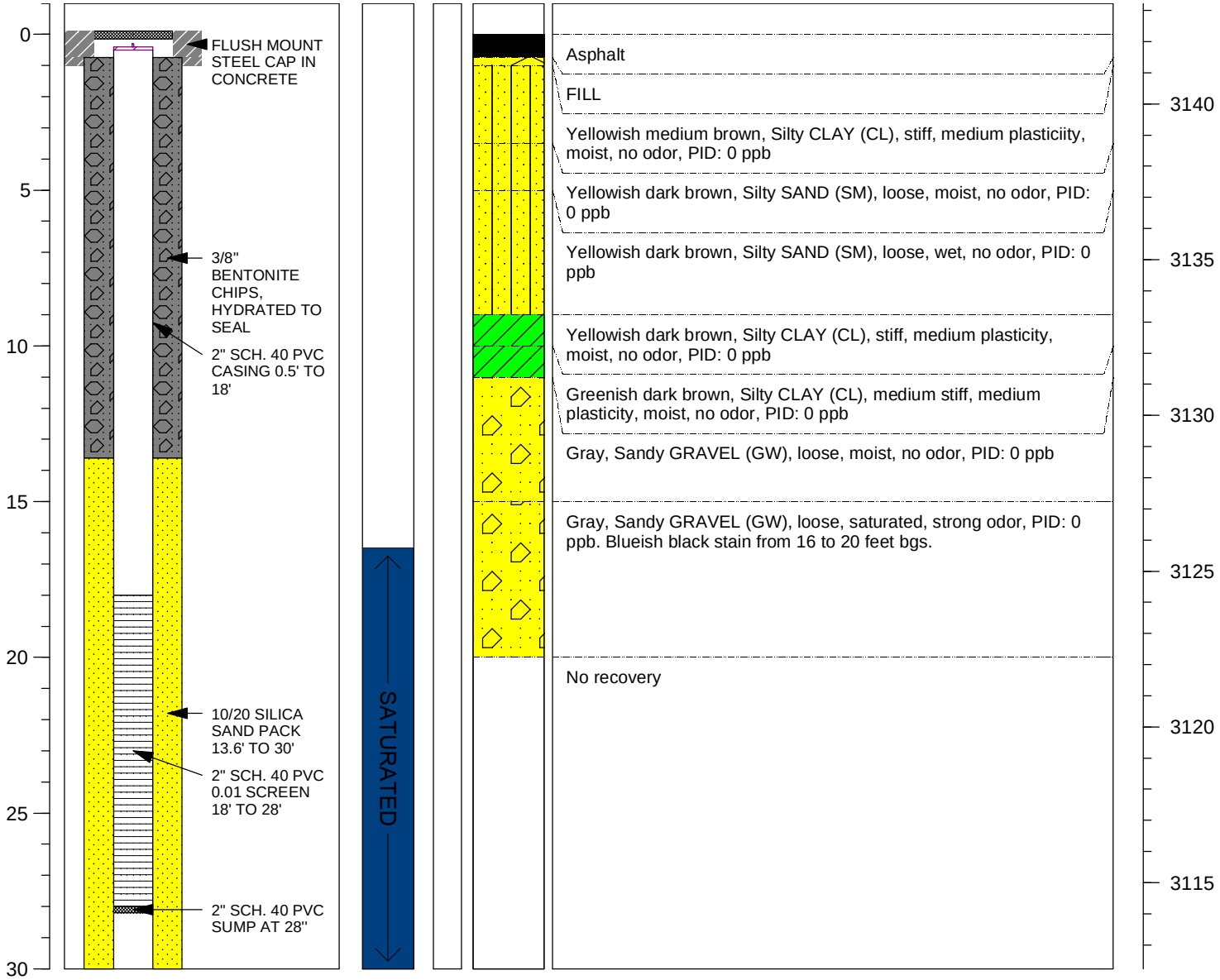
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-108

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 30
Sample Type: Geoprobe Acetate Tube

Date Started: 3/27/2018
Date Completed: 3/27/2018
Easting: 2218503.725
Northing: 556171.051
TOC Elevation: 3142.233



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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-109

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 30
Sample Type: Geoprobe Acetate Tube

Date Started: 3/26/2018
Date Completed: 3/26/2018
Easting: 2220625.657
Northing: 556878.957
TOC Elevation: 3138.304

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				ASPHALT	
					FILL. PID: 108 ppb	
					Yellowish dark brown, Silty CLAY (CL), stiff, low plasticiity, moist, no odor, PID: 0 ppb	3135
5					Yellowish dark brown, Silty SAND with Clay (SM), medium dense, moist, no odor, PID: 0 ppb	
					Yellowish dark brown, Silty SAND with Clay (SM), loose, moist, no odor, PID: 54 ppb	3130
10	3/8" BENTONITE CHIPS, HYDRATED TO SEAL; 2" SCH. 40 PVC CASING 0.5' TO 19.3'				Yellowish dark brown, Silty SAND with Clay (SM), loose, wet, no odor, PID: 0 ppb	
					Greenish gray, Sandy GRAVEL (GW), loose, moist, no odor, PID: 0 ppb	3125
15					Greenish gray, Sandy GRAVEL (GW), loose, saturated, no odor, PID 178 ppb	
20	10/20 SILICA SAND PACK 12.6' TO 24.3'	SATURATED			No recovery	3120
						3115
25	2" SCH. 40 PVC 0.01 SCREEN 19.3' TO 29.3'					
						3110
30	2" SCH. 40 PVC SUMP AT 29.3'					

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-109

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 30
Sample Type: Geoprobe Acetate Tube

Date Started: 3/26/2018
Date Completed: 3/26/2018
Easting: 2220625.657
Northing: 556878.957
TOC Elevation: 3138.304

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
30						

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-110

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 30
Sample Type: Geoprobe Acetate Tube

Date Started: 3/26/2018
Date Completed: 3/26/2018
Easting: 2221539.465
Northing: 557571.006
TOC Elevation: 3135.016

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				ASPHALT	3135
					Black, Clayey SILT (ML), stiff, medium plasticiity, moist, no odor, PID: 0 ppb	
					Greenish dark brown, Silty CLAY (CL), stiff, low plasticiity, moist, no odor, PID: 0 ppb	
5					Greenish medium brown, Clayey SILT (ML), soft, low plasticiity, moist, no odor, PID: 0 ppb	3130
	3/8" BENTONITE CHIPS, HYDRATED TO SEAL				Greenish medium brown, Silty SAND (SM), loose, moist, no odor, PID: 0 ppb	
10	2" SCH. 40 PVC CASING 0.5' TO 19'				Greenish light brown, Clayey SILT (ML), stiff, low plasticiity, moist, no odor, PID: 0 ppb	3125
					Greenish light brown, Sandy SILT with Clay (ML), soft, low plasticiity, moist, no odor, PID: 0 ppb	
					Greenish dark brown, Silty SAND (SM), loose, moist, no odor, PID: 11 ppb	
15					Gray, Sandy GRAVEL (GW), loose, moist, no odor, PID: 50 ppb	3120
					Gray, Sandy GRAVEL (GW), loose, moist, no odor, PID: 146 ppb @ 16'	
20		SATURATED			No recovery	3115
25	10/20 SILICA SAND PACK 15.6' TO 30' 2" SCH. 40 PVC 0.01 SCREEN 19' TO 29'					3110
30	2" SCH. 40 PVC SUMP AT 29'					3105

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

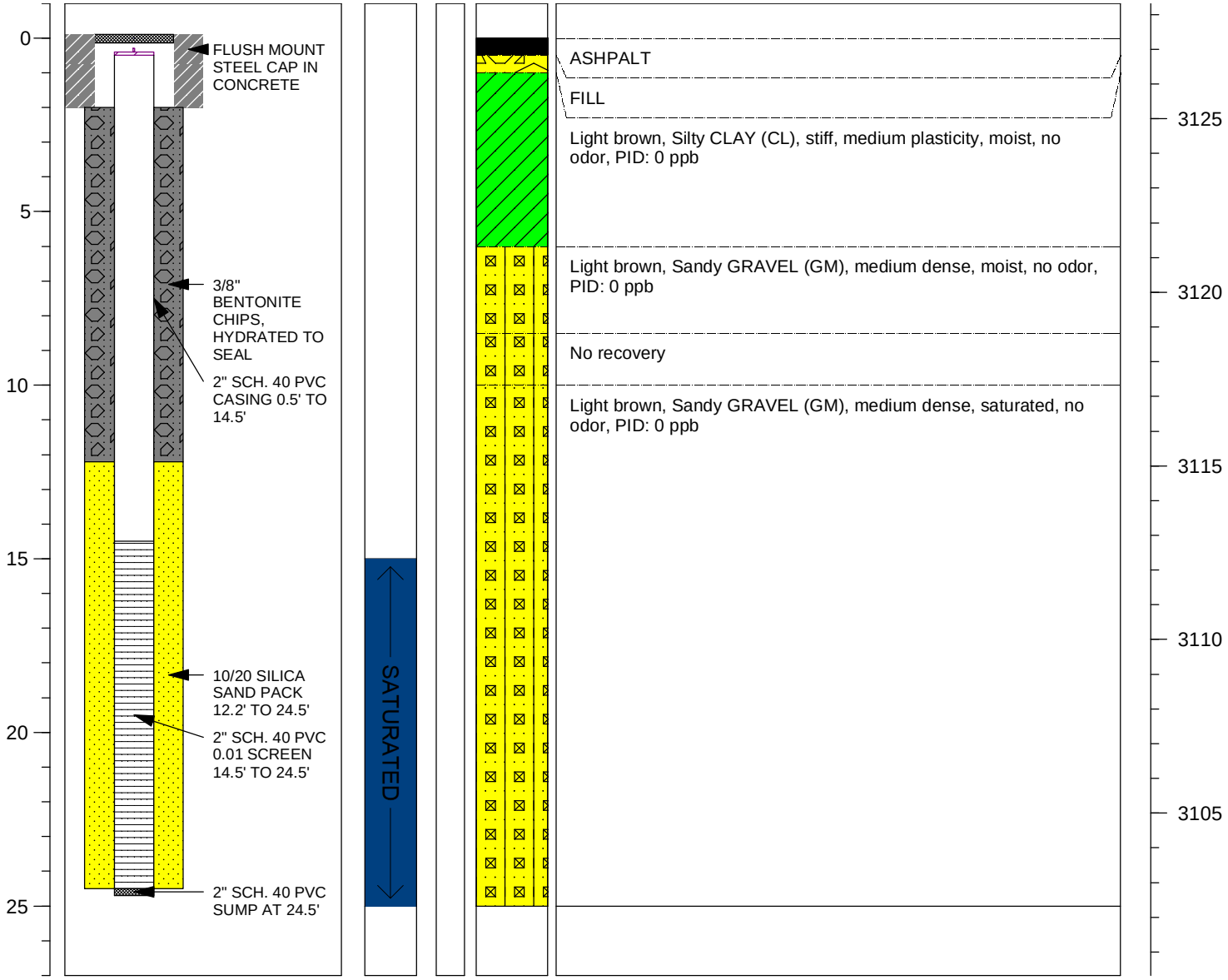
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-111

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Vicki Bierwirth
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 24.5
Sample Type: Geoprobe Acetate Tube

Date Started: 5/1/2018
Date Completed: 5/1/2018
Easting: 2222996.48
Northing: 559071.346
TOC Elevation: 3127.325



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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

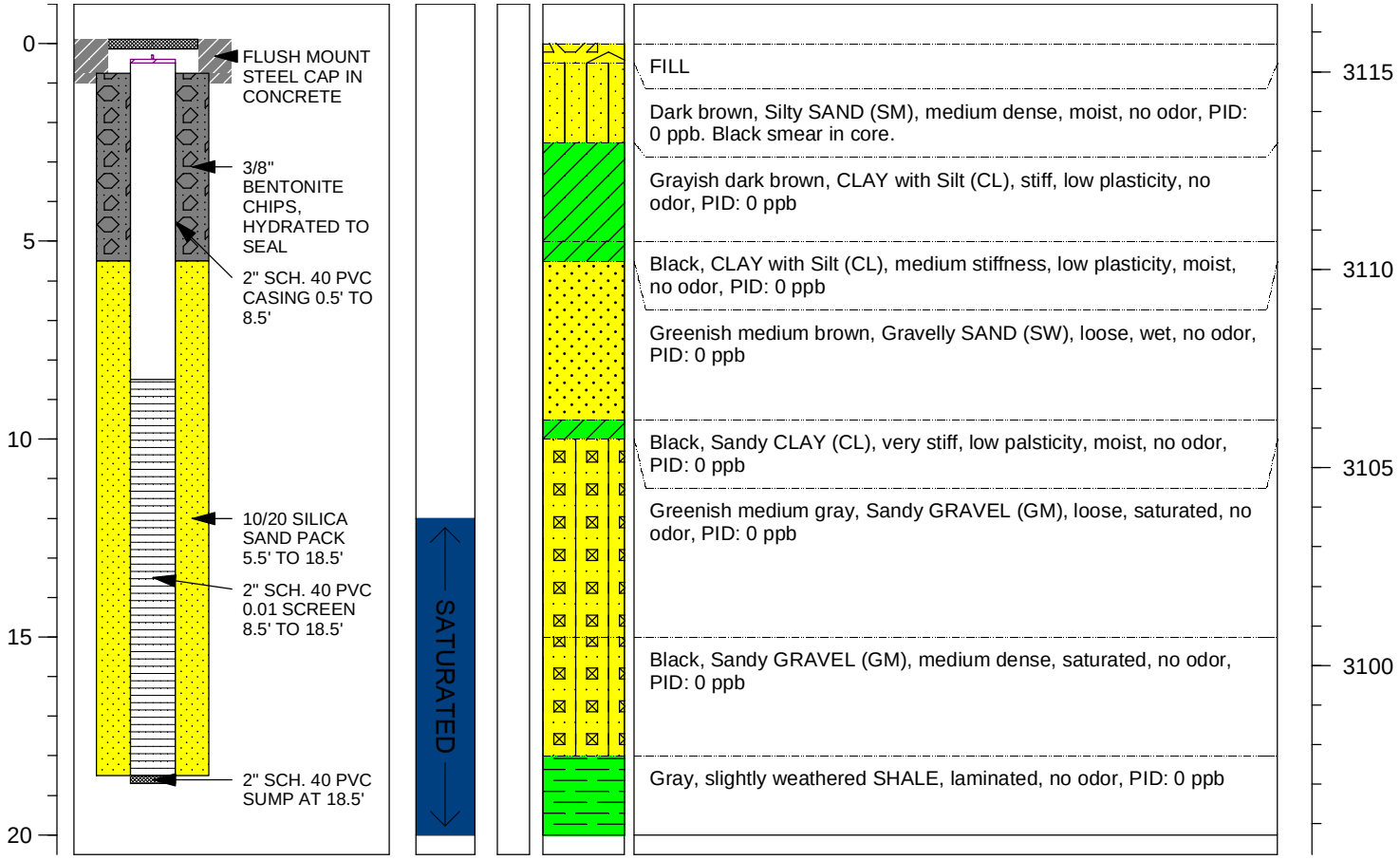
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-112

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 20
Sample Type: Geoprobe Acetate Tube

Date Started: 5/19/2018
Date Completed: 5/19/2018
Easting: 2224065.048
Northing: 558897.66
TOC Elevation: 3115.719



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Notes: PCE groundwater screening sample collected at 13-18 feet bgs with peristaltic pump after 1 gallon purge. Lithology and soil sample from 5D-GW-01. MW-112 dtw=6.13' btoc.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-113

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 14
Sample Type: Geoprobe Acetate Tube

Date Started: 3/23/2018
Date Completed: 3/23/2018
Easting: 2224439.129
Northing: 560050.935
TOC Elevation: 3112.171

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE; 3/8" BENTONITE CHIPS, HYDRATED TO SEAL; 2" SCH. 40 PVC CASING 0.5' TO 4'				ASPHALT	
					FILL	
					Dark gray, Silty CLAY (CL), stiff, medium plasticiity, moist, no odor, PID: 0 ppb. Limited recovery, calcium carbonate and iron stains	3110
5		SATURATED			Brownish dark gray, Silty SAND (SM), loose, saturated, no odor, PID: 0 ppb. Limited recovery	
					Gray, Sandy GRAVEL (GW), very loose, saturated, no odor, PID: 0 ppb	3105
10	10/20 SILICA SAND PACK 2.5' TO 14'; 2" SCH. 40 PVC 0.01 SCREEN 4' TO 14'				Gray, Sandy GRAVEL (GW), very loose, saturated, no odor, PID: 0 ppb. Limited recovery	3100
15	2" SCH. 40 PVC SUMP AT 14'					

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-114

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 3/23/2018
Date Completed: 3/23/2018
Easting: 2222899.45
Northing: 559514.144
TOC Elevation: 3127.898

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				ASPHALT	
					FILL	
					Yellowish dark brown, Clayey SILT (ML), stiff, low plasticity, moist, no odor, PID: 0 ppb	3125
5					Yellowish dark brown, Clayey SILT (ML), stiff, low plasticity, moist, no odor, PID: 0 ppb	
	3/8" BENTONITE CHIPS, HYDRATED TO SEAL				Yellowish dark brown, Silty SAND (SM), medium dense, moist, no odor, PID: 0 ppb	3120
	2" SCH. 40 PVC CASING 0.5' TO 14.4'				Yellowish medium brown, Clayey SILT (ML), stiff, medium plasticity, moist, no odor, PID: 0 ppb	
10					Yellowish dark brown, Silty SAND with Clay (SM), dense, moist, no odor, PID: 0 ppb. Mottled with gray spots.	
					Brown, Clayey SILT (ML), stiff, low plasticity, moist, no odor, PID: 0 ppb	3115
15					Gray, Sandy GRAVEL (GW), loose, dry, no odor, PID: 0 ppb	
		SATURATED			Gray, Sandy GRAVEL (GW), loose, saturated, no odor, PID: 0 ppb	
						3110
20	10/20 SILICA SAND PACK 12.6' TO 25'				No recovery	
	2" SCH. 40 PVC 0.01 SCREEN 14.4' TO 24.4'					
						3105
25	2" SCH. 40 PVC SUMP AT 24.4'					

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

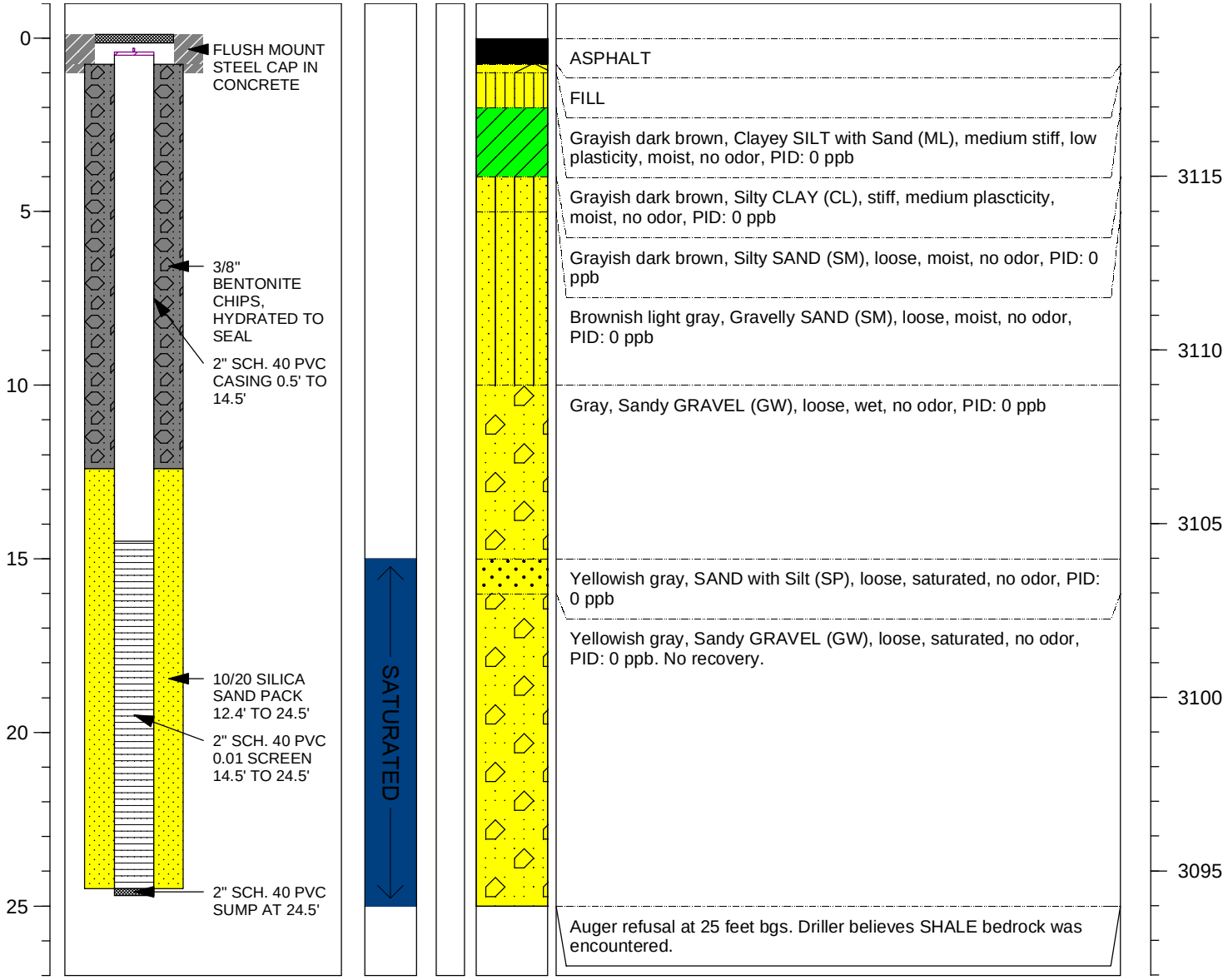
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-115

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 3/20/2018
Date Completed: 3/20/2018
Easting: 2224114.342
Northing: 560668.977
TOC Elevation: 3118.988



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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

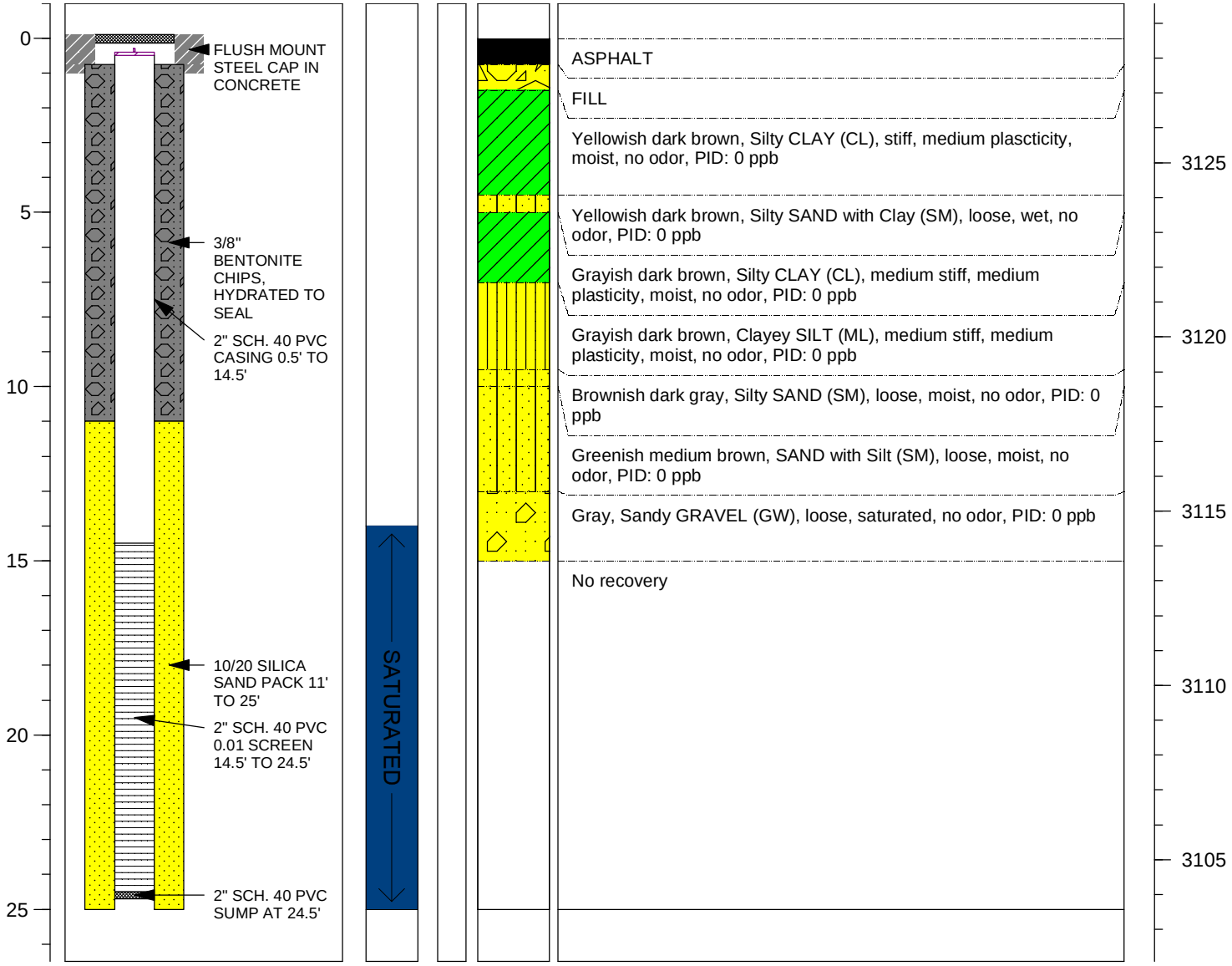
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-116

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 3/23/2018
Date Completed: 3/23/2018
Easting: 2222230.422
Northing: 559315.22
TOC Elevation: 3128.575



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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-117

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Vicki Bierwirth
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 23
Sample Type: Geoprobe Acetate Tube

Date Started: 4/28/2018
Date Completed: 4/28/2018
Easting: 2222581.316
Northing: 560862.542
TOC Elevation: 3123.519

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				FILL	
					Light brown, Silty CLAY (CL), soft, medium plasticity, moist, no odor, PID: 0 ppb	3120
5	3/8" BENTONITE CHIPS, HYDRATED TO SEAL; 2" SCH. 40 PVC CASING 0.5' TO 13'				Medium brown, Clayey SAND with Silt (SC), medium dense, wet, no odor, PID: 0 ppb	
					Medium gray, Sandy GRAVEL (GM), dense, moist, no odor, PID: 0 ppb	3115
10					Light gray, Sandy GRAVEL (GM), medium dense, wet, strong hydrocarbon odor, PID: 237 ppb	3110
15	10/20 SILICA SAND PACK 11' TO 23'; 2" SCH. 40 PVC 0.01 SCREEN 13' TO 23'	SATURATED			Light gray, Sandy GRAVEL (GM), medium dense, saturated, strong hydrocarbon odor, PID: 6687 ppb	3105
20						
25	2" SCH. 40 PVC SUMP AT 23'					3100

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-118

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Vicki Bierwirth
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 4/28/2018
Date Completed: 4/28/2018
Easting: 2221051.308
Northing: 560985.459
TOC Elevation: 3128.963

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				FILL	
					Light brown, Sandy CLAY (CL), stiff, low plasticity, moist, no odor, PID: 0 ppb	3125
5					Light brown, Silty SAND (SM), very dense, moist, no odor, PID: 0 ppb	
	3/8" BENTONITE CHIPS, HYDRATED TO SEAL				Light gray, Cobbly SAND (SM), very dense, moist, no odor, PID: 0 ppb	3120
10	2" SCH. 40 PVC CASING 0.5' TO 15'				Dark brown, Sandy GRAVEL (GM), extremeley dense, moist, no odor, PID: 0 ppb	
					Dark brown, Silty SAND (SM), loose, wet, no odor, PID: 0 ppb	3115
15					Medium brown, Sandy GRAVEL (GM), medium dense, wet, no odor, PID: 0 ppb	
	10/20 SILICA SAND PACK 13' TO 25'	SATURATED			Medium brown, Sandy GRAVEL (GM), medium dense, saturated, no odor, PID: 0 ppb	3110
20	2" SCH. 40 PVC 0.01 SCREEN 15' TO 25'				Medium brown, Sandy GRAVEL (GM), very dense, saturated, no odor, PID: 0 ppb	
25	2" SCH. 40 PVC SUMP AT 25'					3105

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

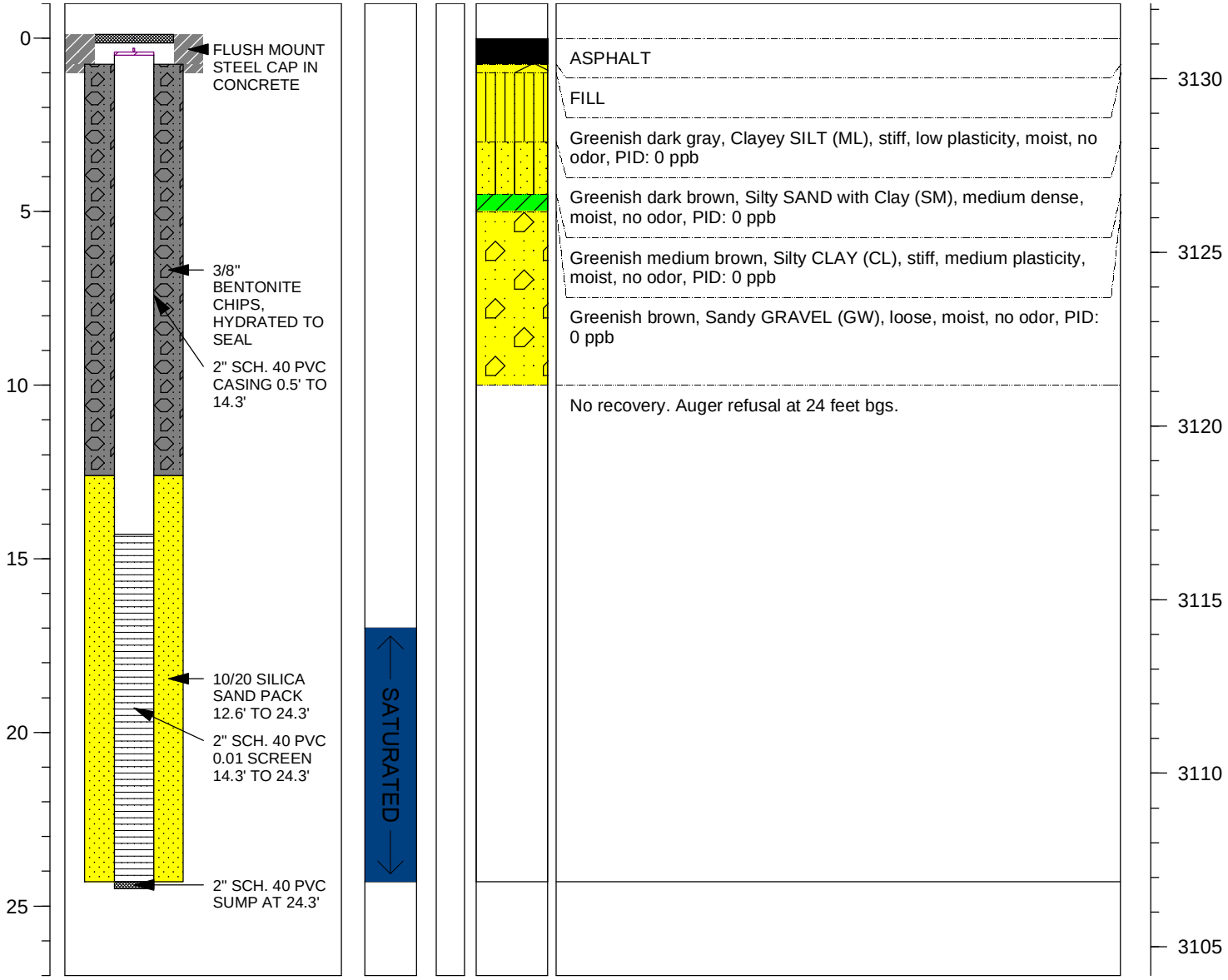
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-119

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 24.3
Sample Type: Geoprobe Acetate Tube

Date Started: 3/25/2018
Date Completed: 3/25/2018
Easting: 2220253.458
Northing: 560206.031
TOC Elevation: 3131.176



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Notes: Sand heave at 24' bgs. Top of water estimated at 17' bgs.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

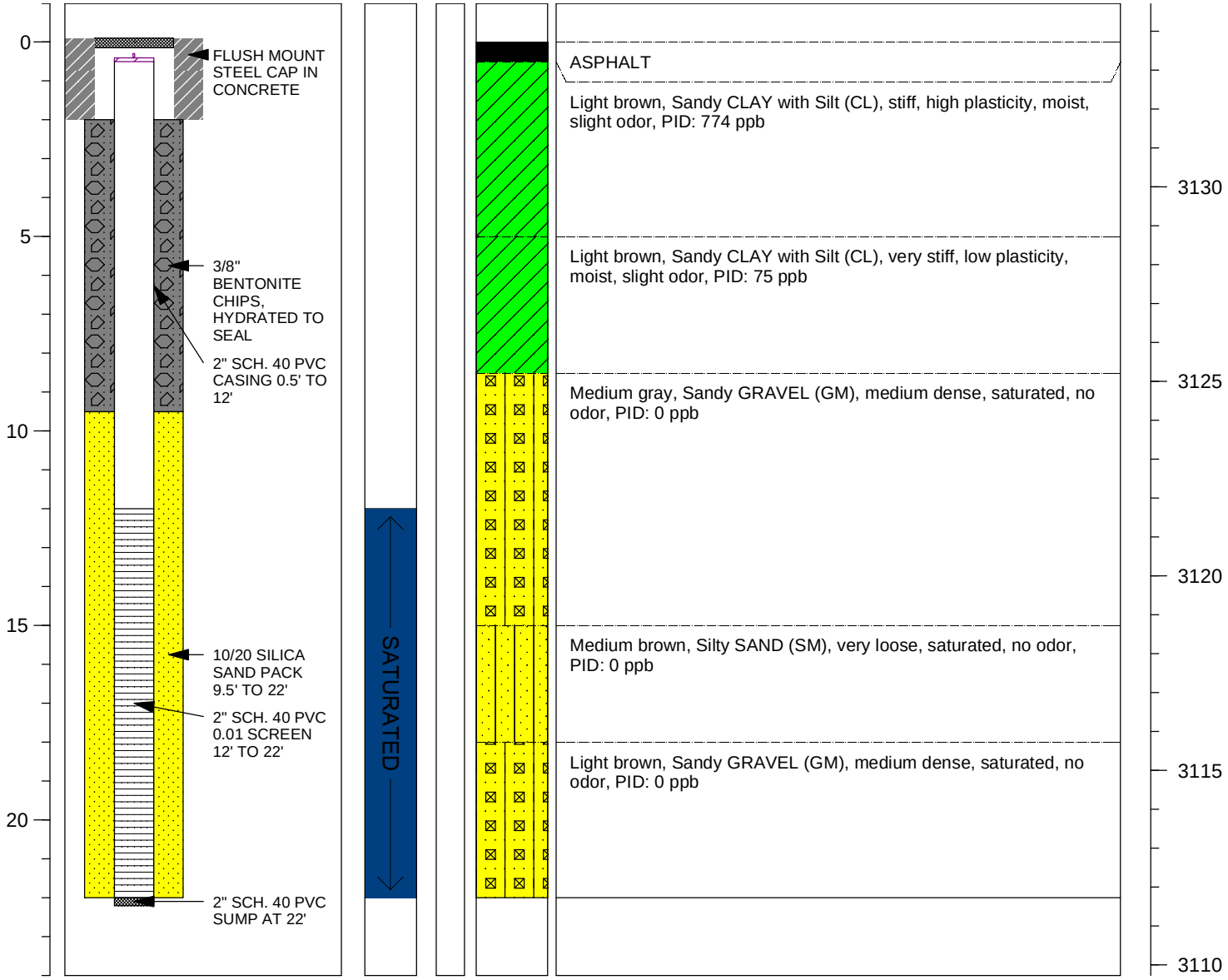
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-120

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Vicki Bierwirth
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 22
Sample Type: Geoprobe Acetate Tube

Date Started: 4/30/2018
Date Completed: 4/30/2018
Easting: 2219221.333
Northing: 559469.436
TOC Elevation: 3133.724



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Notes: Flowing sands present.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-121

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Vicki Bierwirth
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 22
Sample Type: Geoprobe Acetate Tube

Date Started: 4/25/2018
Date Completed: 4/25/2018
Easting: 2216697.99
Northing: 557252.353
TOC Elevation: 3143.65

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				Medium brown, Sandy GRAVEL (GM), loose, moist, no odor, PID: 0 ppb	3140
5	3/8" BENTONITE CHIPS, HYDRATED TO SEAL; 2" SCH. 40 PVC CASING 0.5' TO 12'				Light brown, Clayey SAND (SC), medium dense, moist, no odor, PID: 0 ppb	3135
10					Light brown, Sandy CLAY (CL), soft, medium plasticity, moist, no odor, PID: 0 ppb	
					Light brown, Clayey SAND (SC), loose, wet, no odor, PID: 0 ppb	3130
					Dark brown, Silty SAND (SM), loose, wet, no odor, PID: 0 ppb	
15	10/20 SILICA SAND PACK 10' TO 22'; 2" SCH. 40 PVC 0.01 SCREEN 12' TO 22'	SATURATED			Dark brown, Sandy GRAVEL (GM), very loose, wet, no odor, PID: 0 ppb	
					Dark brown, Silty SAND (SM), very loose, saturated, no odor, PID: 0 ppb	
20	2" SCH. 40 PVC SUMP AT 22'				Medium brown, Sandy GRAVEL (GM), very loose, saturated, no odor, PID: 0 ppb	3125
						3120

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-122

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Vicki Bierwirth
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 23
Sample Type: Geoprobe Acetate Tube

Date Started: 4/25/2018
Date Completed: 4/25/2018
Easting: 2215748.565
Northing: 556501.98
TOC Elevation: 3146.393

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				FILL	
					Light brown, Sandy CLAY (CL), medium stiff, medium plasticity, moist, no odor, PID: 0 ppb	3145
5	3/8" BENTONITE CHIPS, HYDRATED TO SEAL; 2" SCH. 40 PVC CASING 0.5' TO 13'				Light brown, Silty SAND (SM), medium dense, moist, no odor, PID: 0 ppb	3140
10					Light brown, Silty SAND (SM), loose, wet, no odor, PID: 0 ppb	3135
					Medium gray, Sandy GRAVEL (GM), medium dense, wet, no odor, PID: 0 ppb	
15		SATURATED			Medium brown, Silty SAND (SM), loose, saturated, no odor, PID: 0 ppb	3130
20	10/20 SILICA SAND PACK 10.9' TO 23'; 2" SCH. 40 PVC 0.01 SCREEN 13' TO 23'				Medium brown, Sandy GRAVEL (GM), loose, saturated, no odor, PID: 0 ppb	3125
25	2" SCH. 40 PVC SUMP AT 23'					

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-123

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Vicki Bierwirth
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 26
Sample Type: Geoprobe Acetate Tube

Date Started: 4/26/2018
Date Completed: 4/26/2018
Easting: 2213784.168
Northing: 557183.97
TOC Elevation: 3152.887

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				FILL	
					Light brown, Sandy CLAY (CL), stiff, medium plasticity, moist, no odor, PID: 0 ppb	3150
5					Light brown, Silty SAND (SM), loose, moist, no odor, PID: 0 ppb	3145
10	3/8" BENTONITE CHIPS, HYDRATED TO SEAL; 2" SCH. 40 PVC CASING 0.5' TO 16'				Light brown, Silty CLAY (CL), very stiff, medium plasticity, moist, no odor, PID: 0 ppb	3140
15					Light brown, Sandy CLAY (CL), soft, low plasticity, wet, no odor, PID: 0 ppb	3135
					Light gray, Sandy GRAVEL (GM), loose, saturated, no odor, PID: 0 ppb	
20	10/20 SILICA SAND PACK 13.5' TO 26'; 2" SCH. 40 PVC 0.01 SCREEN 16' TO 26'	SATURATED			Medium brown, silty SAND (SM), loose, saturated, no odor, PID: 0 ppb	3130
25	2" SCH. 40 PVC SUMP AT 26'				Light gray, Sandy GRAVEL (GM), loose, saturated, no odor, PID: 0 ppb	3125

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-124

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Vicki Bierwierth
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 4/27/2018
Date Completed: 4/27/2018
Easting: 2211787.53
Northing: 556452.08
TOC Elevation: 3158.059

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				FILL	
					Light brown, Silty SAND (SM), very dense, dry, no odor, PID: 0 ppb	3155
5					Medium brown, Sandy GRAVEL (GM), medium dense, dry, no odor, PID: 0 ppb	
	3/8" BENTONITE CHIPS, HYDRATED TO SEAL				Light brown, Silty SAND (SM), dense, dry, no odor, PID: 0 ppb	3150
10	2" SCH. 40 PVC CASING 0.5' TO 15'				Light brown, Clayey SAND (SC), dense, dry, no odor, PID: 0 ppb	3145
15					Brown, Clayey SAND (SC), dense, wet, no odor, PID: 0 ppb	3140
	10/20 SILICA SAND PACK 13' TO 25'				Brown, Clayey SAND (SC), dense, saturated, no odor, PID: 0 ppb	
20	2" SCH. 40 PVC 0.01 SCREEN 15' TO 25'	SATURATED			Medium gray, Sandy GRAVEL (GM), medium dense, saturated, no odor, PID: 0 ppb	3135
25	2" SCH. 40 PVC SUMP AT 25'					

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

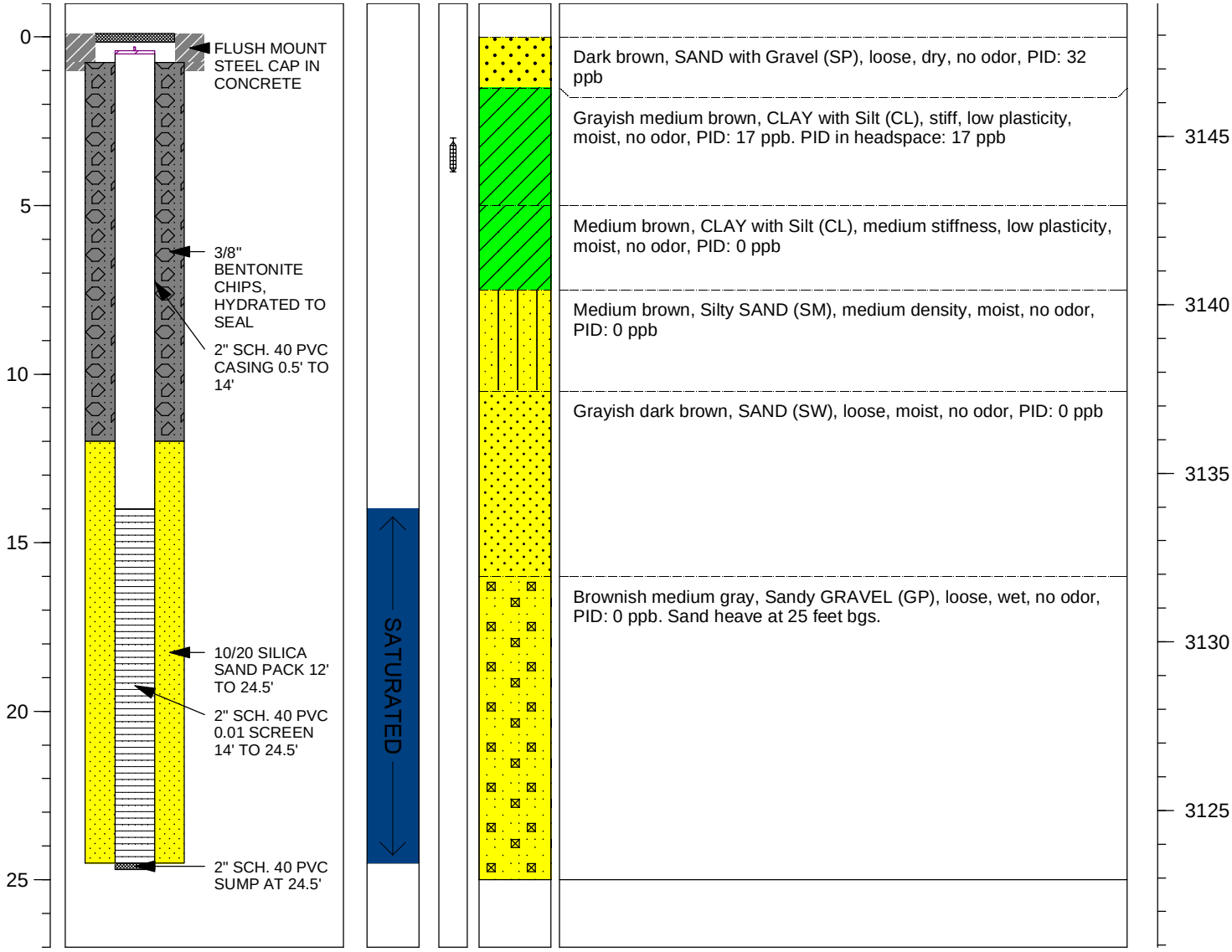
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-125

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 8
Total Depth (ft): 24.5
Sample Type: Geoprobe Acetate Tube

Date Started: 3/22/2018
Date Completed: 3/22/2018
Easting: 2215712.579
Northing: 555587.367
TOC Elevation: 3147.943



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Notes: PCE groundwater screening sample collected at 18-23 feet bgs with peristaltic pump after 1 gallon purge. Lithology and soil sample from HLS-GW-04.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

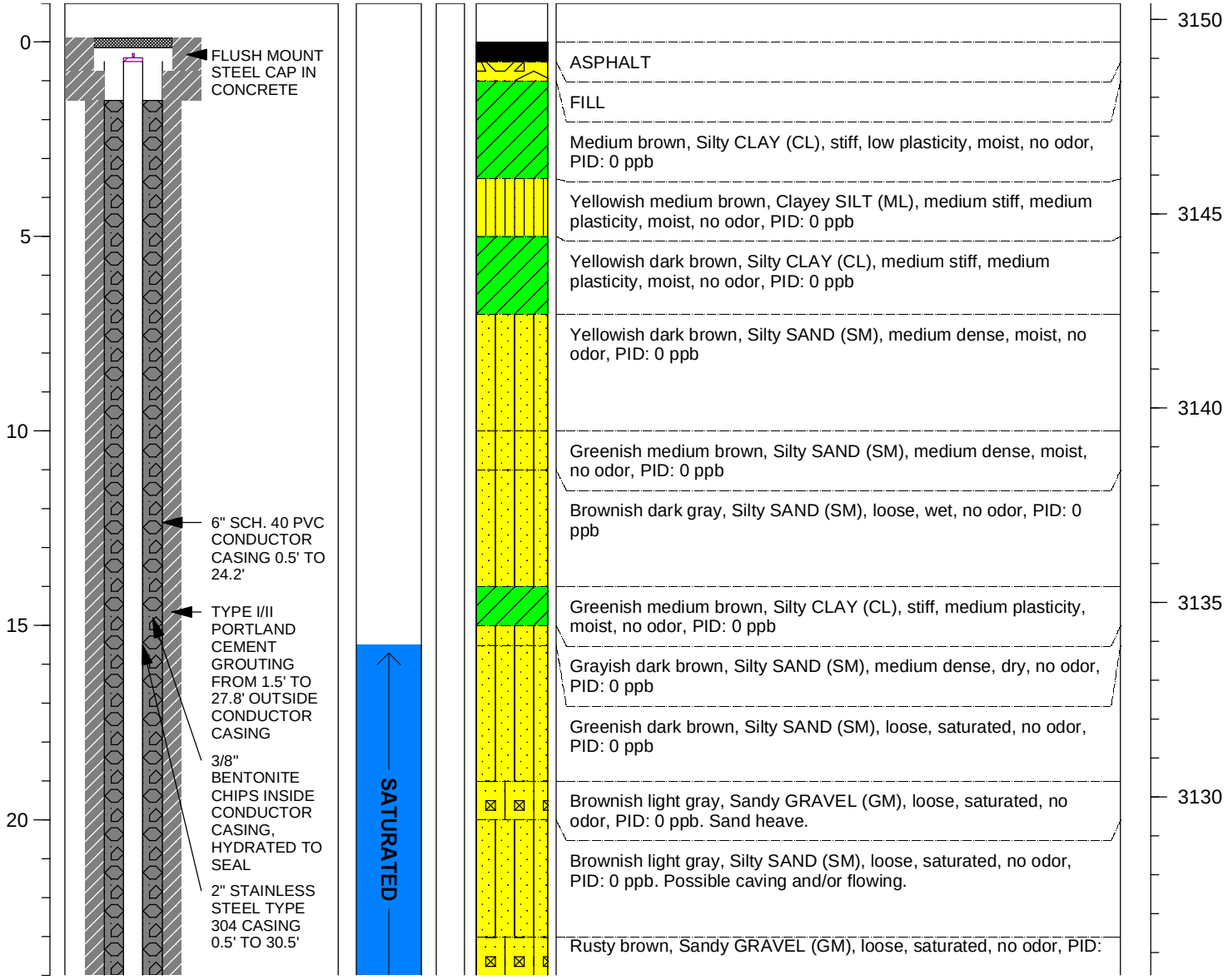
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-126

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA/Air Rotary
Borehole Diameter (in): 12 out/5 in
Total Depth (ft): 36.1
Sample Type: Geoprobe Acetate Tube

Date Started: 4/16/2018
Date Completed: 4/16/2018
Easting: 2215174.328
Northing: 555832.436
TOC Elevation: 3149.414



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Notes: Top of bedrock shale at 25.5' bgs. Bedrock drilling was dry - no evidence of water during drilling.

Easting and northings in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

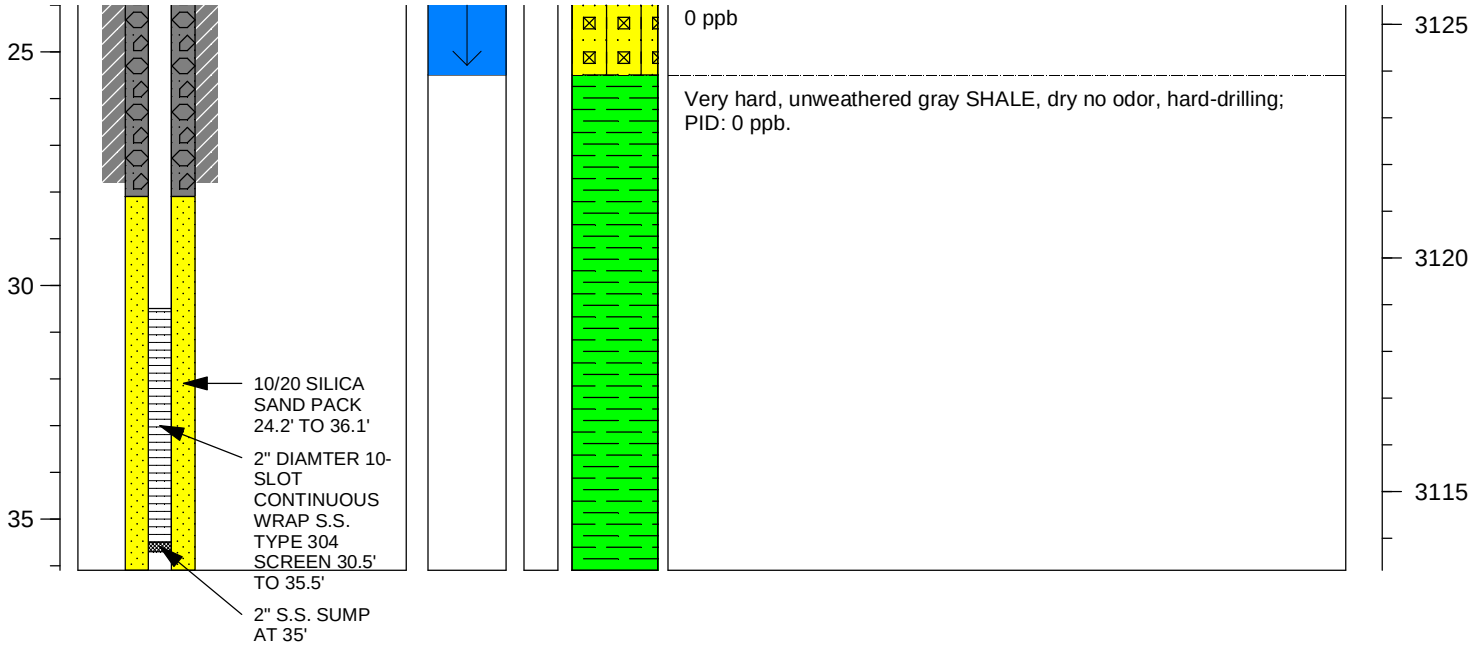
BORING ID: MW-126

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA/Air Rotary
Borehole Diameter (in): 12 out/5 in
Total Depth (ft): 36.1
Sample Type: Geoprobe Acetate Tube

Date Started: 4/16/2018
Date Completed: 4/16/2018
Easting: 2215174.328
Northing: 555832.436
TOC Elevation: 3149.414

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
					0 ppb	
					Very hard, unweathered gray SHALE, dry no odor, hard-drilling; PID: 0 ppb.	



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Notes: Top of bedrock shale at 25.5' bgs. Bedrock drilling was dry - no evidence of water during drilling.

Easting and northings in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-127

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Vicki Bierwirth
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA/Air Rotary
Borehole Diameter (in): 12 out/5 in
Total Depth (ft): 45
Sample Type: Geoprobe Acetate Tube

Date Started: 4/17/2018
Date Completed: 4/18/2018
Easting: 2214930.918
Northing: 555774.437
TOC Elevation: 3151.185

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				ASPHALT	
					Brown, Sandy GRAVEL (GM), loose, moist, no odor, PID: 0 ppb	3150
5						3145
10					Brown, Gravely SAND (SW), loose, moist, no odor, PID: 0 ppb. Sand content increased at 12'.	3140
15	6" SCH. 40 PVC CONDUCTOR CASING 0.5' TO 30.4'				Gray, Sandy GRAVEL (GM), loose, saturated, no odor, PID: 0 ppb. Sand heave 18' to 19'.	3135
20	TYPE I/II PORTLAND CEMENT GROUTING FROM 1.5' TO 30.4' OUTSIDE CONDUCTOR CASING; 3/8" BENTONITE CHIPS INSIDE CONDUCTOR CASING, HYDRATED TO SEAL 2" STAINLESS	SATURATED				3130
25						

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Notes: Top of bedrock at 28.3 ' bgs.
Alluvial samples collected from Geoprobe Acetate Tube. Bedrock sample collected from drill cuttings.

Easting and northings in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-127

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Vicki Bierwirth
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA/Air Rotary
Borehole Diameter (in): 12 out/5 in
Total Depth (ft): 45
Sample Type: Geoprobe Acetate Tube

Date Started: 4/17/2018
Date Completed: 4/18/2018
Easting: 2214930.918
Northing: 555774.437
TOC Elevation: 3151.185

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
25	STEEL TYPE 304 CASING 0.5' TO 40'					3125
30					Gray, unweathered, competent SHALE, no odor, hard drilling, PID: NT. Very little recovery - recovered material is fine and small particles of shale.	3120
35					Dark gray, unweathered, competent SHALE, no odor, hard drilling, PID: 0 ppb. Very little recovery - recovered material is fine and small particles of shale.	3115
40	10/20 SILICA SAND PACK 34.5' TO 45.2'				Medium gray, unweathered, competent SHALE, no odor, hard drilling, PID: 0 ppb. Poor recovery - recovered material fractured into small particles and many fine pieces of shale.	3110
45	2" 10 SLOT CONTINUOUS WRAP STAINLESS STEEL TYPE 304 SCREEN 40' TO 45' 2" S.S. SUMP AT 45'					

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Notes: Top of bedrock at 28.3 ' bgs.
Alluvial samples collected from Geoprobe Acetate Tube. Bedrock sample collected from drill cuttings.

Easting and northings in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-128

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Vicki Bierweirth
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 24
Sample Type: Geoprobe Acetate Tube

Date Started: 4/27/2018
Date Completed: 4/27/2018
Easting: 2213754.627
Northing: 556493.328
TOC Elevation: 3151.252

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				FILL	
					Light gray, Clayey SILT (ML), medium stiff, low plasticity, moist, no odor, PID: 0 ppb	3150
5	3/8" BENTONITE CHIPS, HYDRATED TO SEAL; 2" SCH. 40 PVC CASING 0.5' TO 10'				Medium brown, Clayel SILT (ML), stiff, medium plasticity, moist, no odor, PID: 0 ppb	3145
10					Medium brown, Clayey SAND (SC), dense, moist, no odor, PID: 0 ppb	3140
15	10/20 SILICA SAND PACK 8' TO 20'; 2" SCH. 40 PVC 0.01 SCREEN 10' TO 20'	SATURATED			Medium brown, Silty SAND (SM), loose, saturated, no odor, PID: 0 ppb	3135
20	2" SCH. 40 PVC SUMP AT 20'				Medium gray, Sandy GRAVEL (GM), medium dense, saturated, no odor, PID: 0 ppb	3130

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Notes: Alluvial sample interval collected in Geoprobe Acetate Tube. Bedrock sample taken from drill cuttings.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-129

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Devon Forrest
Location: Billings, MT
Contractor: IME

Driller: Jose Pereda
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 27
Sample Type: Geoprobe Acetate Tube

Date Started: 5/16/2018
Date Completed: 5/16/2018
Easting: 2218435.051
Northing: 556739.544
TOC Elevation: 3142.584

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)
0	FLUSH MOUNT STEEL CAP IN CONCRETE				FILL	
					Medium brown, Clayey SAND (SC), loose, moist, no odor, PID: 8 ppb	3140
5					Medium brown, Silty SAND (SM), loose, moist, no odor, PID; 0 ppb	
	3/8" BENTONITE CHIPS, HYDRATED TO SEAL				Medium brown, CLAY with Sand (CL), stiff, medium plasticity, moist, no odor, PID: 0 ppb	3135
10	2" SCH. 40 PVC CASING 0.5' TO 17'				Brown, Silty SAND (SM), loose, moist, no odor, PID: 0 ppb	3130
15					Dark gray, Silty GRAVEL with Sand (GM), dense, moist, no odor, PID: 0 ppb. Large cobbles at 15.5 feet bgs.	
		SATURATED			Gray, Silty GRAVEL (GM), extremeley dense, saturated, moderate hydrocarbon odor, PID: 982 ppb. Sand heave at 20 feet bgs.	3125
20	10/20 SILICA SAND PACK 14.6' TO 27'					
	2" SCH. 40 PVC 0.01 SCREEN 17' TO 27'					3120
25						
	2" SCH. 40 PVC SUMP AT 27'					3115

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Notes:

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

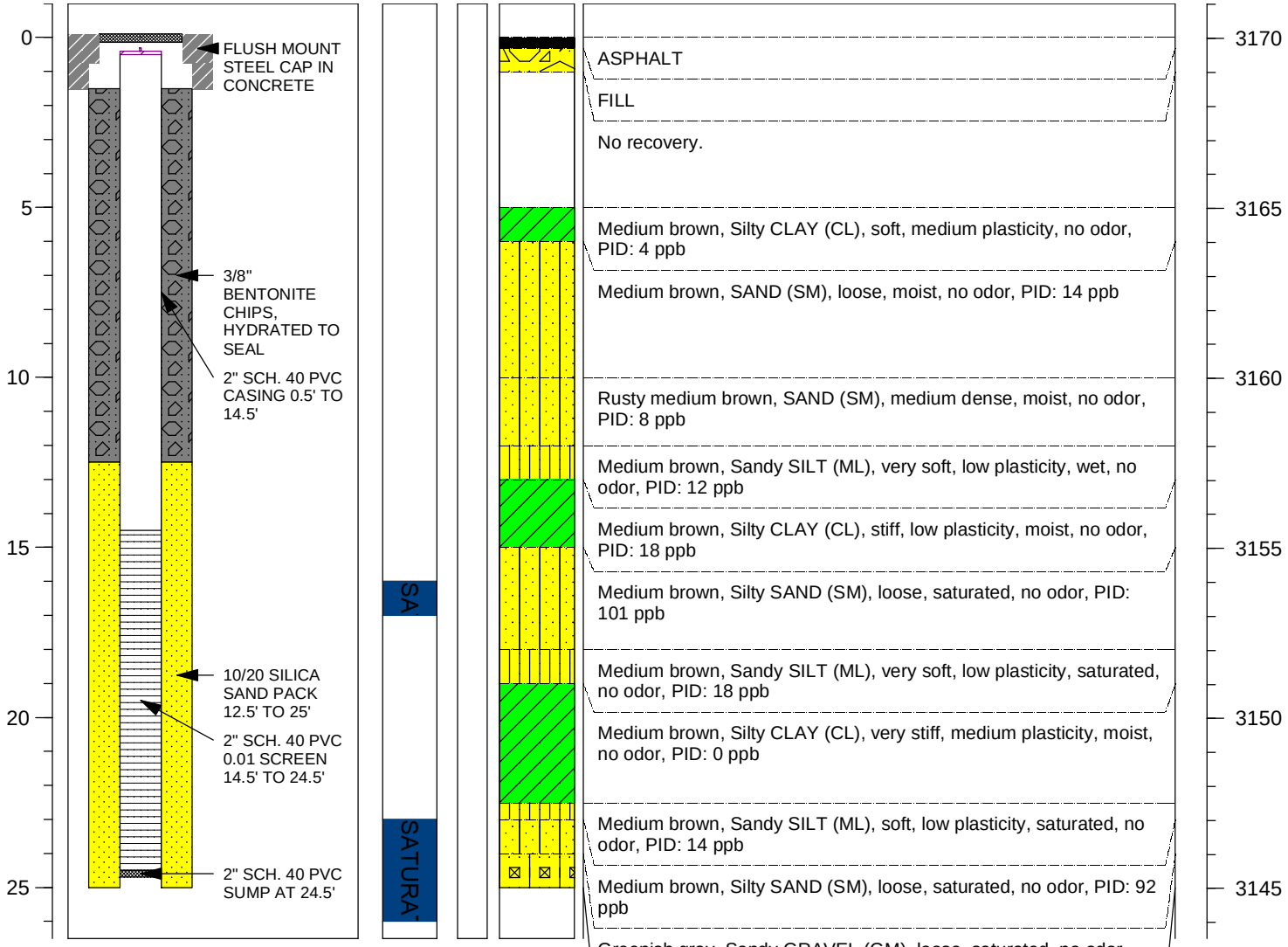
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-130

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Sarah Seitz
Location: Billings, MT
Contractor: IME

Driller: Jose Pereda
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 5/14/2018
Date Completed: 5/14/2018
Easting: 2209703.074
Northing: 553914.711
TOC Elevation: 3170.029



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Notes: PID of ambient air 35 ppb to 54 ppb. Saturated 16-17' bgs and 23-25' bgs. 17-23' bgs interval wet, but not saturated.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG AND WELL CONSTRUCTION

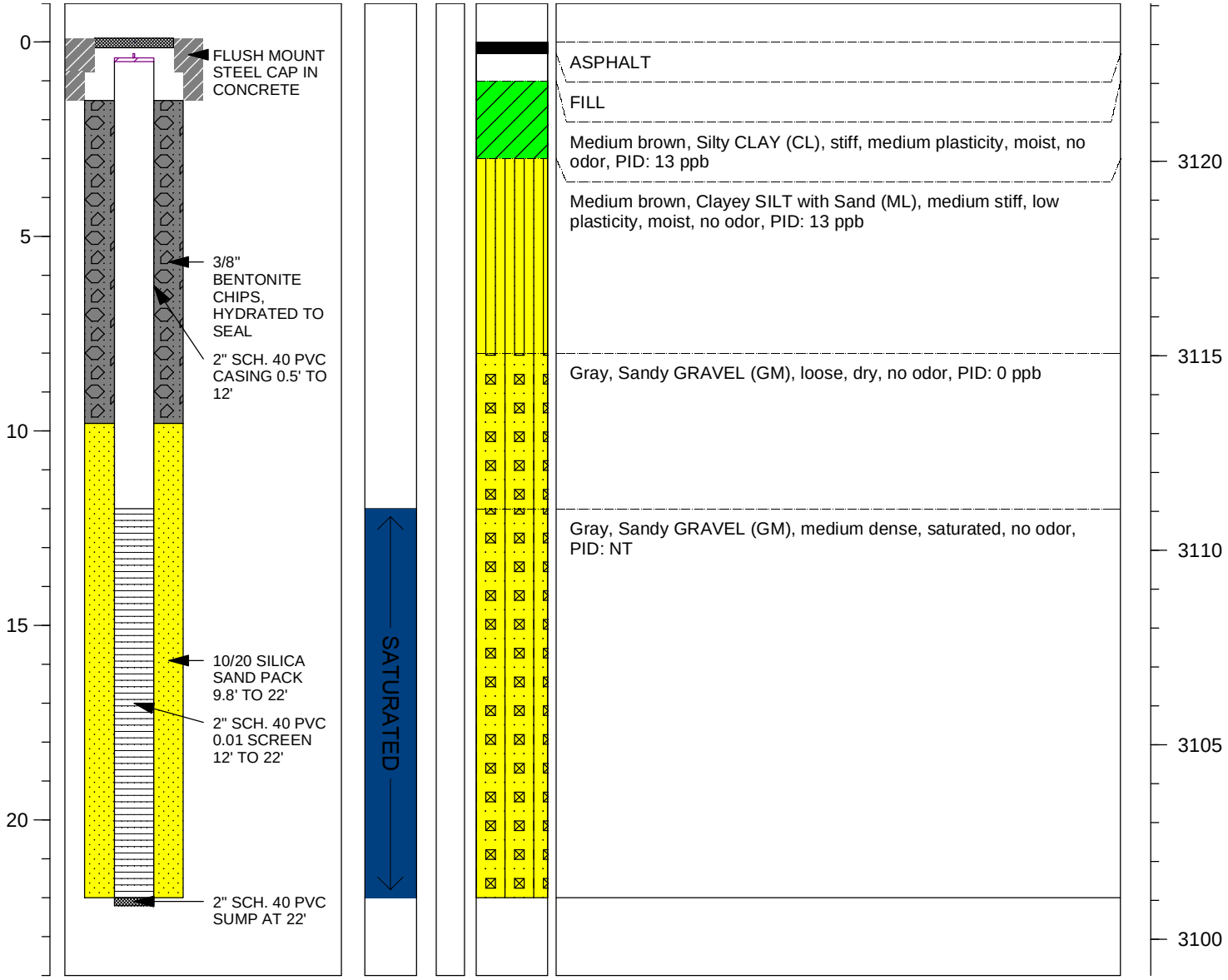
BORING ID: MW-132

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Sarah Seitz
Location: Billings, MT
Contractor: IME

Driller: Jose Pereda
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 22
Sample Type: Geoprobe Acetate Tube

Date Started: 5/15/2018
Date Completed: 5/15/2018
Easting: 2223475.794
Northing: 560191.606
TOC Elevation: 3123.067

DEPTH (FT BGS)	WELL CONSTRUCTION	GROUNDWATER DEPTH	SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	ELEVATION* (FT MSL)



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Notes: PID of ambient air between 0 ppb and 56 ppb. Very little recovery 15-20 feet bgs.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

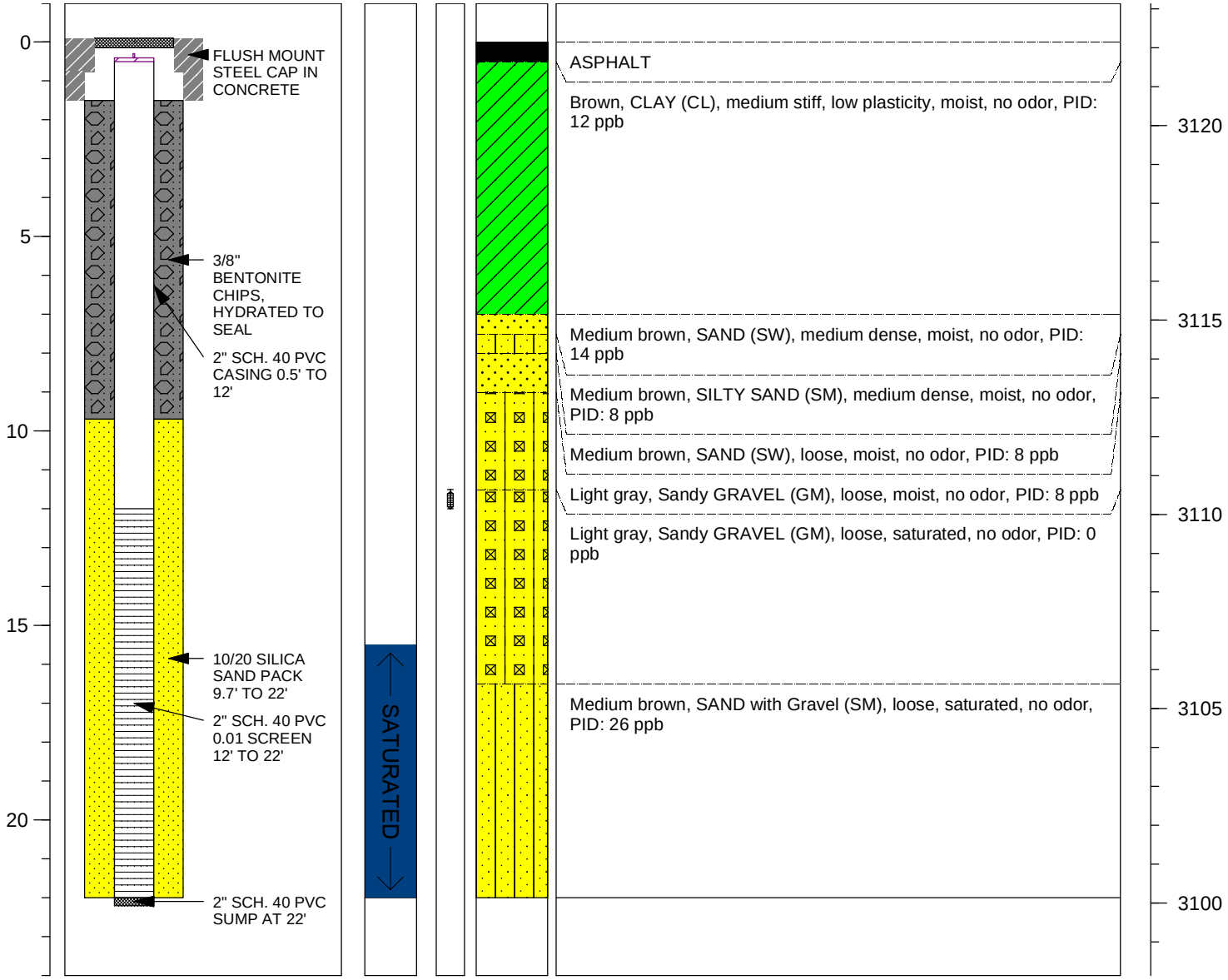
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-133

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Sarah Seitz
Location: Billings, MT
Contractor: IME

Driller: Jose Pereda
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 22
Sample Type: Geoprobe Acetate Tube

Date Started: 5/15/2018
Date Completed: 5/15/2018
Easting: 2223529.029
Northing: 560327.837
TOC Elevation: 3122.142



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Notes: PID of ambient air between 13 ppb and 26 ppb.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

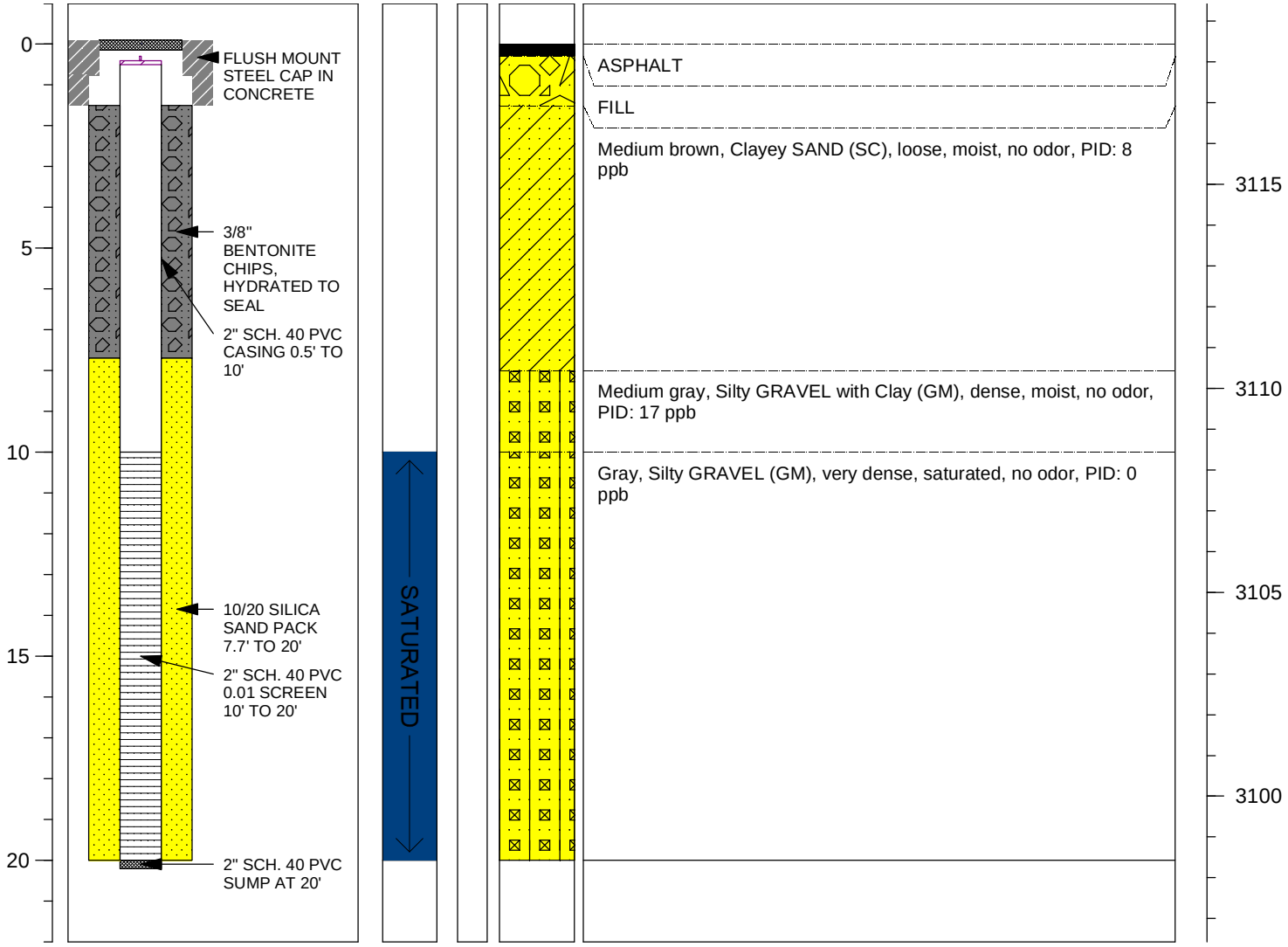
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-134

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Devon Forrest
Location: Billings, MT
Contractor: IME

Driller: Jose Pereda
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 20
Sample Type: Geoprobe Acetate Tube

Date Started: 5/16/2018
Date Completed: 5/16/2018
Easting: 2223896.198
Northing: 560325.85
TOC Elevation: 3118.431



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Notes: PID of ambient air between 4 ppb and 30 ppb.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

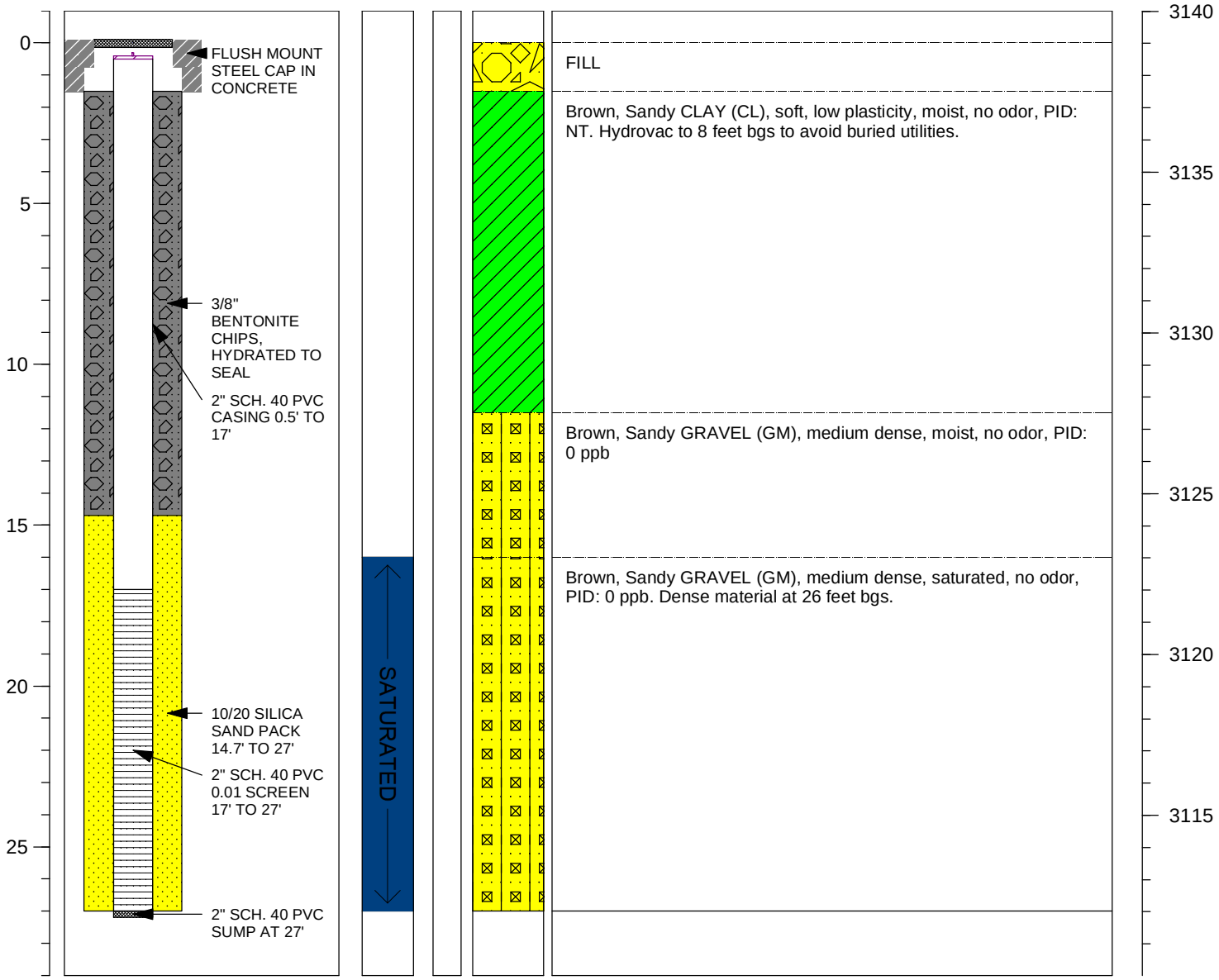
BORING LOG AND WELL CONSTRUCTION

BORING ID: MW-135

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Devon Forrest
Location: Billings, MT
Contractor: IME

Driller: Jose Pereda
Drilling Method: HSA
Borehole Diameter (in): 6
Total Depth (ft): 27
Sample Type: Geoprobe Acetate Tube

Date Started: 5/17/2018
Date Completed: 5/17/2018
Easting: 2219381.835
Northing: 557415.181
TOC Elevation: 3139.019



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Notes: Hydrovac to 8 feet bgs.

Easting and northing in State Plane Coordinates NAD83
Elevation measurement is feet above mean sea level

BORING LOG

BORING ID: 2C-GW-01

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: Direct Push
Borehole Diameter (in): 1.5 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 2/8/2017
Date Completed: 2/8/2017
Easting: 2208911.37
Northing: 552841.546
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				Yellowish dark brown, Gravelly SAND (SW), loose, moist, no odor, PID: 0 ppb	0
				Yellowish dark brown, Silty CLAY (CL), very stiff, low plasticity, moist, no odor, PID: 0 ppb	
5				Yellowish medium brown, Silty SAND (SM), medium dense, moist, no odor, PID: 0 ppb	-5
				Greenish medium brown, Silty SAND (SM), loose, moist, no odor, PID: 0 ppb	
10				Greenish light brown, Silty CLAY (CL), very stiff, low plasticity, moist, no odor, PID: 0 ppb	-10
				Brown, Sandy SILT (SM), loose, saturated, no odor, PID: 0 ppb. 2 inch gravel layer at 10.5 feet bgs	
15				Brown, Silty SAND (SM), loose, saturated, no odor, PID: 0 ppb	-15
				Brown, CLAY with Silt (CL), very stiff, medium plasticity, moist, no odor, PID: 0 ppb	
20	SATURATED			Gray, Sandy GRAVEL (GM), medium dense, saturated, no odor, PID: 0 ppb	-20
				Grayish dark brown, SAND with Silt (SM), loose, saturated, no odor, PID: 0 ppb	
				Brown, Sandy GRAVEL (GM), loose, saturated, no odor, PID: 0 ppb	
25					-25

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Notes:

Easting/Northing is in State Plane Coordinates NAD83.
NM = not measured

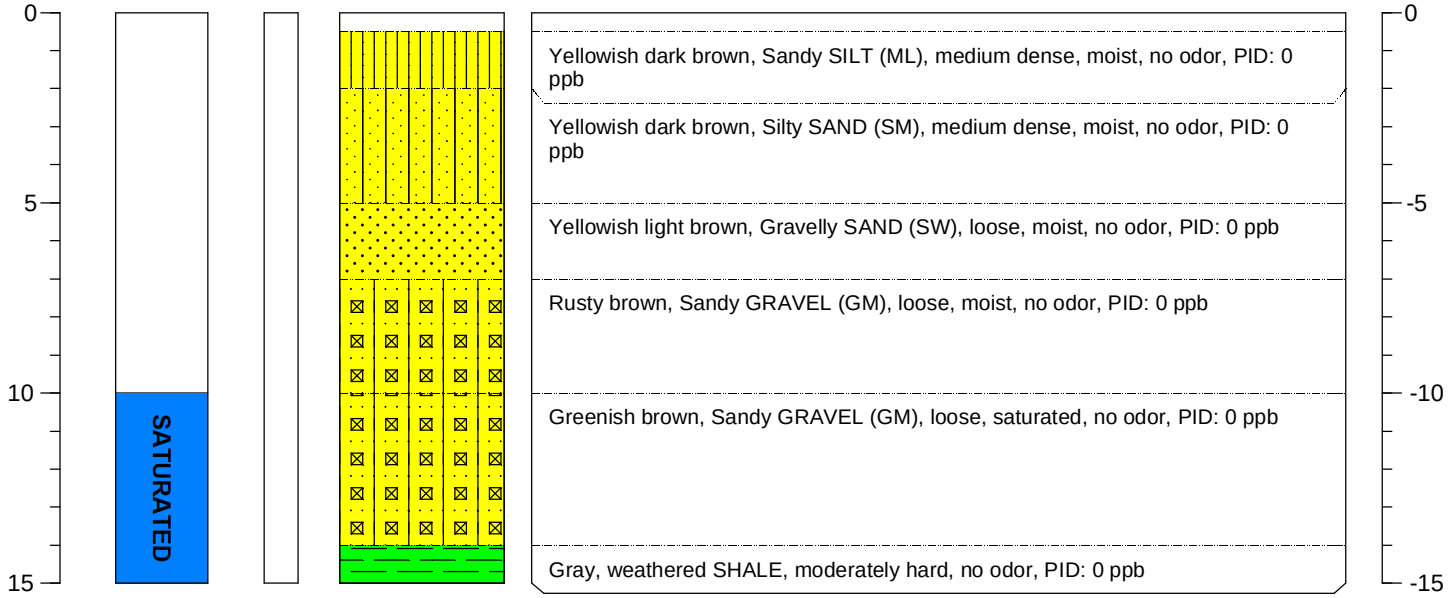
BORING LOG

BORING ID: 2C-GW-04

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: Direct Push
Borehole Diameter (in): 1.5
Total Depth (ft): 15
Sample Type: Geoprobe Acetate Tube

Date Started: 2/8/18
Date Completed: 2/8/18
Easting: 2210043.314
Northing: 555011.685
Elevation: NM



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Notes:

Easting/Northing is in State Plane Coordinates NAD83.
NM = not measured

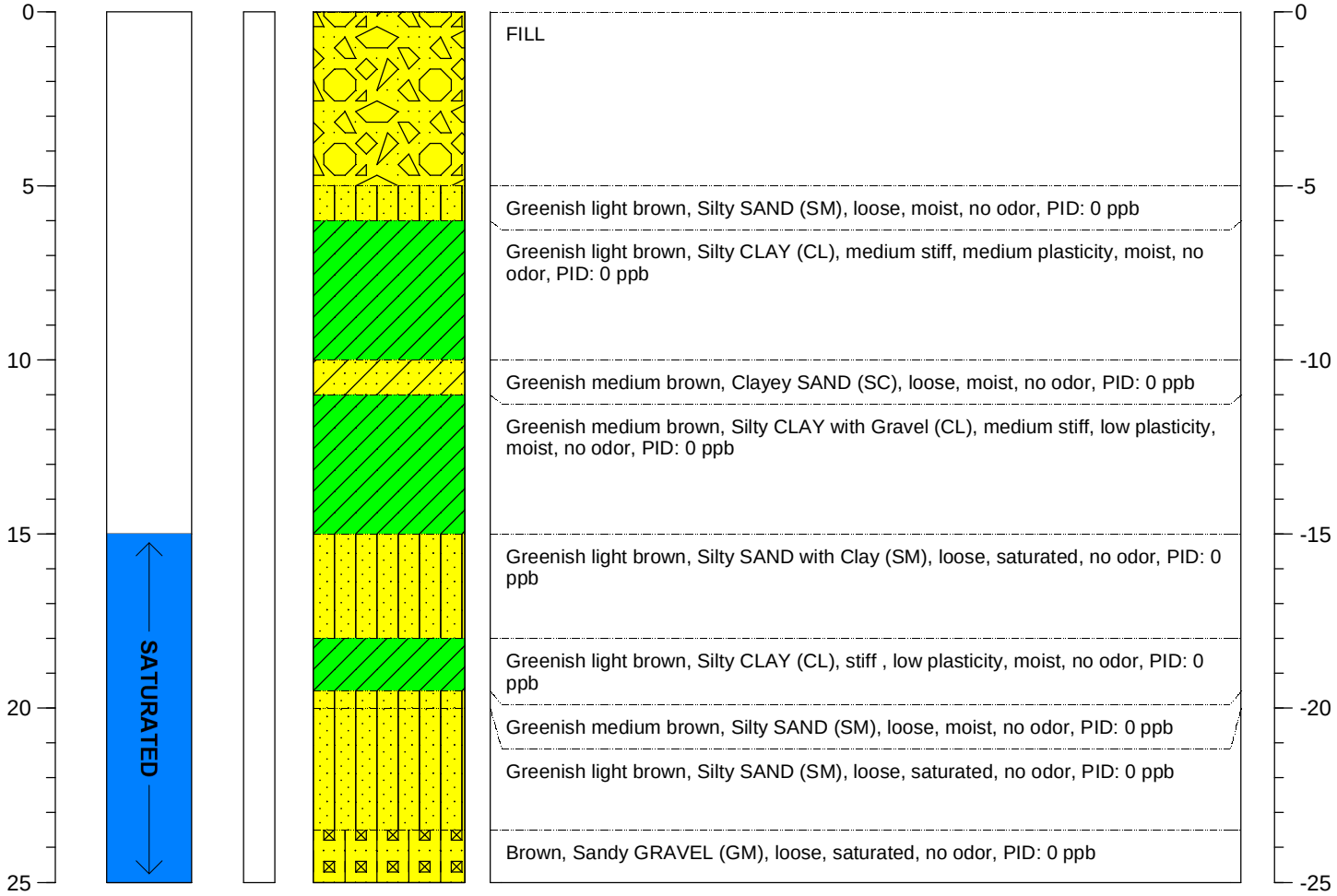
BORING LOG

BORING ID: 2C-GW-05

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: Direct Push
Borehole Diameter (in): 1.5
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 2/7/2018
Date Completed: 2/7/2018
Easting: 2210609.287
Northing: 555022.101
Elevation: NM



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Notes: No MIP data collected at this boring. PCE groundwater screening sample collected at 18-23 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

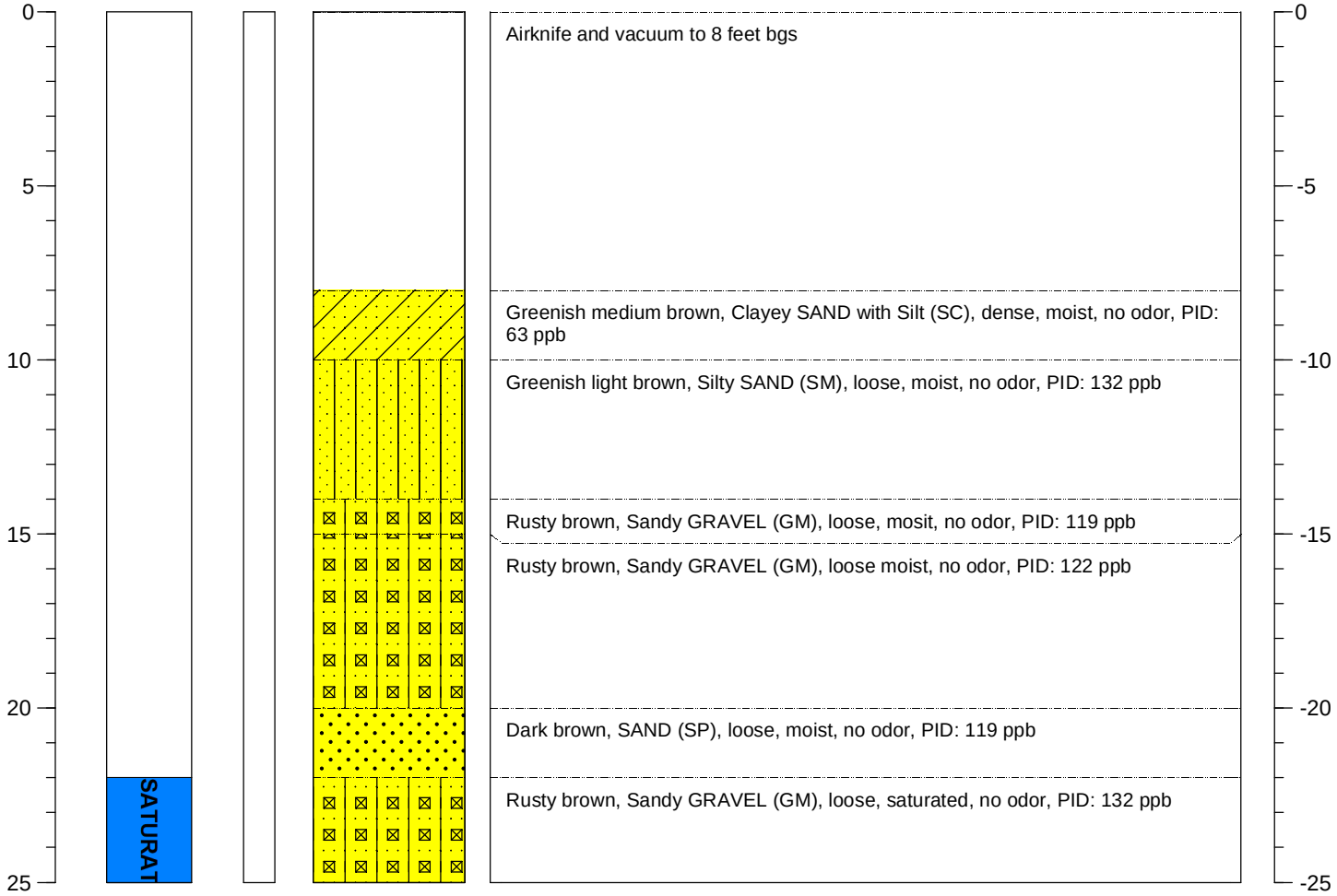
BORING LOG

BORING ID: 4B-GW-03

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: Direct Push
Borehole Diameter (in): 1.5
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 2/6/2018
Date Completed: 2/6/2018
Easting: 2217772.972
Northing: 555559.03
Elevation: NM



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Notes: No MIP data collected at this boring. PCE groundwater screening sample collected at 22-25 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

BORING LOG

BORING ID: 4D-GW-02

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: Direct Push
Borehole Diameter (in): 1.5
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 2/6/2018
Date Completed: 2/6/2018
Easting: 2220835.467
Northing: 556610.788
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				Airknife and vacuum to 7.5 feet bgs	0
5					-5
				Dark brown, Silty SAND (SM), loose, moist, no odor, PID: 0 ppb	
10				Brown, Sandy GRAVEL (GM), loose, moist, no odor, PID: 1575 ppb	-10
15					-15

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Notes: No MIP data collected at this boring. PCE groundwater screening sample collected at 17-23 feet bgs with peristaltic pump after 1 gallon purge. Hole abandoned with 8.75 inch bentonite plug.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

BORING LOG

BORING ID: 5D-GW-01

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: IME

Driller: Duane Leary
Drilling Method: Direct Push
Borehole Diameter (in): 1.5 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 2/7/2018
Date Completed: 2/7/2018
Easting: Easting
Northing: Northing
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				FILL	0
				Dark brown, Silty SAND (SM), medium dense, moist, no odor, PID: 0 ppb. Black smear in core.	
				Grayish dark brown, CLAY with Silt (CL), stiff, low plasticity, no odor, PID: 0 ppb	
5				Black, CLAY with Silt (CL), medium stiffness, low plasticity, moist, no odor, PID: 0 ppb	-5
				Greenish medium brown, Gravelly SAND (SW), loose, wet, no odor, PID: 0 ppb	
10	SATURATED			Black, Sandy CLAY (CL), very stiff, low palsticity, moist, no odor, PID: 0 ppb	-10
				Greenish medium gray, Sandy GRAVEL (GM), loose, saturated, no odor, PID: 0 ppb	
15				Black, Sandy GRAVEL (GM), medium dense, saturated, no odor, PID: 0 ppb	-15
				Gray, slightly weathered SHALE, laminated, no odor, PID: 0 ppb	
20					-20

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Notes: No MIP data collected at this boring. PCE groundwater screening sample collected at 13-18 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

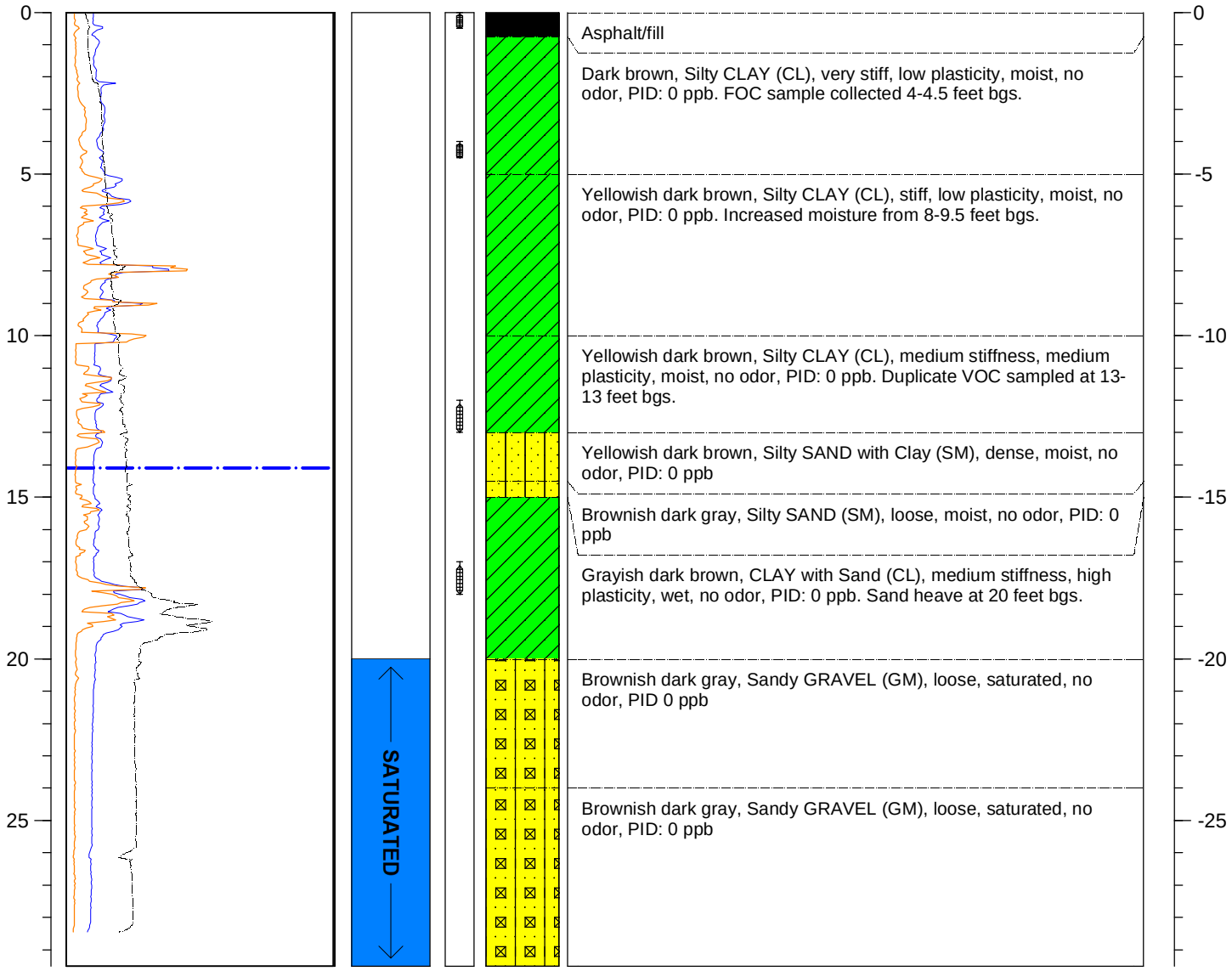
BORING LOG AND MIP DATA

BORING ID: BSL-MIP-01

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Charles Greesen
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 29.5
Sample Type: Geoprobe Acetate Tube

Date Started: 12/3/2017
Date Completed: 12/3/2017
Easting: 2214919.897
Northing: 555633.7625
Elevation: NM



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Notes:

Easting/Northing is in State Plane Coordinates NAD83.
MIP PID, FID, XSD outputs scaled to relative responses (see Appexdix D).
NM = not measured
Dashed blue line = MIP GW measurement

BORING LOG

BORING ID: BSL-MIP-09

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Wallace Coles
Location: Billings, MT
Contractor: Earth Probe

Driller: Mark Taggert
Drilling Method: Direct Push
Borehole Diameter (in): 2 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 3/29/2018
Date Completed: 3/29/2018
Easting: 2214946.557
Northing: 555782.6906
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				Asphalt	0
				Light brown, Clayey SAND with Gravel (SC), dense, dry, no odor, PID: 7545 ppb	
5					-5
				Light brown, Clayey SAND with Gravel (SC), dense, dry, no odor, PID: 92.82 ppm. Pipe encountered at 0.5 feet bgs	
10				Light brown, Clayey SAND with Gravel (SC), dense, dry, no odor, PID: 1647 ppb	-10
15				Medium brown, Gravelly SAND (SP), medium dense, wet, strong odor, PID: not measured. Clay lenses present.	-15
20					-20
25					-25

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Notes: No MIP data collected at this location. PCE groundwater screening sample collected at 14-23 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

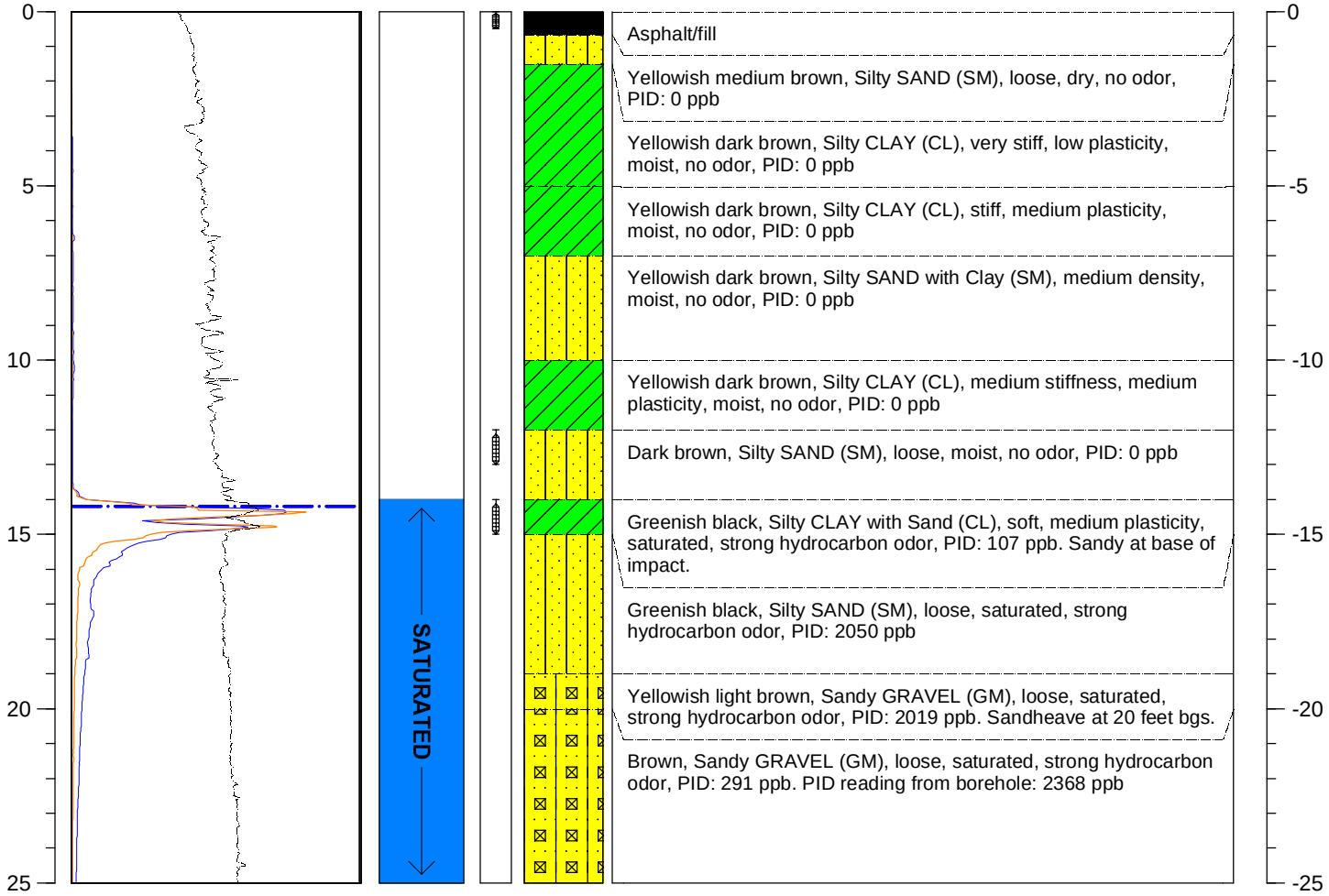
BORING LOG AND MIP DATA

BORING ID: BSL-MIP-20

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Charles Greusen
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 12/4/2017
Date Completed: 12/4/2017
Easting: 2214956.62
Northing: 555890.4557
Elevation:



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Notes: Duplicate MS/MSD collected at 12-13 feet bgs

Easting/Northing is in State Plane Coordinates NAD83.
MIP PID, FID, XSD outputs scaled to relative responses (see Appexdix D).
NM = not measured
Dashed blue line = MIP GW measurement

BORING LOG

BORING ID: BSL-MIP-T18

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Wallace Coles
Location: Billings, MT
Contractor: Earth Probe

Driller: Mark Taggert
Drilling Method: Direct Push
Borehole Diameter (in): 2 in
Total Depth (ft): 15
Sample Type: Geoprobe Acetate Tube

Date Started: 3/28/2018
Date Completed: 3/28/2018
Easting: 2214863.23
Northing: 555850.4348
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				Asphalt	0
				Black, Clayey SAND with Gravel (SC), dense, moist, slight odor, PID: 225 ppm. Black staining.	
				Medium brown, Silty CLAY (CL), soft, low plasticity, moist, slight odor, PID: 244.6 ppm	
5					-5
10					-10
15				Black, Clayey SILT (ML), soft, low plasticity, wet, moderate odor, PID: not measured. Black staining.	-15

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Notes: No MIP data collected at this boring. PCE groundwater screening sample collected at 15 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

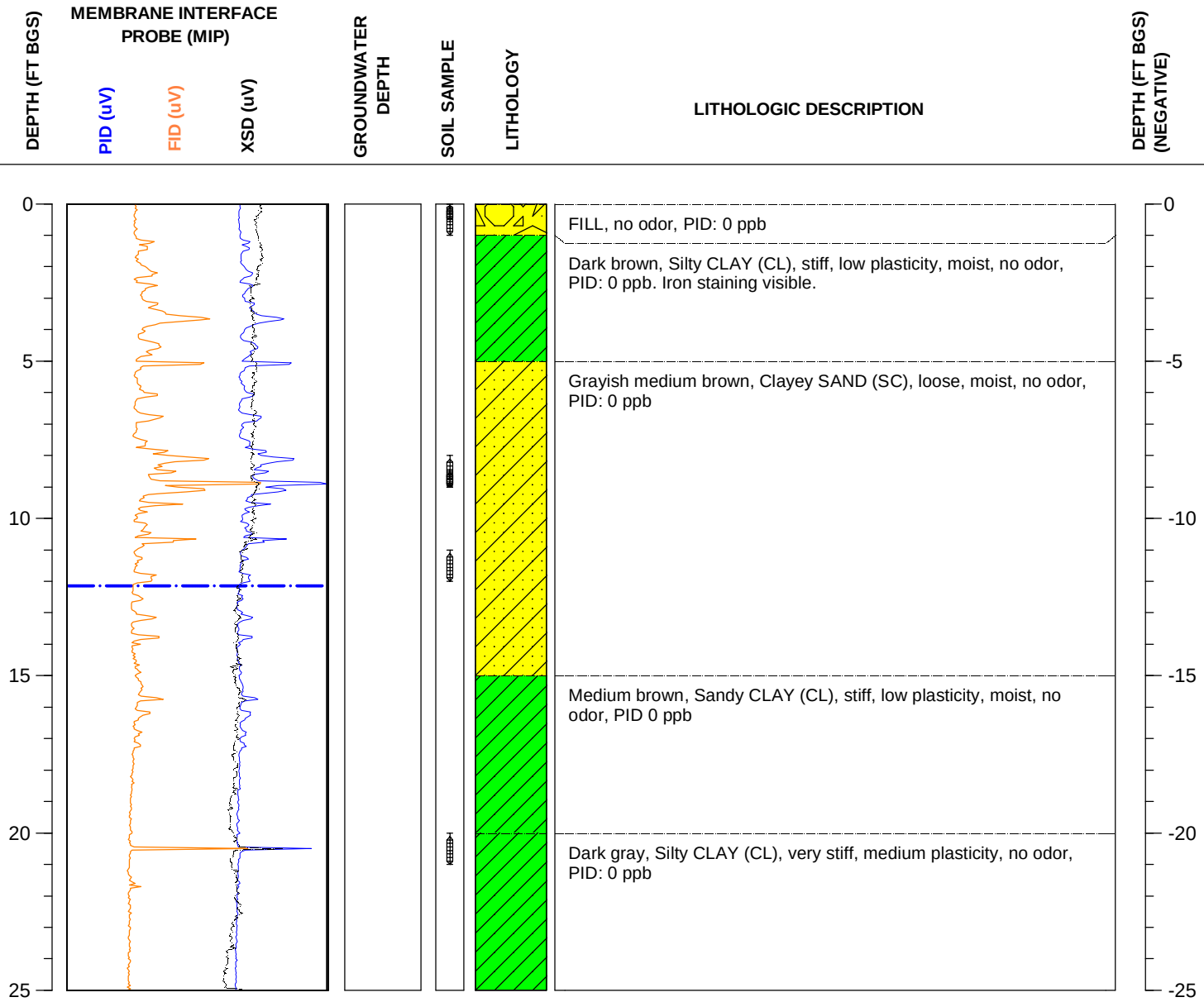
BORING LOG AND MIP DATA

BORING ID: CAL-MIP-02

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Charles Greuson
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 11/28/2017
Date Completed: 11/28/2017
Easting: 2210868.37
Northing: 555470.5835
Elevation: NM



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Notes: PCE groundwater screening sampling collected at 12-23 ft bgs with a peristaltic pump after a 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.
MIP PID, FID, XSD outputs scaled to relative responses (see Appexdix D).
NM = not measured
Dashed blue line = MIP GW measurement

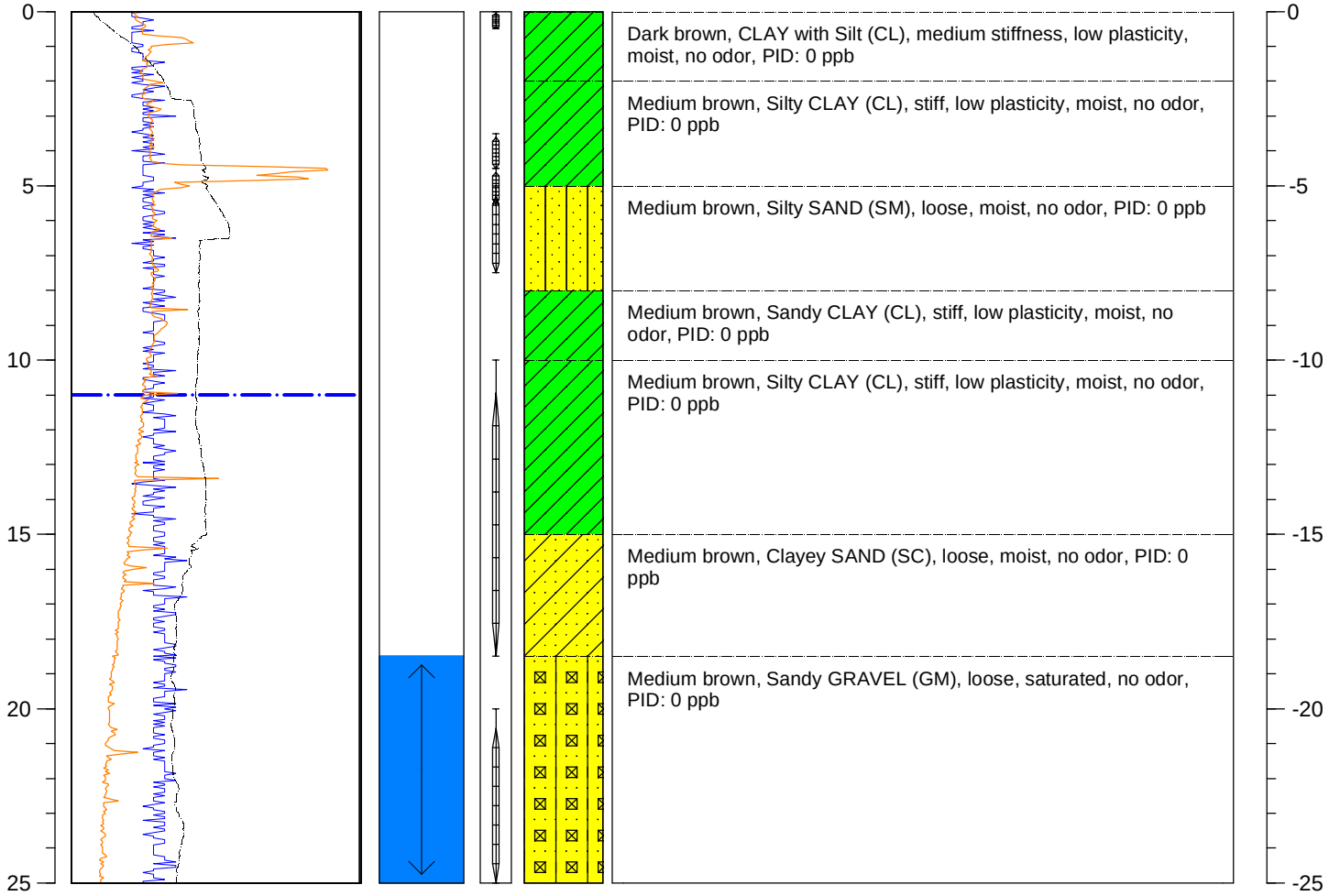
BORING LOG AND MIP DATA

BORING ID: CAL-MIP-03

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Charles Greuson
Drilling Method: Direct push
Borehole Diameter (in): 1.25
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 11/28/2017
Date Completed: 11/28/2017
Easting: 2211272.223
Northing: 555459.2667
Elevation: NM



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Notes: PCE groundwater screening sample collected at 19-23 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.
MIP PID, FID, XSD outputs scaled to relative responses (see Appexdix D).
NM = not measured
Dashed blue line = MIP GW measurement

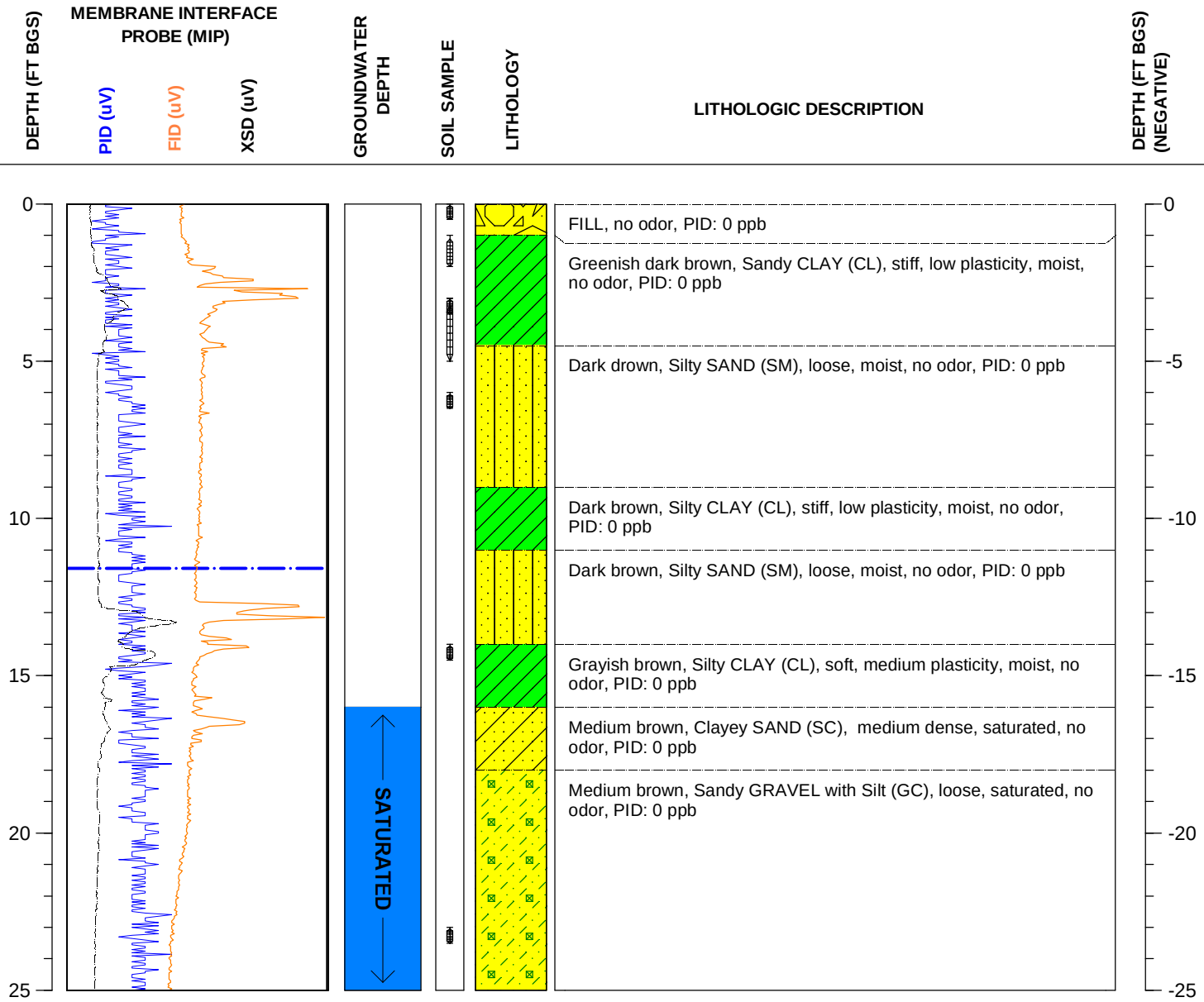
BORING LOG AND MIP DATA

BORING ID: CAL-MIP-04

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Charles Greuson
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 11/28/2017
Date Completed: 11/28/2017
Easting: 2211206.009
Northing: 555465.1315
Elevation: NM



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Notes: PCE groundwater screening sampling collected at 10-23 ft bgs with a peristaltic pump after a 1 gallon purge. Duplicate collected from 6 feet bgs. Additional runs required for volume, PID reading from bottom of additional run: 497 ppb

Easting/Northing is in State Plane Coordinates NAD83.
MIP PID, FID, XSD outputs scaled to relative responses (see Appexdix D).
NM = not measured
Dashed blue line = MIP GW measurement

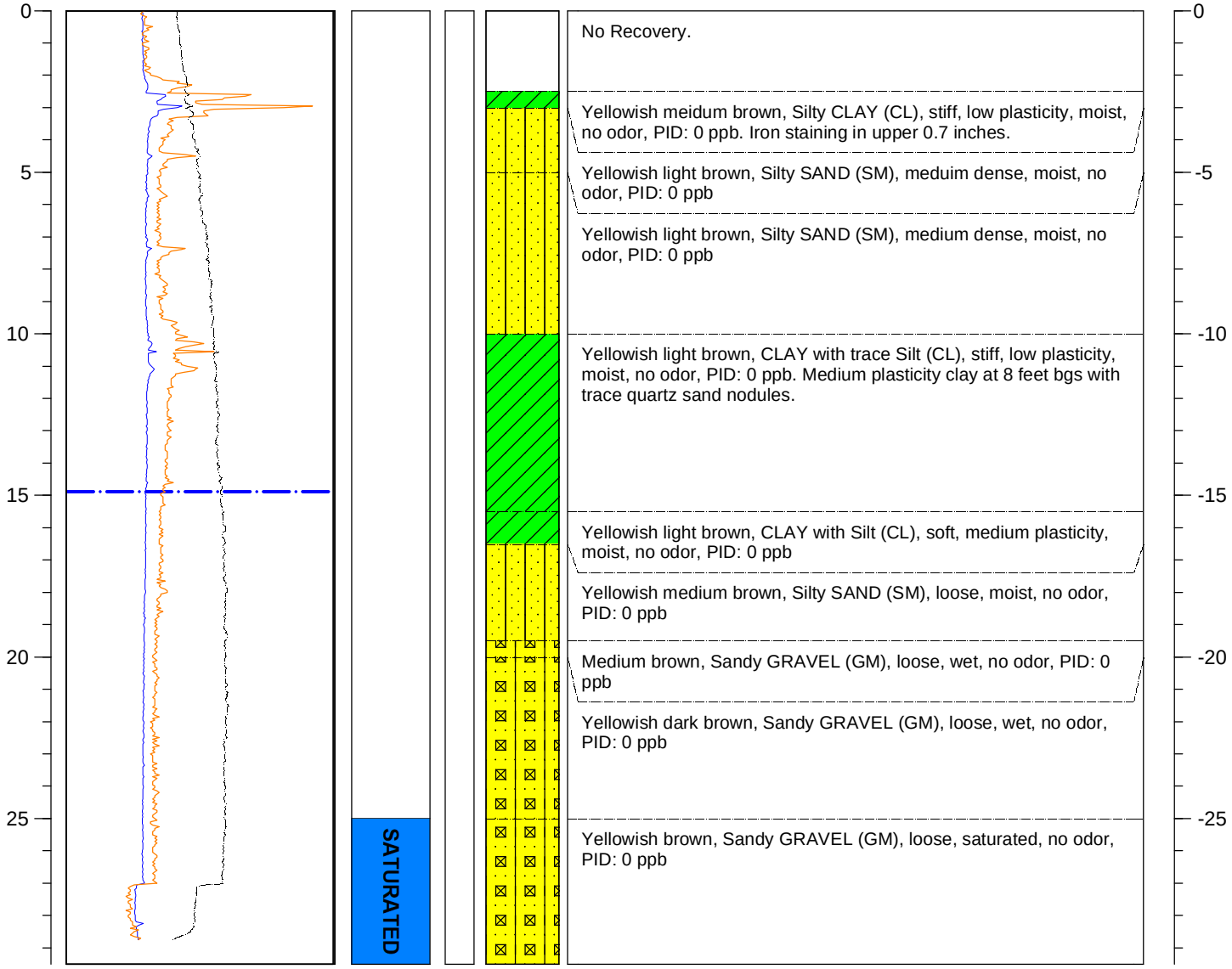
BORING LOG AND MIP DATA

BORING ID: CAL-MIP-08

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Logan McLougth
Drilling Method: Direct Push
Borehole Diameter (in): 1.25
Total Depth (ft): 29.5
Sample Type: Geoprobe Acetate Tube

Date Started: 11/15/2017
Date Completed: 11/15/2017
Easting:
Northing:
Elevation: NM



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Notes: Samples not collected from this boring.

Easting/Northing is in State Plane Coordinates NAD83.
MIP PID, FID, XSD outputs scaled to relative responses (see Appexdix D).
NM = not measured
Dashed blue line = MIP GW measurement

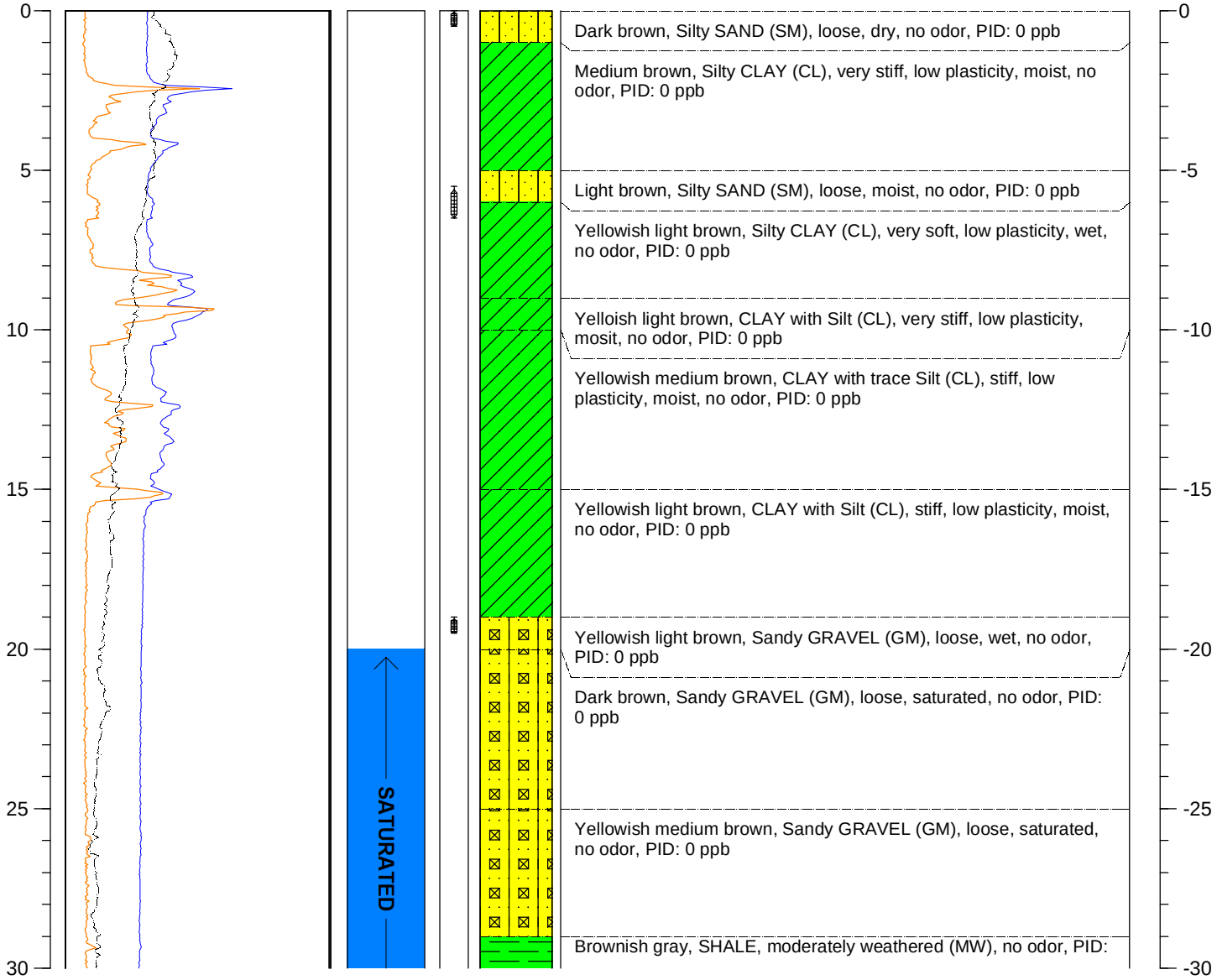
BORING LOG AND MIP DATA

BORING ID: CAL-MIP-09

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Logan McLougth
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 32.5
Sample Type: Geoprobe Acetate Tube

Date Started: 11/15/2017
Date Completed: 11/15/2017
Easting: 2211238.189
Northing: 555524.3829
Elevation: NM



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Notes: PCE groundwater screening sample collected at 15-29 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.
MIP PID, FID, XSD outputs scaled to relative responses (see Appexdix D).
NM = not measured
Dashed blue line = MIP GW measurement

BORING LOG AND MIP DATA

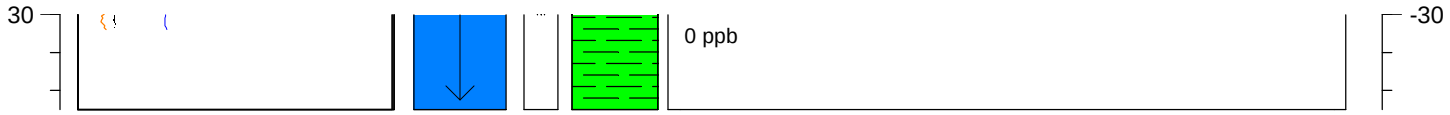
BORING ID: CAL-MIP-09

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Logan McLougth
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 32.5
Sample Type: Geoprobe Acetate Tube

Date Started: 11/15/2017
Date Completed: 11/15/2017
Easting: 2211238.189
Northing: 555524.3829
Elevation: NM

DEPTH (FT BGS)	MEMBRANE INTERFACE PROBE (MIP) PID (uV)	FID (uV)	XSD (uV)	GROUNDWATER DEPTH	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)



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Notes: PCE groundwater screening sample collected at 15-29 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.
MIP PID, FID, XSD outputs scaled to relative responses (see Appexdix D).
NM = not measured
Dashed blue line = MIP GW measurement

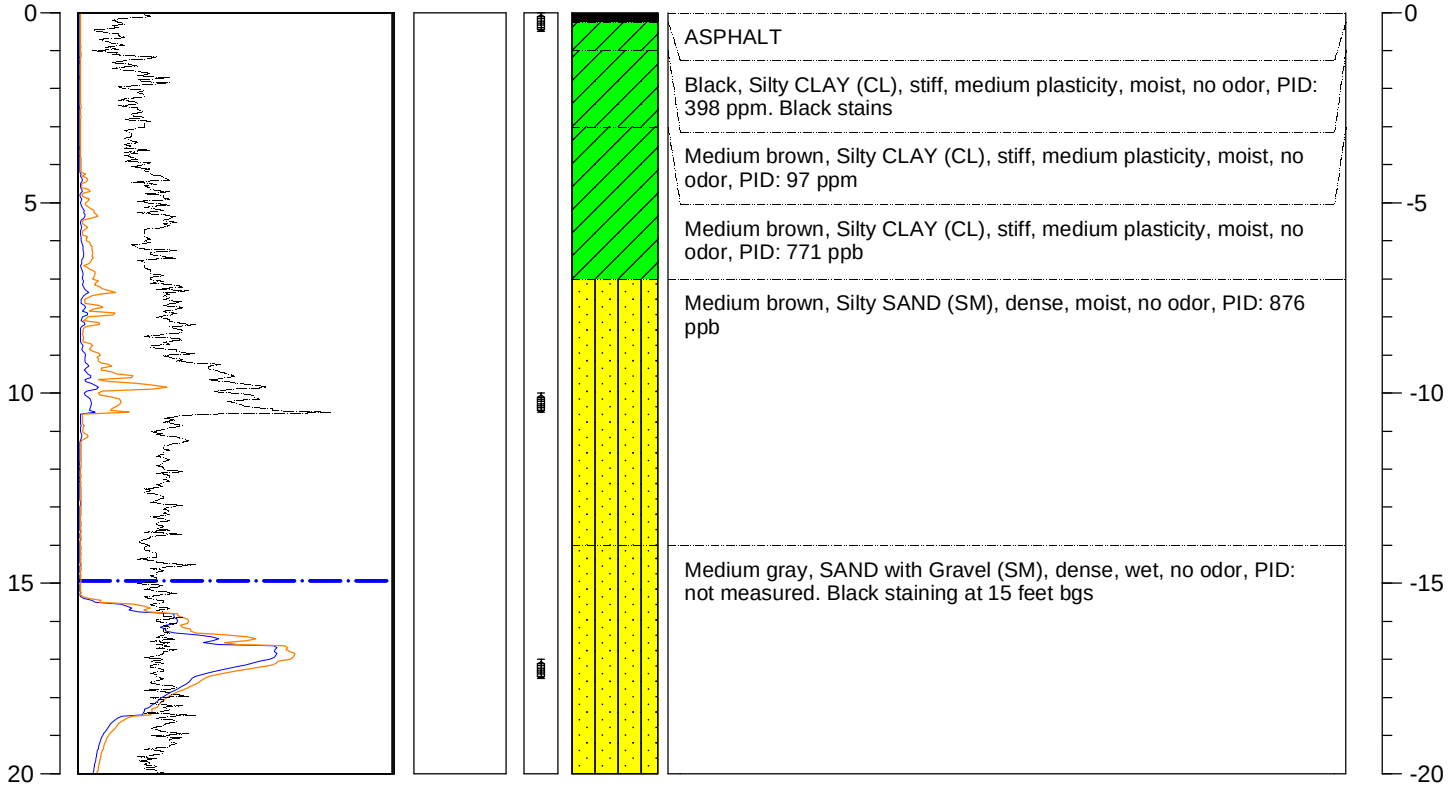
BORING LOG AND MIP DATA

BORING ID: REX-MIP-03

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Wallace Coles
Location: Billings, MT
Contractor: Earth Probe

Driller: Mark Taggert
Drilling Method: Direct Push
Borehole Diameter (in): 2 in
Total Depth (ft): 20
Sample Type: Geoprobe Acetate Tube

Date Started: 3/28/2018
Date Completed: 3/28/2018
Easting: 2222897.261
Northing: 559521.1273
Elevation: NM



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Notes: No MIP data collected at this boring. PCE groundwater screening sample collected at 18 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.
MIP PID, FID, XSD outputs scaled to relative responses (see Appexdix D).
NM = not measured
Dashed blue line = MIP GW measurement

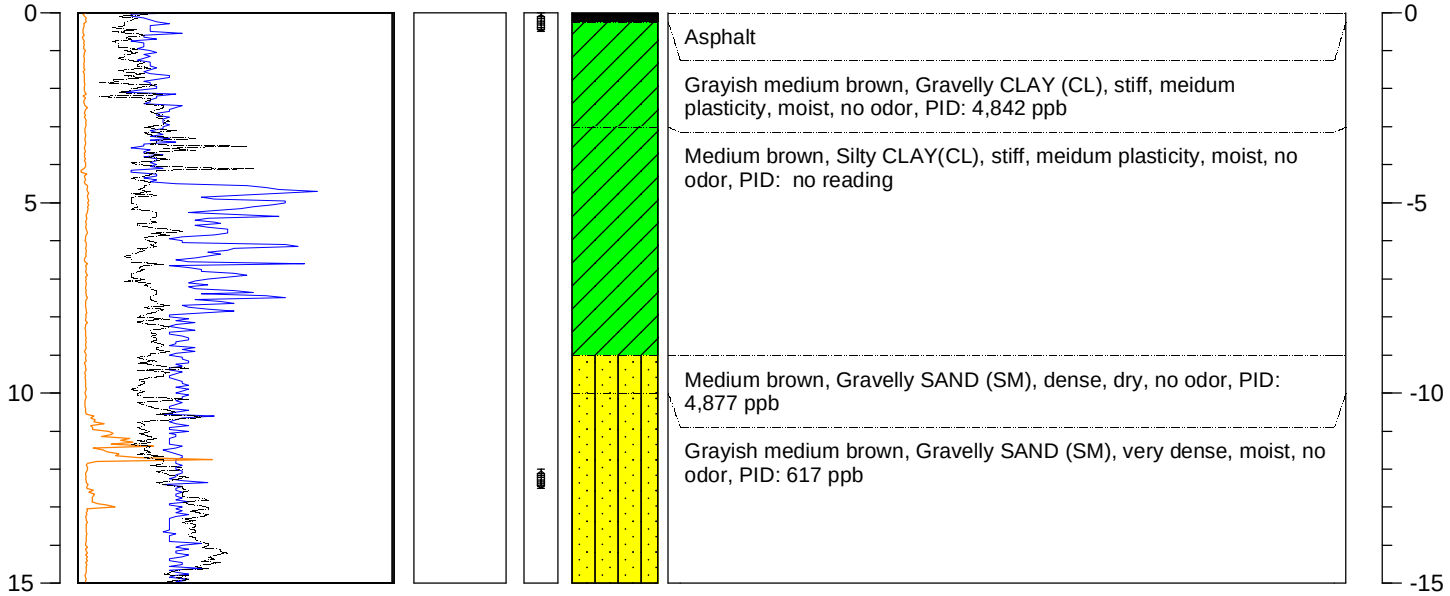
BORING LOG AND MIP DATA

BORING ID: REX-MIP-04

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Earth Probe

Driller: Mark Taggert
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 15
Sample Type: Geoprobe Acetate Tube

Date Started: 3/28/2018
Date Completed: 3/28/2018
Easting: 2222730.745
Northing: 559461.9105
Elevation: NM



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Notes:

Easting/Northing is in State Plane Coordinates NAD83.
MIP PID, FID, XSD outputs scaled to relative responses (see Appexdix D).
NM = not measured
Dashed blue line = MIP GW measurement

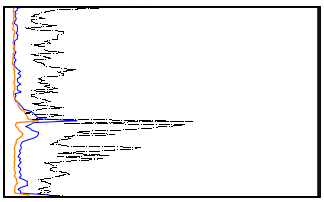
BORING LOG AND MIP DATA

BORING ID: REX-MIP-07

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Earth Probe

Driller: Mark Taggart
Drilling Method: Direct Push
Borehole Diameter (in): 2 in
Total Depth (ft): 5
Sample Type: Geoprobe Acetate Tube

Date Started: 3/28/2018
Date Completed: 3/28/2018
Easting: 2222734.252
Northing: 559546.4585
Elevation: NM

DEPTH (FT BGS)	MEMBRANE INTERFACE PROBE (MIP) PID (uV)	FID (uV)	XSD (uV)	GROUNDWATER DEPTH	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0							Asphalt Medium brown, Silty CLAY (CL), stiff, low plasticity, moist, no odor, PID: 172 ppb. Black staining 0.25 feet to 1.0 feet bgs. PID: 87 ppm at 4 feet bgs.	0
5								-5

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Notes:

Easting/Northing is in State Plane Coordinates NAD83.
MIP PID, FID, XSD outputs scaled to relative responses (see Appexdix D).
NM = not measured
Dashed blue line = MIP GW measurement

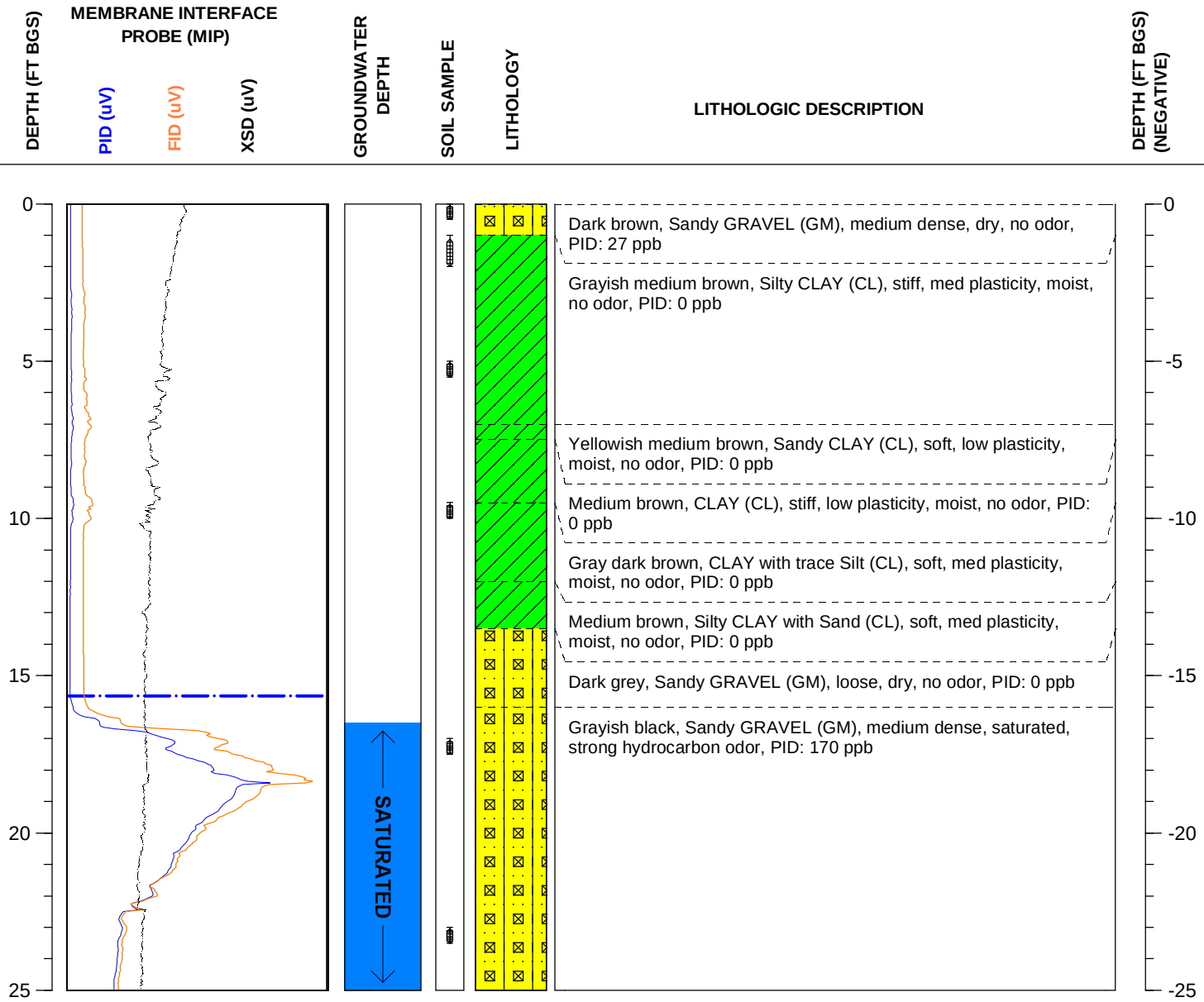
BORING LOG AND MIP DATA

BORING ID: REX-MIP-08

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Jacob Scott
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Logan McLoth
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 12/21/2017
Date Completed: 12/21/2017
Easting: 2222765.715
Northing: 559594.8202
Elevation: NM



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Notes: PCE groundwater screening sample collected at 19-23 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.
MIP PID, FID, XSD outputs scaled to relative responses (see Appexdix D).
NM = not measured
Dashed blue line = MIP GW measurement

BORING LOG

BORING ID: HLS-GW-03

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Jacob Scott
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Charles Brenson
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 12/1/2017
Date Completed: 12/1/2017
Easting: 2215637.238
Northing: 555412.9541
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				Medium brown, CLAY with Sand (CL), stiff, low plasticity, moist, no odor, PID: 0 ppb	0
5				Grayish medium brown, CLAY with Silt (CL), medium stiffness, medium plasticity, moist, no odor, PID: 103 ppb at 7.5 feet bgs. PID: 145 ppb in head space.	-5
10					-10
				Medium brown, CLAY with Sand (CL), soft, low plasticity, moist, no odor, PID: 0 ppb	
15				Grayish dark brown, Gravelly SAND (SM), medium dense, moist, no odor, PID: 0 ppb	-15
				Grayish dark brown, Sandy GRAVEL (GM), loose, wet, no odor, PID: 0 ppb	
20					-20
25					-25

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Notes: PCE groundwater screening sample collected at 18-23 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

BORING LOG

BORING ID: HLS-GW-04

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Jacob Scott
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Charles Grenson
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 12/1/2017
Date Completed: 12/1/2017
Easting: 2215637.308
Northing: 555488.2522
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				Dark brown, SAND with Gravel (SP), loose, dry, no odor, PID: 32 ppb	0
				Grayish medium brown, CLAY with Silt (CL), stiff, low plasticity, moist, no odor, PID: 17 ppb. PID in headspace: 17 ppb	
5				Medium brown, CLAY with Silt (CL), medium stiffness, low plasticity, moist, no odor, PID: 0 ppb	-5
				Medium brown, Silty SAND (SM), medium density, moist, no odor, PID: 0 ppb	
10				Grayish dark brown, SAND (SW), loose, moist, no odor, PID: 0 ppb	-10
15				Brownish medium gray, Sandy GRAVEL (GP), loose, wet, no odor, PID: 0 ppb. Sand heave at 25 feet bgs.	-15
20					-20
25					-25

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Notes: PCE groundwater screening sample collected at 18-23 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

BORING LOG

BORING ID: HLS-GW-05

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Jacob Scott
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Charles Greuson
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 12/2/2017
Date Completed: 12/2/2017
Easting: 2215627.48
Northing: 555615.083
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				Dark brown, Sandy TOPSOIL, loose, dry, no odor, PID: 0 ppb	0
				Medium brown, CLAY with Silt (CL), stiff, low plasticity, moist, no odor, PID: 0 ppb	
5					-5
				Grayish dark brown, Silty SAND (SM), medium density, moist, no odor, PID: 0 ppb	
10					-10
				Grayish dark brown, SAND (SW), loose, moist, no odor, PID: 0 ppb	
				Dark gray, GRAVEL with Sand (GM), loose, moist, no odor, PID: 0 ppb	
15				Dark grey, Sandy GRAVEL (GM), loose, wet, no odor, PID: 0 ppb. Limited recovery from 15-20 feet bgs.	-15
20					-20
25					-25

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Notes: No samples collected from boring.

Easting/Northing is in State Plane Coordinates NAD83.
NM = not measured

BORING LOG

BORING ID: **WETZ-GW-01**

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Lenny Darnell
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 9
Sample Type: Geoprobe Acetate Tube

Date Started: 30-Nov-17
Date Completed: 30-Nov-17
Easting: 2221335.524
Northing: 559980.326
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				Asphalt/fill	0
				Grayish dark brown, Silty CLAY (CL), stiff, low plasticity, moist, no odor, PID: 0 ppb	
5				Grayish dark brown, Silty CLAY with Sand (CL), stiff, low plasticity, moist, no odor, PID: 0 ppb	-5
				Brown, Silty SAND (SM), loose, moist, no odor, PID: 0 ppb	
				Dark brown, Sandy GRAVEL (GM), loose, dry, no odor. PID: 0 ppb	

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Notes: Boring terminated due to impenetrable gravel.

Easting/Northing is in State Plane Coordinates NAD83.
NM = not measured

BORING LOG

BORING ID: **WETZ-GW-02**

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Jacob Scott
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Charles Greusen
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 9
Sample Type: Geoprobe Acetate Tube

Date Started: 11/30/2017
Date Completed: 11/30/2017
Easting: 2221463.562
Northing: 560086.663
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				No Recovery	0
5				Grayish dark brown, CLAY with Silt (CL), medium stiffness, low plasticity, moist, no odor, PID: 73 ppb	-5
				Grayish light brown, Sandy GRAVEL (GP), loose, dry, no odor, PID: 0 ppb	

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Notes: PID reading in head space: 466 ppb.

Easting/Northing is in State Plane Coordinates NAD83.
NM = not measured

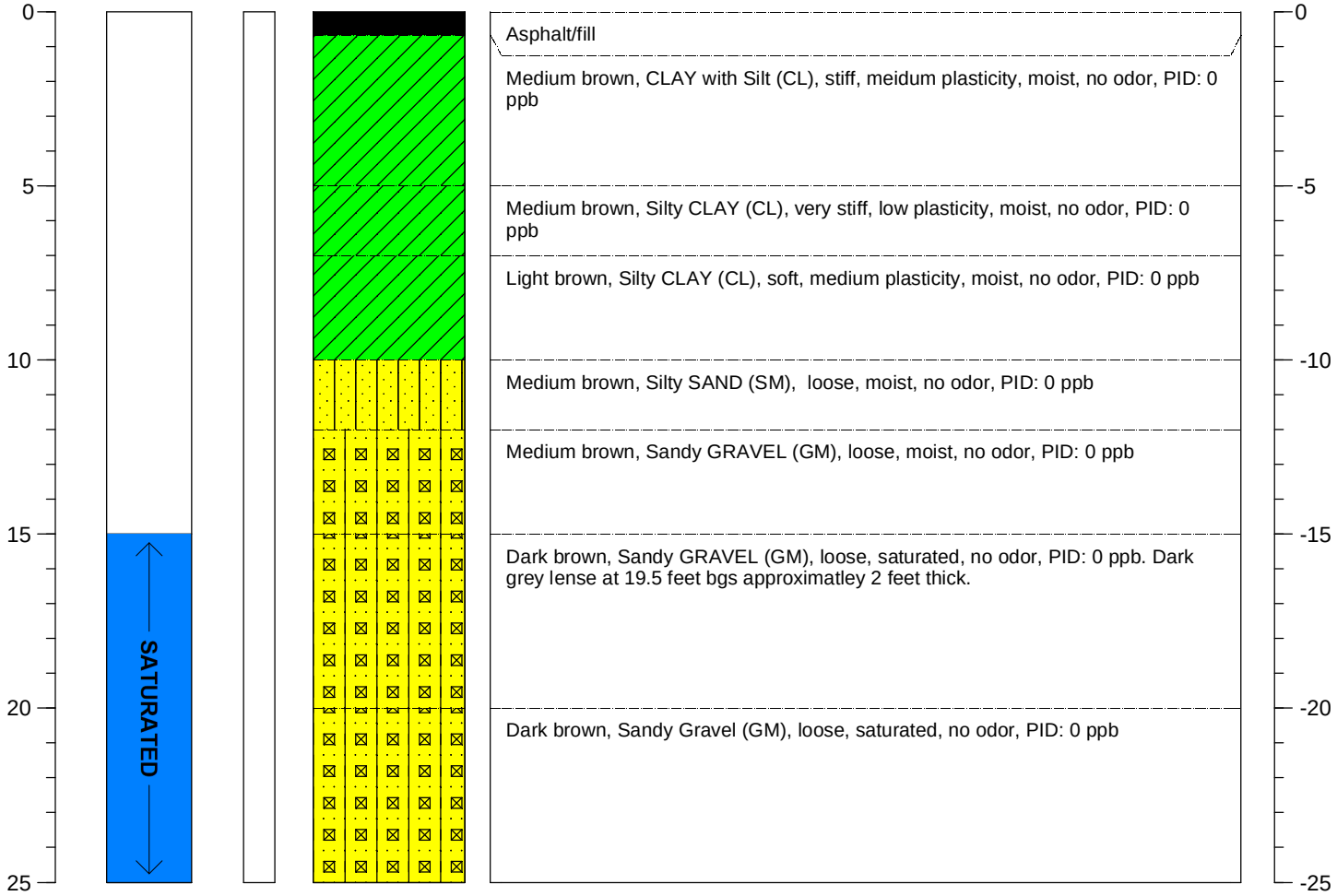
BORING LOG

BORING ID: ALSCO-GW-01

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Lenny Darnel
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 25
Sample Type: Geoporobe Acetate Tube

Date Started: 11/29/17
Date Completed: 11/29/17
Easting: 2215795.345
Northing: 553080.919
Elevation: NM



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Notes: No MIP data collected at this boring.
PCE groundwater screening sampling collected at 19-23 ft bgs with a peristaltic pump after a 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

BORING LOG

BORING ID: ALSCO-GW-02

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Lenny Darnell
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 11/29/2017
Date Completed: 11/29/2017
Easting: 2215788.206
Northing: 553157.495
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				Asphalt/fill	0
				Dark brown, Silty CLAY (CL), stiff, low plasticity, moist, no odor, PID: 0 ppb	
5				Dark grey, Silty CLAY (CL), medium stiffness, medium plasticity, moist, no odor, PID: 0 ppb	-5
10				Greyish dark brown, Sandy CLAY with Silt (CL), medium stiffness, medium plasticity, moist, no odor, PID: 0 ppb. Soil sample taken 9-10 feet bgs analyzed for VOCs, SVOCs, 19 RCRA metals, EPH/VPH, and moisture.	-10
				Greyish medium brown, Silty SAND (SM), medium dense, moist, no odor, PID: 0 ppb	
				Yellowish medium brown, Sandy GRAVEL (GM), loose, moist, no odor, PID: 0 ppb	
15				Medium brown, Sandy GRAVEL (GM), loose, saturated, no odor, PID: 0 ppb	-15
20	SATURATED			Dark brown, Silty SAND (SM), loose, saturated, no odor, PID: 0 ppb	-20
25					-25

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Notes: No MIP data collected at this boring. PCE groundwater screening sample collected at 19-23 feet bgs with peristaltic pump after 1 gallon purge. Two additional macro core runs to 10 feet bgs for volume.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

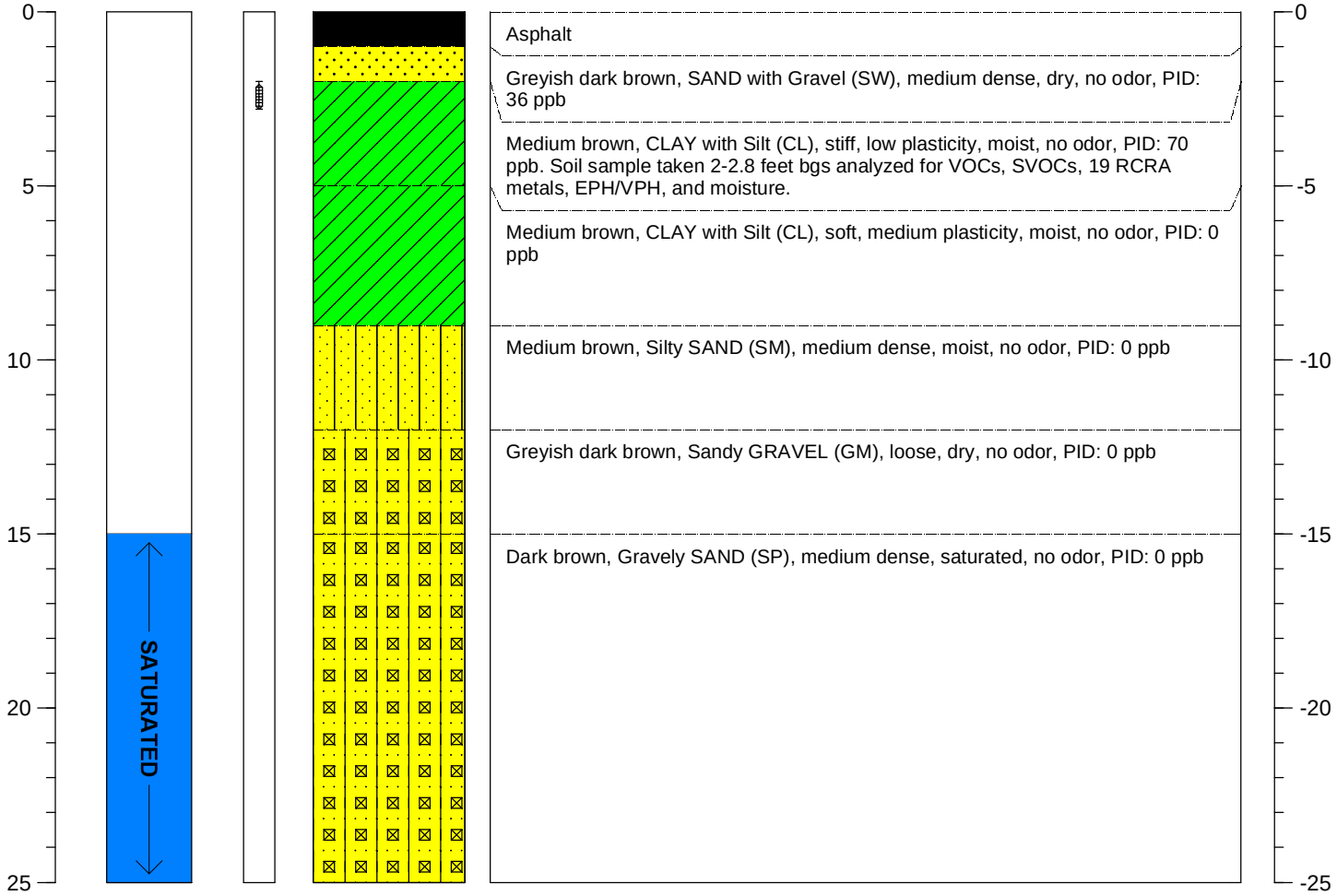
BORING LOG

BORING ID: ALSCO-GW-03

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Jacob Scott
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Charles Brenson
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 11/29/2017
Date Completed: 11/29/2017
Easting: 2215869.192
Northing: 553196.4615
Elevation: NM



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Notes: No MIP data collected at this boring. PCE groundwater screening sample collected at 18-23 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

BORING LOG

BORING ID: HLS-GW-04

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Jacob Scott
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Charles Grenson
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 12/1/2017
Date Completed: 12/1/2017
Easting: 2215637.308
Northing: 555488.2522
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				Dark brown, SAND with Gravel (SP), loose, dry, no odor, PID: 32 ppb	0
				Grayish medium brown, CLAY with Silt (CL), stiff, low plasticity, moist, no odor, PID: 17 ppb. PID in headspace: 17 ppb	
5				Medium brown, CLAY with Silt (CL), medium stiffness, low plasticity, moist, no odor, PID: 0 ppb	-5
				Medium brown, Silty SAND (SM), medium density, moist, no odor, PID: 0 ppb	
10				Grayish dark brown, SAND (SW), loose, moist, no odor, PID: 0 ppb	-10
15					-15
				Brownish medium gray, Sandy GRAVEL (GP), loose, wet, no odor, PID: 0 ppb. Sand heave at 25 feet bgs.	
20					-20
25					-25

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Notes: PCE groundwater screening sample collected at 18-23 feet bgs with peristaltic pump after 1 gallon purge.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

BORING LOG

BORING ID: ALSCO-GW-05

Client: Montana DEQ
Project: Billings PCE Remedial Investigation
Geologist: Charles VanHuevelen
Location: Billings, MT
Contractor: Dakota Technologies

Driller: Charles Greeson
Drilling Method: Direct Push
Borehole Diameter (in): 1.25 in
Total Depth (ft): 25
Sample Type: Geoprobe Acetate Tube

Date Started: 11/29/2017
Date Completed: 11/29/2017
Easting: 2215459.681
Northing: 553146.5728
Elevation: NM

DEPTH (FT BGS)	GROUNDWATER DEPTH (INFERRED FT BGS)	SOIL SAMPLE	LITHOLOGY	LITHOLOGIC DESCRIPTION	DEPTH (FT BGS) (NEGATIVE)
0				Aphalt/fill	0
				Yellowish dark brown, Silty CLAY (CL), stiff, low plasticity, moist, no odor, PID: 0 ppb. Grey color in upper 6 inches.	
5				Yellowish dark brown, Silty CLAY (CL), soft, medium plasticity, moist, no odor, PID: 0 ppb	-5
				Brown, Silty CLAY (CL), soft, medium plasticity, moist, no odor, PID: 0 ppb. Silt content increases 8-10 feet bgs.	
10				Brown, CLAY with Silt (CL), medium stiffness, medium plasticity, moist, no odor, PID: 0 ppb	-10
				Dark brown, Silty SAND with Clay (SM), loose, moist, no odor, PID: 0 ppb	
15				Dark brown, Sandy GRAVEL (GM), loose, wet, no odor, PID: 0 ppb	-15
20					-20
25					-25

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Notes: No MIP data collected at this boring. PCE groundwater screening sample collected at 19-23 feet bgs with peristaltic pump.

Easting/Northing is in State Plane Coordinates NAD83.

NM = not measured

APPENDIX A-3

GROUNDWATER GRADIENT AND TRANSPORT CALCULATIONS

GRADIENT CALCULATIONS FROM BILLINGS PCE POTENTIOMETRIC SURFACE FIGURES

Gradient Calculations from Billings PCE Potentiometric Surface Figures

Calculated: by A. Vann and S. Seitz
Date: December 2018

July and Aug. 2017		**May-18**		**Sep-18**	
Measured Gradients		Measured Gradients		Measured Gradients	
0.0064		0.0027083		0.0052	
0.003166667		0.0036667		0.0045	
0.0025		0.0024167		0.002916667	
0.002791667		0.00225		0.004583333	
0.003916667		0.0033333		0.00225	
0.00375		0.0035833		0.003125	
0.003125		0.0036		0.002083333	
0.002166667		0.002		0.00375	
0.003477083	Average	0.0041667		0.002291667	
		0.0033333		0.00375	
		0.0031058	Average	0.003445	Average

Flow direction

Generally northeast, but more easterly between fromer Central Ave Laundry and Big Sky Linen, and east of former Rex Cleaners

In the DSR, Trihydro noted that the alluvial aquifer groundwater hydraulic conductivity (K) was estimated to be generally around 109 to 299 feet per day (ft/d) for the sands and gravels in the alluvial aquifer formation, but only 0.2 to 1.1 ft/d in the finer-grained material (Trihydro, 2017a). That calculation and literature values were consistent with the EPA calculated and field measurements of K conducted in irrigation and EPA wells in 2006 to 2008. The EPA evaluated hydraulic properties and reported 40.8 ft/day for vertical K and 408 ft/d for horizontal K, for a calculated approximate velocity of 3.3 ft/d, which was used for modeling purposes in 2008-2010 (URS Operating Services, 2010). EPA also performed slug tests near the BSL source area, but these were less quantitative and resulted in a range of hydraulic conductivities from 7.7 to 71.5 ft/d (Trihydro, 2017a) During the RI, MiHPT investigations in the alluvial aquifer source zone investigations and found the following HPT-calculated K values (Section 8 and Appendix D):

- BSL area: HPT-calculated K values are relatively uniform in the saturated alluvial zone, typically ranging from 60 to 80 ft/d
- Former CAL area: HPT-calculated K values are relatively uniform in the deeper water saturated alluvial zone, typically around 80 to 100 ft/d
- Former Rex area: HPT-calculated K values are relatively uniform in the saturated alluvial zone, are consistent with the values reported above for other MiHPT investigation areas, and typically ranging from around 60 to 80 ft/d

Estimated Seepage Velocity (Freeze and Cherry, Groundwater, 1979)

Estimated Porosity = Specific Yield

Silty sand	20	%	Clean Sand/Gravel	28	%
Hydraulic conductivity	60	ft/day		299	ft/day

July/August 2017

Estimated Seepage Velocity Low			Estimated Seepage Velocity High		
V =	1.04E+00	ft/day	V =	3.71E+00	ft/day
V=	3.81E+02	ft/yr	V=	1.36E+03	ft/yr

Range =	381	to	1355	ft/yr	July/August 2017

GRADIENT CALCULATIONS FROM BILLINGS PCE POTENTIOMETRIC SURFACE FIGURES

May 2018

Estimated Seepage Velocity Low			Estimated Seepage Velocity High		
V =	9.32E-01	ft/day	V =	3.32E+00	ft/day
V=	3.40E+02	ft/yr	V=	1.21E+03	ft/yr

Range =	340	to	1211	ft/yr	July/August 2017

Sep-18

Estimated Seepage Velocity Low			Estimated Seepage Velocity High		
V =	1.03E+00	ft/day	V =	3.68E+00	ft/day
V=	3.77E+02	ft/yr	V=	1.34E+03	ft/yr

Range =	377	to	1343	ft/yr	July/August 2017

AQTESOLV

Specific yield is defined as the volume of water released from storage by an unconfined aquifer per unit surface area of aquifer per unit decline of the water table.

Bear (1979) relates specific yield to total porosity as follows:

$$n = S_y + S_r$$

where n is total porosity [dimensionless], S_y is specific yield [dimensionless] and S_r is specific retention [dimensionless], the amount of water retained by capillary forces during gravity drainage of an unconfined aquifer. Thus, specific yield, which is sometimes called *effective porosity*, is less than the total porosity of an unconfined aquifer (Bear 1979).

Representative Values

Heath (1983) reports the following values (in percent by volume) for porosity, specific yield and specific retention:

Material	Porosity (%)	Specific Yield (%)	Specific Retention (%)
Soil	55	40	15
Clay	50	2	48
Sand	25	22	3
Gravel	20	19	1
Limestone	20	18	2
Sandstone (unconsolidated)	11	6	5
Granite	0.1	0.09	0.01
Basalt (young)	11	8	3

The following table shows representative values of specific yield for various geologic materials (from Morris and Johnson 1967):

Material	Specific Yield (%)
Gravel, coarse	21
Gravel, medium	24
Gravel, fine	28
Sand, coarse	30
Sand, medium	32
Sand, fine	33
Silt	20
Clay	6

http://www.aqtesolv.com/aquifer-tests/aquifer_properties.htm

APPENDIX B

SEWER SCOPE INVESTIGATION

B-1. UTILITY CORRIDOR INVESTIGATION FIGURES

B-2. UTILITY CORRIDOR INVESTIGATION PHOTO LOG

B-3. UTILITY CORRIDOR INVESTIGATION VIDEOS

APPENDIX B-1

UTILITY CORRIDOR INVESTIGATION FIGURES

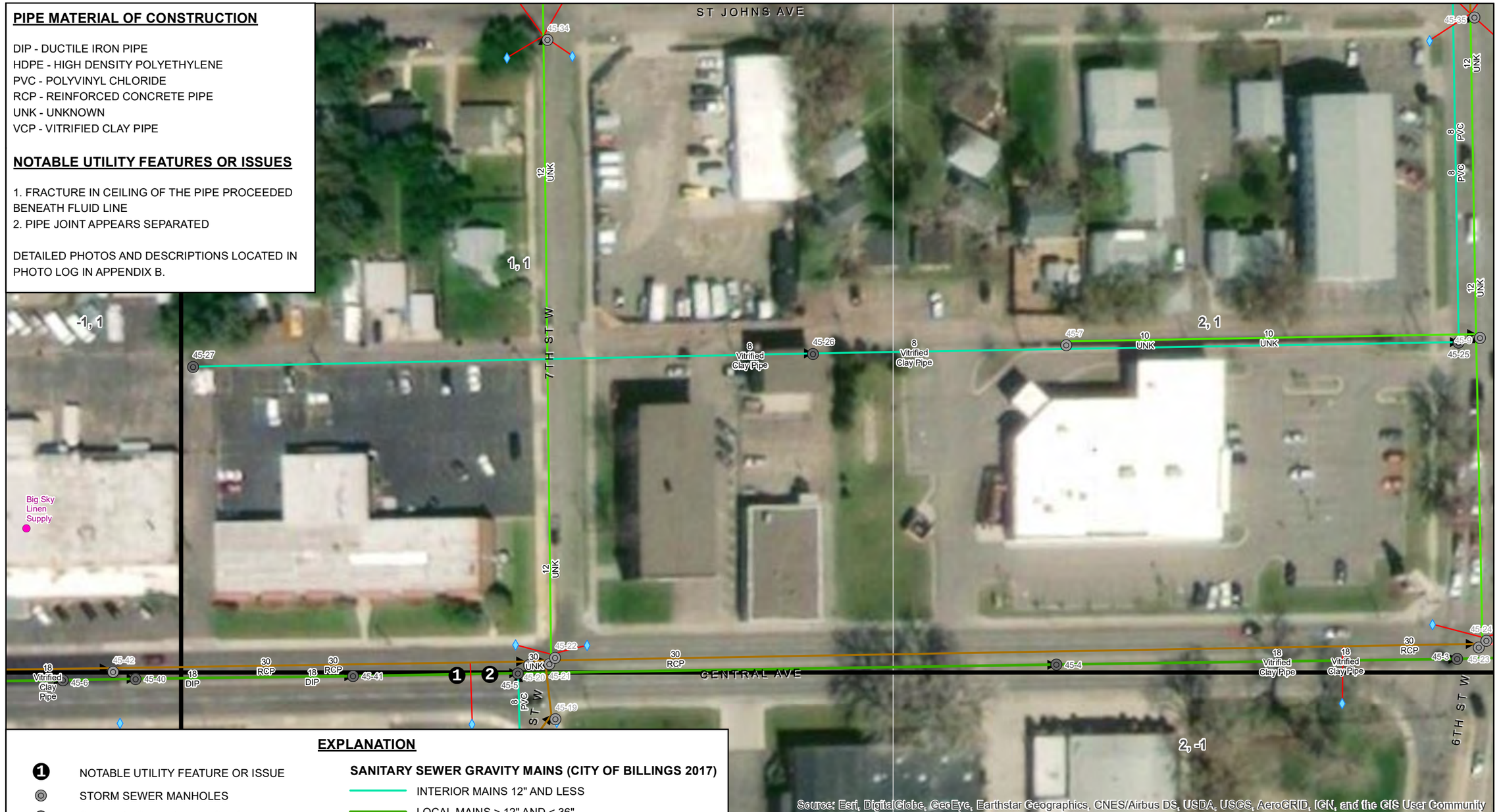
PIPE MATERIAL OF CONSTRUCTION

DIP - DUCTILE IRON PIPE
HDPE - HIGH DENSITY POLYETHYLENE
PVC - POLYVINYL CHLORIDE
RCP - REINFORCED CONCRETE PIPE
UNK - UNKNOWN
VCP - VITRIFIED CLAY PIPE

NOTABLE UTILITY FEATURES OR ISSUES

1. FRACTURE IN CEILING OF THE PIPE PROCEEDED BENEATH FLUID LINE
2. PIPE JOINT APPEARS SEPARATED

DETAILED PHOTOS AND DESCRIPTIONS LOCATED IN PHOTO LOG IN APPENDIX B.



EXPLANATION

- NOTABLE UTILITY FEATURE OR ISSUE
- STORM SEWER MANHOLES
- SANITARY SEWER MANHOLES
- STORM INLETS

STORM GRAVITY MAINS (CITY OF BILLINGS 2017)

- INTERIOR MAINS 12" AND LESS
- LOCAL MAINS >12" AND <36"
- SYSTEM MAINS 36" AND LARGER
- INLET MAINS

SANITARY SEWER GRAVITY MAINS (CITY OF BILLINGS 2017)

- INTERIOR MAINS 12" AND LESS
- LOCAL MAINS > 12" AND < 36"
- FACILITY GRID WITH X,Y NUMBER (SPACING = 500 FEET)

N

0 70'

Trihydro CORPORATION
1252 Commerce Drive
Laramie, WY 82070
www.trihydro.com
(P) 307/745.7474 (F) 307/745.7729

FIGURE B-1

BIG SKY LINEN UTILITY CORRIDOR SCOPING

REMEDIAL INVESTIGATION WORK PLAN
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Drawn By: BR	Checked By: AV	Scale: 1 " = 70 '	Date: 4/10/19	File: FigB-1_Billings_SewerUtilities.mxd

PIPE MATERIAL OF CONSTRUCTION

DIP - DUCTILE IRON PIPE
HDPE - HIGH DENSITY POLYETHYLENE
PVC - POLYVINYL CHLORIDE
RCP - REINFORCED CONCRETE PIPE
UNK - UNKNOWN
VCP - VITRIFIED CLAY PIPE

NOTABLE UTILITY FEATURES OR ISSUES

1. PORTION OF PIPE JOINT CONTAINS LARGE CRACK, POTENTIALLY SHOWING SOIL MATERIAL BELOW
2. EXPOSED REBAR AND DETERIORATED CONCRETE JOINTS
3. STORM SEWER PIPING APPEARED TO "Y" BENEATH MONTANA AVE.

DETAILED PHOTOS AND DESCRIPTIONS LOCATED IN PHOTO LOG IN APPENDIX B.

EXPLANATION

- NOTABLE UTILITY FEATURE OR ISSUE
- STORM SEWER MANHOLES
- SANITARY SEWER MANHOLES
- STORM INLETS

STORM GRAVITY MAINS (CITY OF BILLINGS 2017)

- INTERIOR MAINS 12" AND LESS
- SYSTEM MAINS 36" AND LARGER
- INLET MAINS

SANITARY SEWER GRAVITY MAINS (CITY OF BILLINGS 2017)

- INTERIOR MAINS 12" AND LESS
- FACILITY GRID WITH X,Y NUMBER (SPACING = 500 FEET)
- World Imagery
- Low Resolution 15m Imagery
- High Resolution 60cm Imagery
- High Resolution 30cm Imagery
- Citations

N

0 70'

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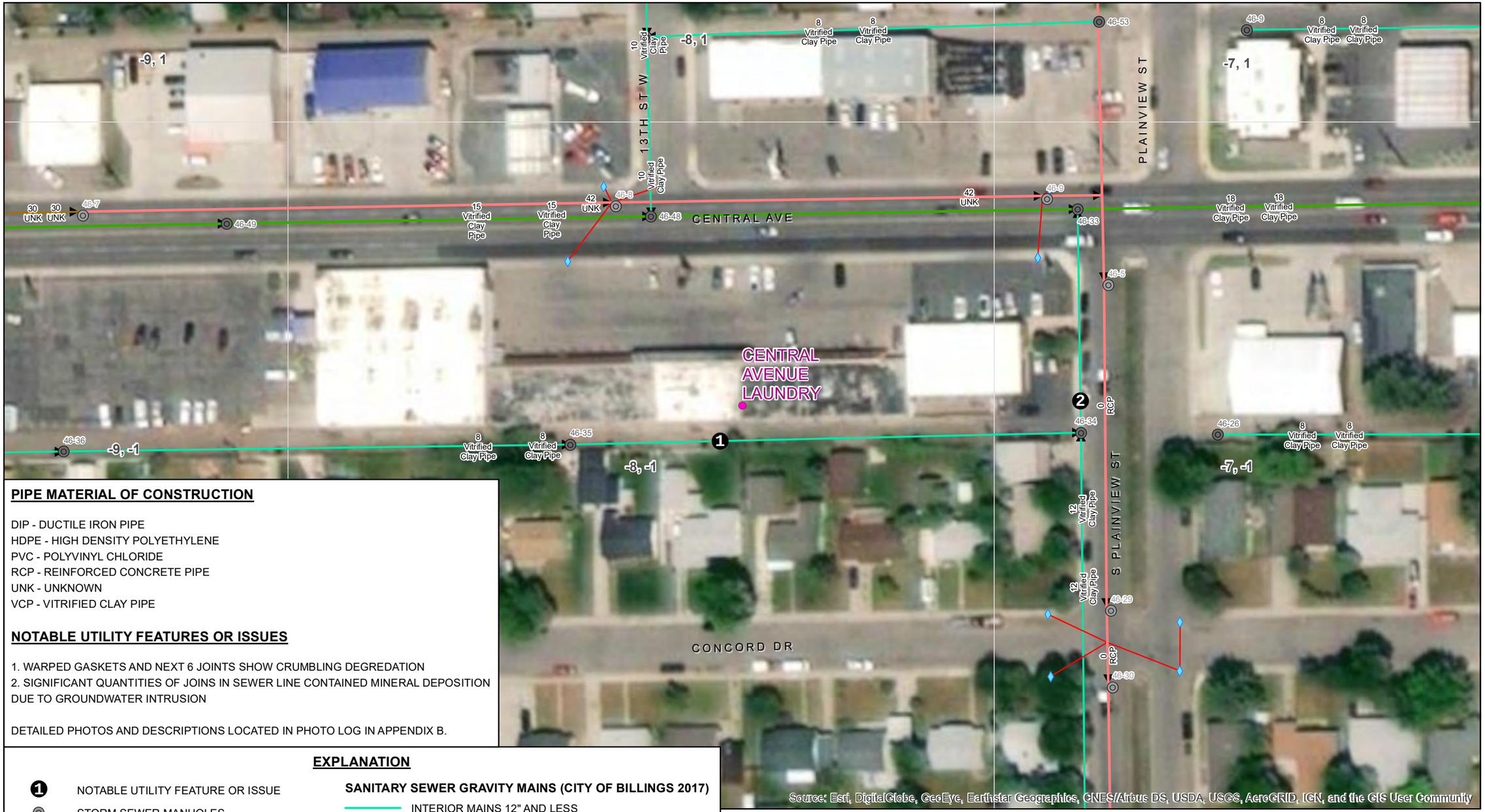
FIGURE B-2

DOWNGRADIENT OF BIG SKY LINEN UTILITY CORRIDOR SCOPING

REMEDIAL INVESTIGATION WORK PLAN
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Drawn By: BR	Checked By: AV	Scale: 1 " = 70 '	Date: 4/10/19	File: FigB-2_Billings_SewerUtilities.mxd



PIPE MATERIAL OF CONSTRUCTION

DIP - DUCTILE IRON PIPE
HDPE - HIGH DENSITY POLYETHYLENE
PVC - POLYVINYL CHLORIDE
RCP - REINFORCED CONCRETE PIPE
UNK - UNKNOWN
VCP - VITRIFIED CLAY PIPE

NOTABLE UTILITY FEATURES OR ISSUES

1. WARPED GASKETS AND NEXT 6 JOINTS SHOW CRUMBLING DEGREDATION
2. SIGNIFICANT QUANTITIES OF JOINS IN SEWER LINE CONTAINED MINERAL DEPOSITION DUE TO GROUNDWATER INTRUSION

DETAILED PHOTOS AND DESCRIPTIONS LOCATED IN PHOTO LOG IN APPENDIX B.

EXPLANATION

- 1 NOTABLE UTILITY FEATURE OR ISSUE
- STORM SEWER MANHOLES
- SANITARY SEWER MANHOLES
- STORM INLETS

STORM GRAVITY MAINS (CITY OF BILLINGS 2017)

- LOCAL MAINS >12" AND <36"
- SYSTEM MAINS 36" AND LARGER
- INLET MAINS

SANITARY SEWER GRAVITY MAINS (CITY OF BILLINGS 2017)

- INTERIOR MAINS 12" AND LESS
- LOCAL MAINS > 12" AND < 36"
- FACILITY GRID WITH X,Y NUMBER (SPACING = 500 FEET)

N

0 70'

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FIGURE B-3

CENTRAL AVENUE LAUNDRY UTILITY CORRIDOR SCOPING

**REMEDIAL INVESTIGATION WORK PLAN
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA**

Drawn By: BR	Checked By: AV	Scale: 1 " = 70 '	Date: 4/10/19	File: FigB-3_Billings_SewerUtilities.mxd

PIPE MATERIAL OF CONSTRUCTION

DIP - DUCTILE IRON PIPE
HDPE - HIGH DENSITY POLYETHYLENE
PVC - POLYVINYL CHLORIDE
RCP - REINFORCED CONCRETE PIPE
UNK - UNKNOWN
VCP - VITRIFIED CLAY PIPE

NOTABLE UTILITY FEATURES OR ISSUES

1. GENERAL CONDITION OF SANITARY SEWER LINE IS POOR SOUTHEAST OF MANHOLE 9-3; SIGNIFICANT CRACKS, DARK STAINING AND SIGNS OF INTRUSION FROM THE SUBSURFACE.
2. LARGE FRACTURE IN PIPE CEILING. SIMILAR DAMAGE ALSO OBSEREVED PASSING BELOW WATER LINE 48.5 FEET PAST MANHOLE 9-3.
3. SERVICE INLET APPEARS OBSTRUCTED; ALLOWING LIQUIDS TO ENTER/LEAVE SEWER SERVICE LINE.
4. CLAY PIPE APPEARED FRACTURED BELOW WATER LINE.
5. LONG CRACK OBSEREVED ON CEILING OF PIPE AT 28 FEET AND AT 30.8 FEET, SERIES OF LONGITUDINAL AND CIRCUMFERENTIAL CRACKS APPEARED.

DETAILED PHOTOS AND DESCRIPTIONS LOCATED IN PHOTO LOG IN APPENDIX B.

EXPLANATION

- 1 NOTABLE UTILITY FEATURE OR ISSUE
- STORM SEWER MANHOLES
- SANITARY SEWER MANHOLES
- STORM INLETS

STORM GRAVITY MAINS (CITY OF BILLINGS 2017)

- INTERIOR MAINS 12" AND LESS
- LOCAL MAINS >12" AND <36"
- INLET MAINS

SANITARY SEWER GRAVITY MAINS (CITY OF BILLINGS 2017)

- INTERIOR MAINS 12" AND LESS
- FACILITY GRID WITH X,Y NUMBER (SPACING = 500 FEET)

N

0 70'

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Laramie, WY 82070
www.trihydro.com
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FIGURE B-4

FORMER REX'S CLEANER'S UTILITY CORRIDOR SCOPING

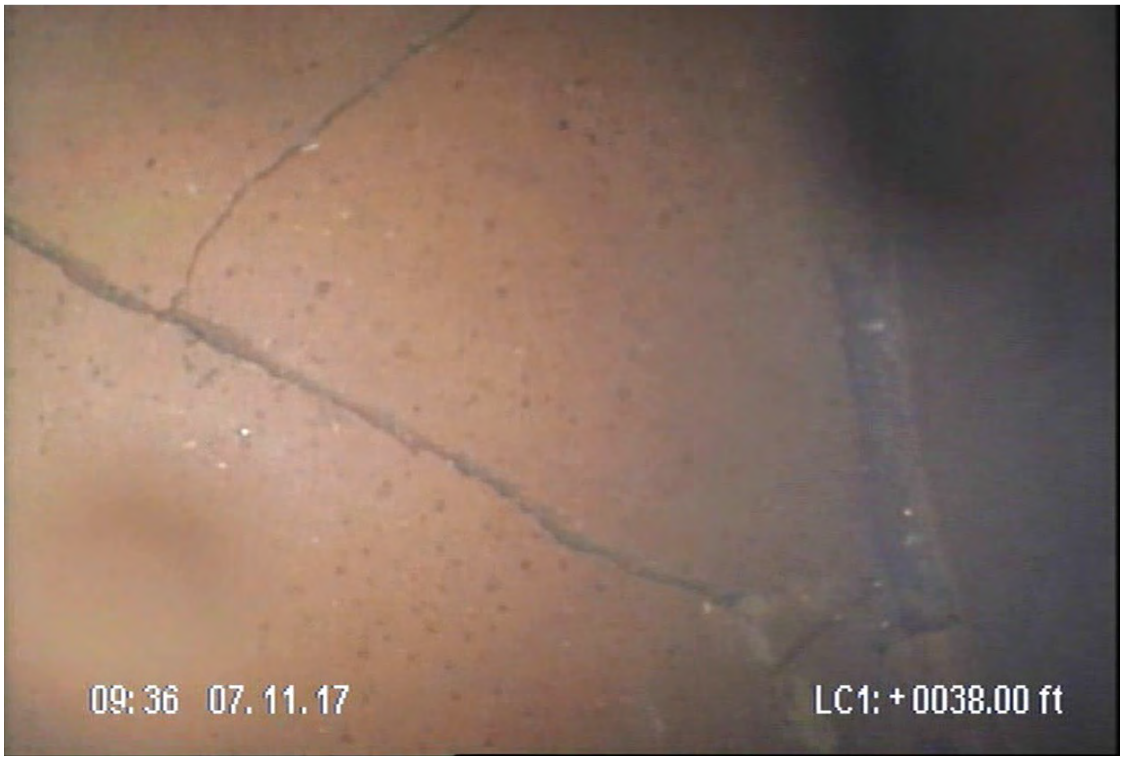
REMEDIAL INVESTIGATION WORK PLAN
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Drawn By: BR	Checked By: AV	Scale: 1 " = 70 '	Date: 4/10/19	File: FigB-4_Billings_SewerUtilities.mxd

APPENDIX B-2

UTILITY CORRIDOR INVESTIGATION PHOTO LOG

APPENDIX B. SEWER SCOPING PHOTO LOG,
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS, MONTANA



BSL 1. Fracture in ceiling of vitrified clay pipe in BSL sanitary sewer.

BSL 2. Pipe fracture appears to proceed below the fluid level in the pipe.

BSL 3. Joint separation in storm sewer piping in Central Avenue near BSL.

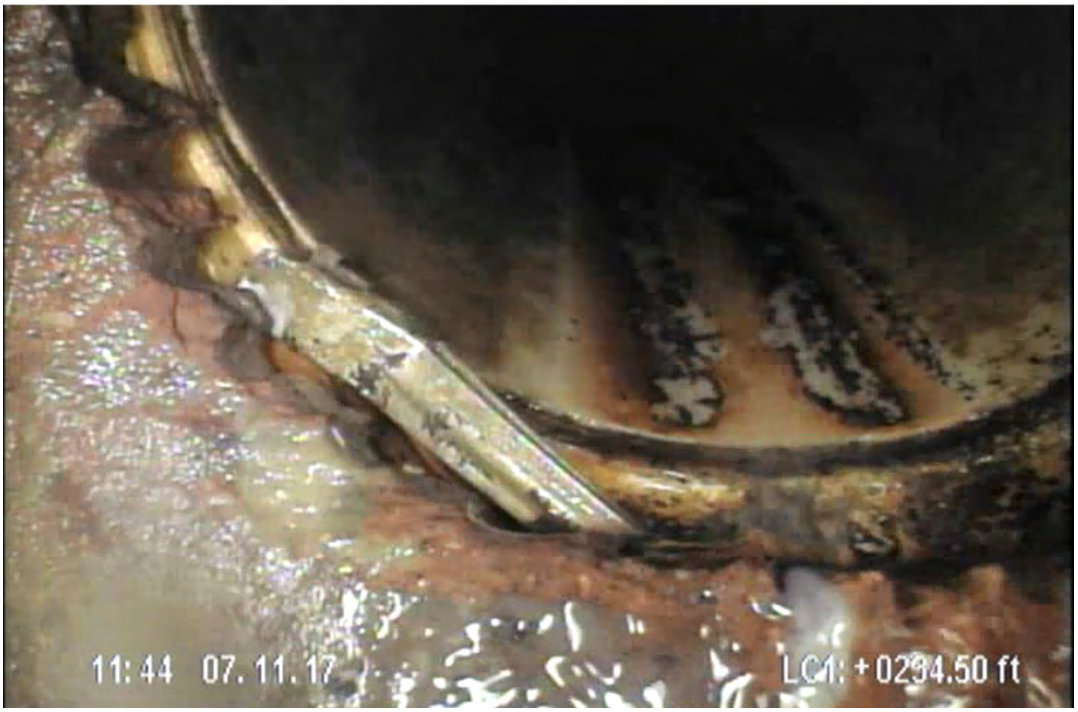
BSL 4. Branching storm sewer beneath Montana avenue.

BSL 5. Potentially failed storm sewer junction and visible rebar in 4th Street West.

BSL 6. Exposed rebar in 4th Street West storm sewer.

CAL 1. Expanded rubber gasket in VCP located in the alley south of 1246 Central Avenue.

CAL 2. Surface degradation of gasket material in VCP behind CAL.



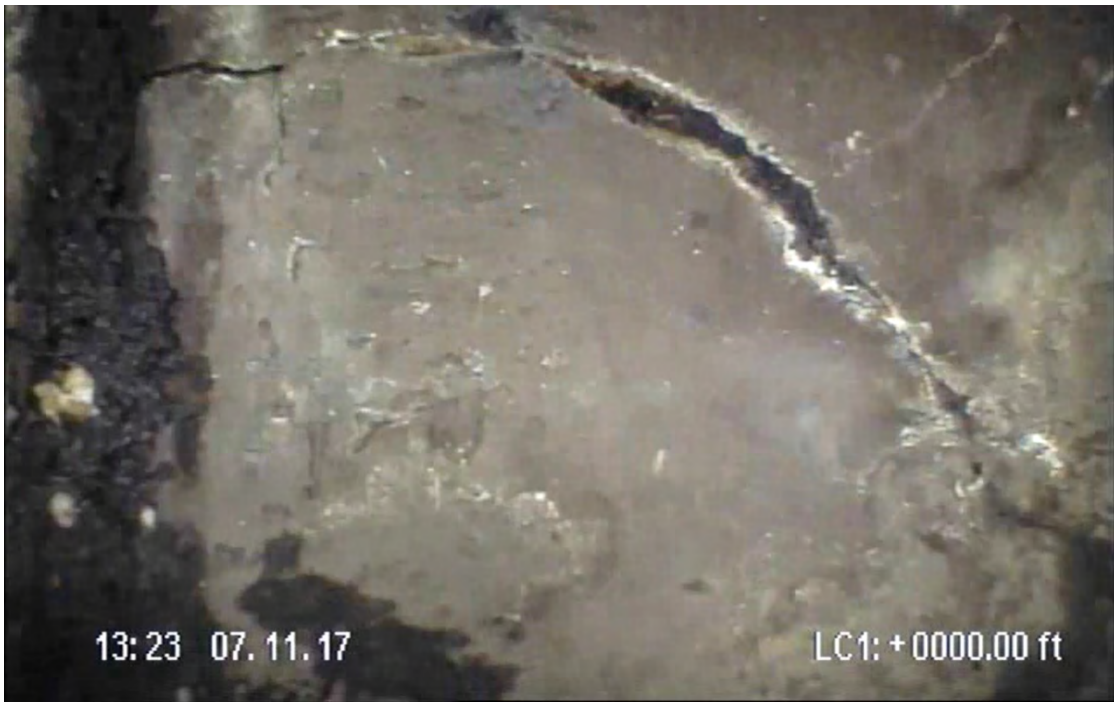
CAL 3. Sewer service inlet showing connections that may not be water tight.

CAL 4. Hairline fractures observed in VCP during sewer scoping.

CAL 5. Solid white deposits noted on gasketing material and piping sidewalls.

CAL 6. Mineral depositions at pipe joins along sanitary sewer piping in Plainview Street.

CAL 7. Largely separated joint with mineral deposition in sanitary sewer in Plainview Street.



REX 1. Large cracks in sanitary sewer piping behind REX.

REX 2. Fractures around VCP service inlet, without sealant.

REX 3. Separating pipe joints in sanitary sewer VCP in alley behind REX.

REX 4. Dark staining appears visible on VCP ceiling in sanitary sewer line behind REX.

REX 5. Sanitary sewer VCP inlet showing signs of separation in addition to a fracture along pipeline, behind REX.

REX 6. Fracture in sanitary sewer VCP pipe ceiling adjacent to sewer inlets, behind REX.

REX 7. Fracture in sanitary sewer VCP near service inlet, extends below water line in pipe. Located behind REX.

REX 8. An apparently separated service inlet appears to be allowing solids to enter/leave the sanitary sewer system behind REX.

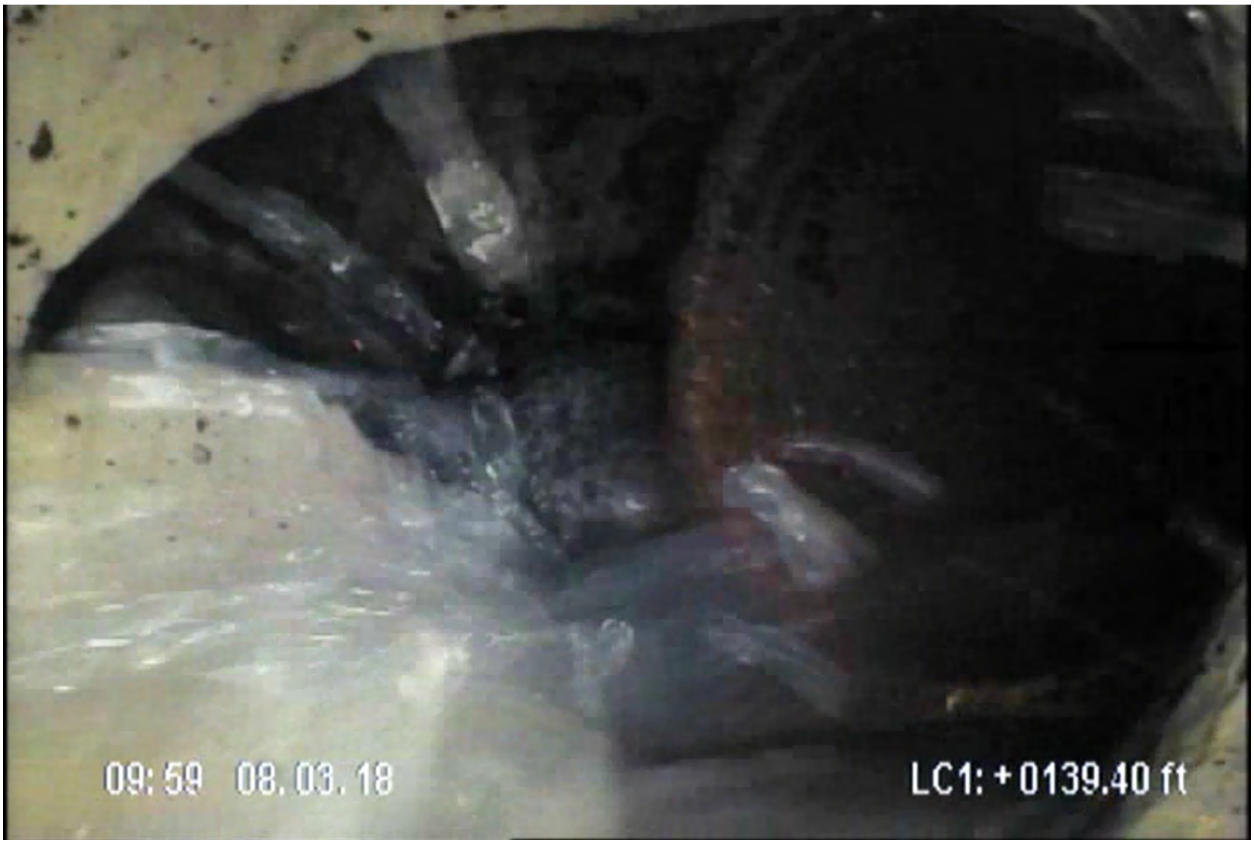
REX 9. Service inlets on either side of the sanitary sewer system appear to be occluded with waste, behind REX.

REX 10. Sanitary sewer VCP appears to be fractured below the water line behind REX.

REX 11. Large crack observed in VCP pipe in sanitary sewer behind REX.

REX 12. Complete piping fracture with visible soil outside of sanitary sewer.

REX 13. Fractured lip of VCP sanitary sewer line. Fracture extends below water line. Located behind REX.



REX 14. Fractured inlet allows communication between groundwater and sanitary sewer contents.

APPENDIX B-3

UTILITY CORRIDOR INVESTIGATION VIDEOS

APPENDIX C

GROUNDWATER SAMPLING PLAN ADDENDUMS

C-1. THIRD QUARTER 2017 GROUNDWATER SAMPLING SCHEDULE MEMO

C-2. SECOND QUARTER 2018 GROUNDWATER SAMPLING SCHEDULE MEMO

C-3. THIRD QUARTER 2018 GROUNDWATER SAMPLING SCHEDULE MEMO

C-4. ALLUVIAL AND BEDROCK GROUNDWATER MONITORING WELL LOCATION RATIONALE MEMO

C-5. HYDROGRAPHS FOR SELECT BILLINGS PCE GROUNDWATER AREAS/WELLS

APPENDIX C-1

THIRD QUARTER 2017 GROUNDWATER SAMPLING SCHEDULE MEMO

memorandum

To:	Mike Gipson, Montana DEQ
From:	Andrew Vann, Trihydro Corporation
cc:	Syris Trahan, Sarah Seitz, Trihydro Corporation
Date:	June 26, 2017 revised July 6, 2017
Re:	Groundwater Sampling Work Plan July 2017, Billings PCE Groundwater CECRA Facility, Billings, Montana

Trihydro Corporation (Trihydro) has been contracted by the Montana Department of Environmental Quality (DEQ) to conduct a Remedial Investigation (RI) at the Billings PCE Groundwater Comprehensive Environmental Cleanup and Responsibility Act (CECRA) Facility (Facility), in Billings, Montana. One of the objectives of the RI at the Facility is to characterize the nature and extent of contamination at the Facility in groundwater, soil, and indoor air. More specifically, the RI's objectives include filling data gaps, identifying potential source areas, evaluating the nature and extent of groundwater contamination, evaluating the potential migration of chlorinated solvents to indoor air, and investigating the potential for harm to human health and the environment. The primary contaminants of potential concern are chlorinated solvents including tetrachloroethene (PCE) and its degradation products (trichloroethene (TCE), cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride); however, other potential contaminants will also be evaluated along with field and monitored natural attenuation (MNA) parameters.

This memo outlines the scope of work (SOW) for an initial groundwater sampling event to evaluate contaminant concentrations and potentiometric surface of the alluvial groundwater beneath the Facility using existing groundwater monitoring wells. The groundwater sampling results from this initial event will be used to guide decision making for additional RI activities.

This initial groundwater sampling event will include evaluating the integrity of the wells, gathering fluid levels for evaluation of the groundwater potentiometric surface, well development for a subset of monitoring wells, and sampling approximately 94 wells to provide current conditions for groundwater at the Facility. The following sections detail the activities and plans for this initial groundwater evaluation and sampling event for the Billings PCE Facility:

- Well Evaluation and Fluid Level Measurement
- Well Development
- Groundwater Well Sampling and Analytical Methods
- Reporting

1.0 WELL EVALUATION AND FLUID LEVEL MEASUREMENT

Well evaluation and fluid level measurement will be conducted for each of the groundwater wells anticipated to be sampled (Table 1 and Figure 1). Fluid level data are collected in association with the well evaluation to evaluate the groundwater flow gradient and well condition. Water level measurements and well condition are collected prior to preparing the well for sample collection. The well condition evaluation will document potential damage to the wellhead, surface completion, or well casing, and examine the need for well development based on sediment in the well and total depth of well. If well damage is noted during monitoring activities, Trihydro will determine whether the well requires repair, abandonment, replacement, or resurveying. Additionally, the Trihydro groundwater field coordinator will discuss with the DEQ Project Officer use of additional, nearby wells in lieu of damaged wells.

Trihydro performed a well inventory from May 15-18, 2017, recording information including handheld GPS coordinates, access/property issues, condition of the surface completion, and well diameter for 81 of the 94 anticipated groundwater monitoring network wells. This information was used to develop Table 1, and to plan the type of equipment needed for fluid level measurements and groundwater sampling. Information for the remaining thirteen wells was not collected because the wells were unable to be located without the aid of a metal detector, or were unable to be accessed due to the presence of vehicles, locked property, or lack of access arrangements (Burlington Northern Santa Fe (BNSF) property). Missing information will be gathered for these wells during the sampling event. The majority of the United States Environmental Protection Agency (EPA) Superfund Technical Assistance and Response Team (START) wells (44) are small diameter wells. These small diameter wells are typically ¾-inch outside diameter (OD) wells with an approximately ½-inch inside diameter (ID) casing. An additional thirteen wells are 1-inch OD with an approximately ¾-inch ID. The other monitoring wells in the Table 1 Facility Monitoring Well Network are typically 2-inch diameter monitoring wells installed by entities other than EPA for investigation of facilities including railroad, industrial, and Leaking Underground Storage Tank (LUST) sites.

Typical oil/water interface probes are too large for the small diameter well casings. Fifty-seven of these wells will be sampled during the initial sampling event. Fluid levels in these wells will be measured using a Heron Skinny Dipper ¼-inch water level meter, or similar probe. The probe will be lowered into each well and will register changes in conductivity indicative of the presence of groundwater (13 µS ±5%). This instrument will facilitate measurement of the potentiometric surface to the nearest 0.01 foot in these smaller wells, but will be unable to distinguish the presence of light- or dense-non-aqueous phase liquids in the wells.

For larger ID wells (greater than 1 inch), an electronic oil/water interface probe Solinst Model 122 Interface Meter, or similar probe, will be used to measure the interfaces of present immiscible layers (i.e., air to light non-aqueous phase liquid (LNAPL), LNAPL to water at typically 20 µS, and water to dense non-aqueous phase liquid (DNAPL)). As the interfaces are detected, the probe is slowly lowered and raised to record an accurate measurement of the interface. These measurements are recorded to the nearest 0.01 foot.

Measurements made during a particular monitoring event are made to the designated reference points with the same instrument. Fluid level measurements for use in development of a potentiometric surface will be collected within 72 hours to limit changes over time due to weather or other conditions. The vertical reference points are typically the north side top of casing and will be marked on the top of casing (TOC) by the field team, if well construction allows.

The TOC, ground elevation, and easting/northing will be established by a licensed surveyor in relation to the nearest permanent benchmark (i.e., USC and GS, USGS, or NGVD), and the vertical control datum used to determine the elevation of the well will be the North American Vertical Datum of 1988 (NAVD 88). The survey results will provide an accuracy of plus or minus 0.1 foot horizontally, and plus or minus 0.01 foot vertically. The horizontal well coordinates will be established by surveying in reference to a permanent benchmark (USGS, or equivalent), and the latitude and longitude coordinates will reference the State Plane NAD83 HARN Coordinate System.

2.0 WELL DEVELOPMENT

The objective of well development is to establish or maintain hydraulic connection between the well and the aquifer material surrounding the well screen and filter pack. Well development can remove fine sediment from the well and sand pack, and improve well communication with the surrounding aquifer for wells that have not been sampled recently or have been used for other purposes in the past.

The majority of the wells to be sampled during this preliminary event have been sampled recently (within the last 2-5 years) as part of EPA START investigations at the Facility or third-party investigations at sites adjacent to or within the Facility. However, 9 wells are suspected to have not been sampled in at least 5 years, and are proposed for redevelopment prior to sampling. An additional 11 wells that are part of the Burlington Northern Santa Fe (BNSF) Billings Facility monitoring well network may also need development. Wells anticipated to require redevelopment are indicated in Table 1. Wells smaller than 2-inch OD are not proposed for development, as the small diameter limits the effectiveness of development due to limits on equipment that can be used as well as additional friction between development tools and the well casing and potential for screen damage.

Prior to well development, the depth to water, depth to LNAPL and/or DNAPL, and total depth of the well will be measured using an electronic oil/water interface probe, as described in Section 1.0. If LNAPL is present at a thickness greater than 0.1 ft, well development will not be performed to avoid smearing LNAPL throughout the sand pack. If the well only contains a sheen of LNAPL, the well will be developed and fluid levels re-evaluated prior to sampling. Wells with measureable DNAPL will not be developed.

As the first step to development of a monitoring well, a surge block will be lowered and raised in each well for approximately 3-5 minutes. After the well has been surged, the well will be purged with a new disposable or decontaminated bailer or decontaminated submersible electric or bladder pump with dedicated tubing for each

well. If a pump is used, the pump will be lowered to 1 foot off the bottom and water will be pumped out of the well. During the development, water quality parameters (pH, conductivity, oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity) will be measured approximately once per well casing volume.

The goal for development is to remove at least 10 well volumes of water. If the well does not produce at least 10 well volumes of water in 24-hours, the development will be determined to be complete if the well was bailed/pumped dry twice within 24-hours or the water quality parameters stabilize to within the stabilization parameters described in Section 3.0, which adhere to DEQ low-flow sampling guidance (DEQ 2005).. Water will not be added into the wells during development.

Some of the existing wells at the Facility do not have boring logs or construction diagrams, and most of the wells have no information on past development, so field evaluation of ability to achieve 10 well volumes will be assessed during development activities. Monitoring well development activities will be documented on the well development field calculation/log sheets. Sampling will not be initiated within 48 hours after development to allow the well to reach equilibrium conditions with the surrounding formation.

Investigation derived waste (IDW) handling, storage, and disposal are described in Section 4.0.

3.0 GROUNDWATER WELL SAMPLING METHODS AND ANALYTICAL

The objective of the initial groundwater sampling event is to evaluate the current nature and extent of groundwater contamination. Data from this sampling event will be used to locate borings and monitoring wells intended to delineate the extent of groundwater contamination exceeding standards as well as additional potential source zone evaluations. From historic data, it appears that groundwater in the shallow alluvial aquifer is approximately 12-19 feet below ground surface beneath the Facility.

Due to the different diameters and construction of historic monitoring wells for the Facility, two different low-flow groundwater sampling methods will be used for the initial groundwater sampling event. Approximately 40 of the monitoring wells are 2-inch diameter PVC wells. These wells can be sampled using a low-flow, down-well bladder sampling pump and dedicated tubing. However, more than 40 previously installed wells were constructed with small diameter 1-inch or ¾-inch PVC. Small diameter bladder pumps are not available to collect a sample from 1-inch wells. Therefore these wells will be sampled with low-flow procedures using a peristaltic pump. The peristaltic pump method could potentially reduce VOC concentrations through volatilization; however, these wells tend to be located in areas with PCE concentrations many times greater than groundwater standards, so slightly reduced VOC concentrations will likely not affect groundwater analytical evaluations. However, in order to assess the potential influence of low-flow peristaltic sampling method at the Facility, a small-scale comparison of sampling methodology using select monitoring wells sampled for VOCs with both a peristaltic and a low-flow down-well pump will be included in this initial groundwater sampling event. This is described in Section 3.3.

Teflon or Teflon-lined tubing will be used for both peristaltic pump and bladder pump sampling. The sampling device inlet will be positioned slowly into the well to the midpoint of the water column or 2 feet from the bottom of the well, whichever is higher, to minimize agitation of sediment. If the water column is less than 4 feet, collection of a turbidity-free sample may not be possible but the flow rate will be minimized in an attempt to minimize turbidity and the sampling device intake may be initially lower than 2 feet from the bottom of the well. New sample tubing will be used for each well during the initial sampling event. Tubing will be dedicated to each well, stored in a sealed plastic bag labeled with each well name, and reused during future sampling events.

The pump speed will be adjusted until there is little or no water-level drawdown (less than 0.3 feet). If the minimum drawdown that can be achieved is greater than 0.3 feet but remains stable, the well will continue to be purged and documented per DEQ SRS Low Flow Purging and Sampling Guidelines (April 2005). The wells with a diameter of less than 2 inches are too small to have both the purge line and water level indicator down-hole at the same time; these will be sampled at the minimum purge rate of 0.2 L/min or slower, and fluid levels and draw-down data will not be collected during sampling. Instead a post-sample groundwater level will be recorded at the completion of the sample collection.

The following field parameters: pH, conductivity, temperature, ORP, turbidity, and DO will be measured approximately every 3 to 5 minutes during purging using a water quality meter with a flow-through cell. Stabilization is achieved when the following parameters are met over three consecutive measurements (DEQ, 2005):

- pH varies less than 0.5 SU
- Conductivity and ORP varies less than 10%
- DO varies less than 10%, or less than 0.2 mg/L
- Turbidity varies less than 10% or is less than 10 Nephelometric Turbidity Units (NTUs).

Note: If ORP values remain between 10 millivolts (mV) and -10mV or DO values remain <1 milligrams per liter (mg/L) for three consecutive measurements, the well will be considered stable (DEQ, 2005).

Field parameters will be recorded prior to sample collection.

Additionally, if stabilization does not occur after three well volumes of purge water are removed from the well, sampling may proceed, and field personnel will note on the field form that more than three well volumes were purged rather than achieving stabilization of parameters.

Sample names are noted in Table 1 and Figure 1 and are similar to previous investigation well IDs. Where wells were named similarly, i.e. MW-1 at several LUST sites, those wells were given precursor

unique facility identifiers to avoid confusion with the following nomenclature. This naming convention is reflected in Figure 1 and Table 1.

During the May 2017 Facility well inventory, 31 previously unidentified wells were located. These wells typically appear to be located at LUST facilities throughout Billings. Identifying information was typically not available for each well, and the LUST Facility ID was not known. To allow these wells to be easily distinguished from wells previously sampled during investigations at the Facility, they were assigned unique well identifiers, using the following nomenclature: EMW-# for "existing monitoring well" followed by numerical reference. These assigned well IDs will be used for sample nomenclatures and COC tracking. Table 1 and Figure 1 (attached) indicate the well names that will be used for the initial groundwater Facility investigation.

Groundwater sample labels will include the project name, sample ID, collection time/date, requested analysis, and preservation. Table 2 identifies containers, holding times, and preservatives required for each analytical method. Sample analytical methods are noted in Table 1 and are discussed in Section 3.2 below.

3.1 SAMPLE HANDLING

Samples will be packed and hand delivered to the laboratory for chemical analysis according to analytical and laboratory methodology. Immediately after samples are collected in the field, completed sample labels will be attached to the sample containers. Samples will be stored on ice per preservation requirements, however due to the close proximity of the lab and hand delivery, samples may still be cooling when arriving at the laboratory, and will be noted by the lab on the sample receipt or chain-of-custody (COC). A COC form will be prepared at the time samples are collected, and will identify the required analytical methods. Samples will be tracked beginning at the sampling locations, through delivery to the laboratory, and through sample analysis by the laboratory. Data from the analysis of the samples will be tracked upon receipt from the laboratory and throughout data analysis and data reporting based on unique sample numbers. The sample handling procedures promote both sample chain-of-custody and data integrity of laboratory analysis. A completed COC form will accompany the samples to the analytical laboratory. A custody seal will be attached to each cooler prior to delivery to the laboratory, unless the cooler is to remain in the sampler's possession or within a locked vehicle or other secure location at all times prior to sample delivery.

3.2 ANALYTICAL METHODOLOGY

Groundwater samples will be analyzed according to Table 1. Each groundwater sample will be analyzed for VOCs by Method EPA 8260B, and select samples will also be analyzed for additional analytes as described below:

- Semi-volatile organic compounds (SVOCs) for EPA 8270 by Method SW3520 including polycyclic aromatic hydrocarbons (PAHs) by EPA 8270 PAH SIM.
- 18 Dissolved metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, thallium, vanadium, and zinc) by EPA 6020 \
- Mercury by EPA 245.1
- Extractable petroleum hydrocarbons (EPH) and volatile petroleum hydrocarbons (VPH) by the Montana-modified Massachusetts method
- Monitored natural attenuation (MNA) parameters including the following:
    - Sulfate/sulfite by E300.0
    - Nitrate/nitrite by E353.2
    - Dissolved organic carbon by SW9060
    - Chloride by E300
    - Methane, ethene, ethane by SW3810/RSK175 Modified

Samples will be hand-delivered to Pace Analytical Laboratories in Billings, Montana. Analysis will be performed at the appropriate Pace Analytical Lab, as needed. This may include Pace shipping some samples to additional Pace locations for other analytical methods. Pace Analytical Laboratories' minimum detection limits are compared to the Montana numeric water quality (DEQ-7) standards, DEQ's risk-based corrective action RBSLs and EPA Tapwater RSLs in the Table 3.

3.3 SAMPLE METHOD COMPARISON

Use of a peristaltic pump has the potential to volatilize organic compounds during groundwater sampling, reducing VOC concentrations in the samples. Therefore, to provide a small-scale, site-specific comparison of the effect of sampling methods on VOC concentrations, six wells will be sampled using both a peristaltic and a low-flow, down-well pump. The peristaltic pump will only be used to collect samples at these wells for VOC analysis by EPA Method 8260B. The down-well pump will also be used to collect a sample for VOC analysis, as well as any other planned analyses at the well.

Two wells will be sampled in areas expected to have groundwater PCE concentrations greater than 400 µg/L, two wells will be sampled which are expected to contain PCE concentrations between 10 and 50 µg/L, and two wells will be sampled which are expected to contain PCE concentrations less than 10 ug/L. The higher concentration wells will be EMW-11 and EMW-15. The mid-concentration wells will be BPGW04 and RH-MW-3. The low concentration wells will be BPGW04 and EMW-03. Both the down-well pump and peristaltic pump tubing will be lowered to the appropriate depth as described in Section 3.0. The well will be purged using the down-hole pump. Once the well parameters have stabilized, the VOC sample will be collected from the down-hole pump, and immediately after the comparison VOC sample will also be collected with the peristaltic pump. The remaining samples for other analytical suites will then be collected using the down-hole pump.

3.4 QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance and quality control (QA/QC) will serve two purposes for field and laboratory sampling:

1. Documentation of data quality
2. To identify areas of weakness within the measurement process that need correction.

3.4.1 FIELD QUALITY CONTROL

The field quality control samples will include the following for groundwater samples:

- Field Duplicate Samples - Duplicate samples are collected to check sampling and laboratory analytical precision. One blind duplicate will be collected per every 20 environmental samples. A blind duplicate (field replicate) sample will be collected to evaluate precision associated with the reproducibility of sampling techniques and the homogeneity of sample matrices. Since the replicate will be "blind" to the laboratory, it will have a coded identity. The duplicate and samples will not include "DUP" or "D" on its label, but will be delineated as a duplicate on the Low-Flow Groundwater Purging/Sampling Form, which is not submitted to the laboratory.
- MS/MSD Samples – MS/MSD samples are collected to check the accuracy and precision of analyses based on the matrix sampled and are collected for soil and water samples. One MS/MSD will be collected per every 20 environmental samples.
- Field Blank: Field blanks are collected to check potential contamination from field conditions (VOCs in air, dust in air/wind, etc.). One field blank will be collected per day for every analysis for groundwater samples for that day.
- Equipment Blank: Equipment blanks are collected to check for potential contamination or cross-contamination with equipment that touches multiple sampling locations. One equipment blank will be collected per day for every analysis except MNA parameters for groundwater samples for that day.

Field duplicates, field blanks, and equipment blanks will not be delineated with its parent sample on the chain-of-custody record form and will be delineated by DATE-#, where the date is presented as year, month, day, such as 20170615 for June 15, 2017, and the number is based on number of QA samples per day starting at -01 each day. MS/MSD samples will be named with the parent sample followed by –MS and –MSD (i.e. BPGP-74-MS and BPGP-74-MSD). The parent sample location and identification of QA/QC samples will be recorded on the field Low-Flow Groundwater Purging/Sampling Form.

3.4.2 DATA VERIFICATION AND USABILITY

The process of data verification is the examination of objective evidence that the requirements of these specified QC acceptance criteria are met. The process of data validation requires confirmation by examination and provision of objective evidence that the particular requirements for a specific intended

use have been fulfilled. Data validation procedures shall be performed for both field and laboratory operations, as described below.

3.4.3 FIELD DATA

Field data validation tasks to be performed may include review of field data contained on field sampling logs for completeness; verification that field duplicates were properly prepared, identified, and analyzed; checking on field analysis for equipment calibration and condition; and review of COC forms for proper completion, signatures of field personnel, and the laboratory sample custodian, and dates. The field data packages will undergo review. If inconsistencies or issues are identified during the review, the records will be verified by field personnel and corrected. Inconsistencies or issues noted during the field data validation review will require implementation of corrective measures and 100% validation of field records. The majority of the data for this Facility initial groundwater sampling event will be collected on the Low-Flow Groundwater Purging/Sampling forms. Additional forms may be used for well development.

3.4.4 LABORATORY DATA

Trihydro will perform data validation review on data received from the laboratory. The data validation will be in accordance with DEQ requirements (Montana DEQ - Remediation Division Data Validation Summary Form (Version 1.2, Revised 11/4/16). Data qualifiers will be applied to the data based on the data validation review. These qualifiers will be maintained in the database with each data point. The data validator will evaluate the overall completeness of the data package. Completeness checks will be administered on data to determine whether deliverables specified in the QA/QC Plan are present. At a minimum, deliverables will include sample COC forms, analytical results, and QC summaries. The reviewer will determine whether required items are present and request copies of missing deliverables. The results of the data validation review will be summarized in a Data Validation Report for each sample report issued by the laboratory

4.0 INVESTIGATION DERIVED WASTE

Investigation derived wastes (IDW) that will be produced at the Facility during the investigation include purge water from monitoring well sampling and development, decontamination water produced during sampling equipment decontamination, and disposable personal protective equipment (PPE).

4.1 IDW STAGING AREA

An IDW staging area will be set up at the BSL property at 715 Central Avenue. The property is equipped with a locked security fence, which will remain closed and locked except as normal operations require. Temporary fencing with a locked gate will be set up to separate the IDW staging area from BSL

operations. Wastes that have not been characterized will not be stored on site for longer than 90 days, in compliance with RCRA hazardous waste storage requirements.

4.2 SOLID MATRIX IDW

Minimal solid matrix IDW is expected to be generated during the initial groundwater sampling event. Disposable sampling equipment and disposable PPE will be cleaned of gross contamination, bagged, and placed in a dumpster for disposal as municipal solid waste. PPE and sampling equipment will not be disposed of in the same drums as other non-hazardous waste media.

4.3 LIQUID MATRIX IDW

Liquid phase IDW is expected to primarily be groundwater and decontamination water. Although not expected to be encountered, if LNAPL or DNAPL liquid phase IDW is generated during the RI, it will be segregated from aqueous phase IDW, characterized independently, and disposed of appropriately.

Aqueous phase IDW generated from groundwater investigations will be collected in a 250-500 gallon polyethylene tank onsite, and will have labels affixed to the outside clearly identifying the source, contents, and the date of generation. The IDW tank will be stored on-site on a secondary containment pad constructed of two layers of 6 mil plastic sheeting or similar manufactured containment system, and will be capable of holding at least twice the volume of the IDW storage tank. Once a tank is full or investigations are no longer expected to produce additional liquid matrix IDW, and prior to 90 days from the time of first generation, a grab sample will be collected from the tank, and submitted for the following analyses to determine if the IDW can be disposed of at the City of Billings Wastewater Treatment Plant (WWTP).

- TCLP Metals by SW 6010B and Mercury by SW 7470A
- VOCs by SW 8260B
- Total petroleum hydrocarbons by Montana-modified Massachusetts Method VPH and EPH
- Total cyanide by SM 4500-CN-E
- Total sulfide by SM 4500S2D

Analytical methods, holding times, and preservation methods are presented in Table 3. The pH and flashpoint will also be measured. Liquid IDW characterization results will be compared to the City of

Billings WWTP non-hazardous waste characterization limits, as shown on the waste discharge authorization manifest included as Attachment A. Waste meeting the disposal requirements will be pumped from the tank and hauled to the WWTP by a licensed waste hauler. Although aqueous phase IDW is not expected to contain contaminants in sufficient quantities to qualify as hazardous, wastes found to contain characteristically hazardous levels of contaminants will be transported and disposed of by Beartooth Environmental Services at a licensed disposal facility. Trihydro will notify DEQ of the specific disposal facility prior to shipment for DEQ review and approval. Waste manifests will be maintained by project staff to document final location and disposition of waste. Characteristically hazardous wastes will not be stored onsite for longer than 90 days.

5.0 REPORTING

Results of sampling and analysis will be reviewed by Trihydro for remedial investigation decisions on additional groundwater plume delineation and source investigations. A summary of sampling activities and non-conformances from this work plan will be recorded in daily logs and discussed in weekly meetings between Trihydro and the DEQ Project Officer. In addition, summary tables documenting analytical data will be provided by DEQ during the weekly meetings. The groundwater summary tables will include data validation flags resulting from the Trihydro data validation process, in addition to the laboratory data qualifier flags. Samples which are rejected as part of the data validation process will not be considered valid data for this Facility or decision making. Final sample results will be compared against DEQ-7 standards and DEQ RBSLs. Trihydro will upload the laboratory and field data into DEQ's environmental data management system (TREADS-EQuiS).

The results of this initial groundwater sampling event will be used to evaluate current groundwater conditions at the Facility, and aid in decision making for placement of additional monitoring wells and potential additional source evaluations. A potentiometric surface map and NAPL occurrence designation will also be generated. This will aid in further development of the Facility conceptual site model. Results and figures will be presented in the Remedial Investigation Report for the Facility in 2018.

6.0 SCHEDULE

Trihydro is planning to prepare for sampling, coordinate with the laboratory, coordinate with property owners, and finalize waste management subcontractor(s) during the first two weeks of July 2017, with a likely field start date of July 24, 2017. The groundwater fluid level and well development activities would take approximately 5 days from July 24 through July 28, 2017. Groundwater sampling would start the week of July 31, 2017 and continue for approximately 6-7 days into the following weekend.

ATTACHMENTS

Table 1: Groundwater Sampling and Analysis Plan Table – Initial Groundwater Sampling Event July 2017
Table 2: Sample Container, Holding Times, and Preservative Requirements
Table 3: Pace Analytical Method Detection Limits

Figure 1: Groundwater Wells to be Sampled Delineated by Well Diameter
Figure 2: Groundwater Wells to be Sampled Delineated by Analytical

REFERENCES

DEQ 2005. SRS Low-Flow Purging and Sampling Guidelines. *Montana Department of Environmental Quality*. April 18, 2005.

EPA 2002. Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers. *Groundwater Forum Issue Paper*. ORD/OSWER EPA/540/S-95/504. May 2002.

TABLE 1. GROUNDWATER SAMPLING DETAILS
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS, MONTANA

Updated on: 6/13/2017

									Investigation Type				Proposed Analyses										
General Location	**Grid Area**	**Location Type (s)**	**Location Number**	**Media Type**	**Proposed Sample ID**	**Sample Method**	**Well Development**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Fluid Levels [6]**	**Field Parameters [7]**	**TCLP [8]**	**Sample Method Comparison [9]**	**Sampling Suite**	**Rationale / Comments**
Existing Monitoring Well Locations																							
Western Edge - North CAL	X:-8,Y:-1	MW	EMW-03	GW	EMW-03	Low-flow pump	Y	2	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of petroleum or former petroleum sites.
Western Edge - East CAL	X:-7,Y:1	MW	ZPMW-1	GW	ZPMW-1	Low-flow pump	Y	2	X	X	-	-	X	-	-	X	-	X	X	-	-	VOCs + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of petroleum or former petroleum sites.
Western Edge - East CAL	X:-7,Y:-1	MW	CENEX-5	GW	CENEX-5	Low-flow pump	Y	2	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of petroleum or former petroleum sites.
Western Edge - Irrigation	X:-4,Y:1	IW	CENTRALPARK-I	GW	CENTRALPARK-I	Grab	N	8	X	X	X	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Upgradient of BSL used for irrigation at Central Park. Concern for risk. Discuss well depth and details with City of Billings.
Western Edge - Park	X:-2,Y:1	MW	BPGW02	GW	BPGW02	Low-flow pump	Y	2	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Upgradient of BSL - needs new monument and secure well cap.
Western Edge BSL	X:1,Y:1	MW	BPGW04	GW	BPGW04	Low-flow pump	N	2	X	X	-	-	X	X	X	X	X	X	X	-	X	Full	Characterize nature and extent of groundwater contamination. Former Tom's Conoco - known area of >9 ug/L PCE
Western Edge - Southwest BSL	X:-1,Y:-1	MW	EMW-09	GW	EMW-09	Low-flow pump	Y	2	X	X	-	-	X	-	-	X	-	X	X	-	-	VOCs + EPH	Characterize nature and extent of groundwater contamination. Sample immediately south/southwest of BSL and along the southern edge of Central Ave., which is a utility cooridor.
BSL Source Area	X:1,Y:1	MW	BPGP74	GW	BPGP74	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Historically highest concentration well just north of sheetpile.
BSL Source Area	X:1,Y:1	MW	BPGP76	GW	BPGP76	Peristaltic	N	0.75	X	X	-	-	X	X	-	-	-	X	X	-	-	VOCs + SVOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BSL Source Area	X:1,Y:1	MW	BPGP51	GW	BPGP51	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BSL Source Area	X:1,Y:1	MW	BPGP51B	GW	BPGP51B	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Deeper well comparison to shallower screen
BSL Source Area	X:1,Y:1	MW	BPGP46	GW	BPGP46	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BSL Source Area	X:1,Y:1	MW	BPGP46b	GW	BPGP46b	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Deeper well comparison to shallower screen
BSL Source Area	X:1,Y:1	MW	BPGP49	GW	BPGP49	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BSL Source Area	X:1,Y:1	MW	BPGP58	GW	BPGP58	Peristaltic	N	0.75	X	X	-	-	X	X	-	-	-	X	X	-	-	VOCs + SVOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Immediately next to building.
BSL Source Area	X:1,Y:1	MW	BPGP61	GW	BPGP61	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BSL Source Area	X:1,Y:1	MW	BPGP02	GW	BPGP02	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. May need to access via manhole. Unable to examine during GW inventory.
BSL Source Area	X:1,Y:1	MW	BPGP78	GW	BPGP78	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located in 2015 indicated non-detect. Need confirmation.
BSL Source Area	X:1,Y:1	MW	BPGP63	GW	BPGP63	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. East/northeast of sheet pile area.
BSL Source Area	X:1,Y:1	MW	BPGP63B	GW	BPGP63B	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. East/northeast of sheet pile area. Comparison to shallow well.
BSL Source Area	X:1,Y:1	MW	BPGP65	GW	BPGP65	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BSL Source Area	X:1,Y:1	MW	BPGP65B	GW	BPGP65B	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BSL Source Area	X:1,Y:1	MW	BPGP04	GW	BPGP04	Peristaltic	N	0.75	X	X	-	-	X	X	-	-	-	X	X	-	-	VOCs + SVOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BSL Source Area	X:1,Y:1	MW	BPGP54	GW	BPGP54	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BSL Source Area	X:1,Y:1	MW	BPGP60	GW	BPGP60	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Well not found during 2017 well inventory - attempt to locate and sample July 2017.
BSL Source Area	X:1,Y:1	MW	BPGP73	GW	BPGP73	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Well not found during 2017 well inventory - attempt to locate and sample July 2017.
BSL Source Area	X:1,Y:1	MW	BPGP66	GW	BPGP66	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample collected within known extent of plume impacts. Also has deeper paired well BPGP66B, not sampling for comparison at this time.
BSL Source Area	X:1,Y:1	MW	BPGP67	GW	BPGP67	Peristaltic	N	0.75	X	X	-	-	X	X	-	-	-	X	X	-	-	VOCs + SVOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Approximately 10+ feet from BPGP66, but order of magnitude lower in concentration in 2015.
BSL Source Area	X:1,Y:1	MW	BPGW01	GW	BPGW01	Low-flow pump	N	2	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BSL Source Area	X:1,Y:1	MW	BPGP59	GW	BPGP59	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BSL Source Area	X:1,Y:1	MW	BPGP53	GW	BPGP53	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Southern Plume Edge	X:1,Y:-1	MW	SMW12	GW	SMW12	Low-flow pump	N	2	X	X	-	-	X	-	-	X	-	X	X	-	-	VOCs + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts, well concentrations may be influenced by watering/irrigation of lawn. Well monuments for SMW12 and BPGP32 were filled with surface irrigation water at GW inventory.
Southern Plume Edge	X:1,Y:-1	MW	BPGP32	GW	BPGP32	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts, well concentrations may be influenced by watering/irrigation of lawn. Well monuments for SMW12 and BPGP32 were filled with surface irrigation water at GW inventory.
Plume Body	X:2,Y:1	MW	BPGP80	GW	BPGP80	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.

TABLE 1. GROUNDWATER SAMPLING DETAILS
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS, MONTANA

Updated on: 6/13/2017

									Investigation Type				Proposed Analyses										
General Location	**Grid Area**	**Location Type (s)**	**Location Number**	**Media Type**	**Proposed Sample ID**	**Sample Method**	**Well Development**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Fluid Levels [6]**	**Field Parameters [7]**	**TCLP [8]**	**Sample Method Comparison [9]**	**Sampling Suite**	**Rationale / Comments**
Plume Body	X:2,Y:1	MW	BPGP81	GW	BPGP81	Peristaltic	N	1	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:2,Y:1	MW	BPGP87	GW	BPGP87	Peristaltic	N	1	X	X	-	-	X	-	-	X	-	X	X	-	-	VOCs + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:4,Y:1	MW	BPGP83	GW	BPGP83	Peristaltic	N	1	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:2,Y:2	MW	BPGP05	GW	BPGP05	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:2,Y:2	MW	BPGP93	GW	BPGP93	Peristaltic	N	1	X	X	-	-	X	-	-	X	-	X	X	-	-	VOCs + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Not found during groundwater inventory, but recent EPA replacement well.
Plume Body	X:4,Y:2	MW	BPGP08	GW	BPGP08	Peristaltic	N	0.5	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Comparison of 4" well to 1/2" well at BPGP08.
Plume Body	X:4,Y: 2	MW	EMW-11	GW	EMW-11	Low-flow pump	N	4	X	X	-	-	X	-	-	-	-	X	X	-	X	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Comparison of 4" well to 1/2" well at BPGP08.
Plume Body	X:4,Y:3	MW	BPGP85	GW	BPGP85	Peristaltic	N	1	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Standing water, well irrigated location possibly.
Plume Body	X:5,Y:2	MW	BPGP84	GW	BPGP84	Peristaltic	N	1	X	X	-	-	X	-	-	X	-	X	X	-	-	VOCs + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:5,Y:3	MW	BPGP12	GW	BPGP12	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:6,Y:3	MW	EMW-15	GW	EMW-15	Low-flow pump	N	2	X	X	-	-	X	-	-	X	-	X	X	-	X	VOCs + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:6,Y:3	MW	PEP07	GW	PEP07	Low-flow pump	N	2	X	X	-	-	X	X	-	X	-	X	X	-	-	VOCs + SVOCs + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Northern Plume Edge	X:5,Y:4	MW	BPGP15	GW	BPGP15	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:6,Y:4	MW	BPGP92	GW	BPGP92	Peristaltic	N	1	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:6,Y:5	MW	BPGP17	GW	BPGP17	Peristaltic	N	0.75	X	X	-	-	X	-	-	X	-	X	X	-	-	VOCs + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Northern Plume Edge	X:6,Y:6	MW	BPGP31	GW	BPGP31	Peristaltic	N	0.75	X	X	-	-	X	X	-	-	-	X	X	-	-	VOCs + SVOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Previously observed PCE concentrations below DEQ-7 standard.
Plume Body	X:7,Y:4	MW	BPGP22	GW	BPGP22	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:7,Y:5	MW	BPGP88	GW	BPGP88	Peristaltic	N	1	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:7,Y:5	MW	BPGP16	GW	BPGP16	Peristaltic	N	0.75	X	X	-	-	X	X	-	X	-	X	X	-	-	VOCs + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:7,Y:6	MW	BPGP25	GW	BPGP25	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Northern Plume Edge	X:7,Y:7	MW	BPGP27	GW	BPGP27	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sample located in northern edge of plume.
Northern Plume Edge	X:7,Y:7	MW	BPGP48	GW	BPGP48	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sample located in northern edge of plume. Previously observed PCE concentrations below DEQ-7 standard.
Plume Body	X:9,Y:5	MW	BPGP94	GW	BPGP94	Peristaltic	N	1	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:9,Y:6	MW	BPGP86	GW	BPGP86	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:9,Y:7	MW	BPGP28	GW	BPGP28	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Northern Plume Edge	X:9,Y:7	MW	BPGP47	GW	BPGP47	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sample located in northern edge of plume.
Plume Body	X:11,Y:6	MW	BPGP89	GW	BPGP89	Peristaltic	N	1	X	X	-	-	X	-	-	X	-	X	X	-	-	VOCs + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:10,Y:7	MW	BPGP41	GW	BPGP41	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:10,Y:7	MW	BPMW10	GW	BPMW10	Low-flow pump	N	2	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Well not found during 2017 well inventory - attempt to locate and sample July 2017.
Plume Body	X:11,Y:7	MW	BPGP42	GW	BPGP42	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body	X:11,Y:7	MW	BPGP39	GW	BPGP39	Peristaltic	N	0.75	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Poly tubing may sorb solvents, and may be inaccurate. Difficult to find. Well slitting performed manually, no record of depth of slitting. Likely requires replacement. If well tubing is confirmed to be poly tubing, will not sample this round.
Plume Body	X:12,Y:8	MW	BPGP90	GW	BPGP90	Peristaltic	N	1	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Well not found during 2017 well inventory - attempt to locate and sample July 2017.
Plume Body	X:12,Y:8	MW	BPGP44	GW	BPGP44	Peristaltic	N	0.75	X	X	-	-	X	X	-	X	-	X	X	-	-	VOCs + SVOCs + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Distal End of Plume	X:14,Y:9	MW	BPGP91	GW	BPGP91	Peristaltic	N	1	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize distal edge of groundwater contamination. Sample located within known extent of plume impacts.
Distal End of Plume	X:14,Y:10	MW	BPGP50	GW	BPGP50	Peristaltic	N	0.75	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize distal edge of groundwater contamination. Sample located within known extent of plume impacts.
Distal End of Plume	X:17,Y:11	MW	EMW-18	GW	EMW-18	Low-flow pump	Y	2	X	X	-	-	X	-	-	X	-	X	X	-	-	VOCs + EPH	Characterize distal edge of groundwater contamination. Well located downgradient of previously most downgradient well BPGP50.

TABLE 1. GROUNDWATER SAMPLING DETAILS
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS, MONTANA

Updated on: 6/13/2017

									Investigation Type				Proposed Analyses										
General Location	**Grid Area**	**Location Type (s)**	**Location Number**	**Media Type**	**Proposed Sample ID**	**Sample Method**	**Well Development**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Fluid Levels [6]**	**Field Parameters [7]**	**TCLP [8]**	**Sample Method Comparison [9]**	**Sampling Suite**	**Rationale / Comments**
Distal End of Plume	X:16,Y:11	MW	EMW-21	GW	EMW-21	Low-flow pump	Y	2	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize distal edge of groundwater contamination. Well located downgradient of previously most downgradient well BPGP50.
Distal End of Plume	X:17,Y:11	MW	EMW-26	GW	EMW-26	Low-flow pump	Y	2	X	X	-	-	X	X	-	X	-	X	X	-	-	VOCs + SVOCs + EPH	Characterize distal edge of groundwater contamination. Well located downgradient of previously most downgradient well BPGP50.
Distal End of Plume	X:16,Y:8	MW	Whiteley MW-1	GW	Whiteley MW-1	Low-flow pump	N	2	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Delineate groundwater impacts between main plume body and Rex's Cleaners
Distal End of Plume	X:16,Y:8	MW	Whiteley MW-2	GW	Whiteley MW-2	Low-flow pump	N	2	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Delineate groundwater impacts between main plume body and Rex's Cleaners
Distal End of Plume	X:17,Y:8	MW	RH-MW-1	GW	RH-MW-1	Low-flow pump	N	2	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. RH-MW-1 may be destroyed, and RH-MW-2 or similar may be used as an alternate.
Distal End of Plume	X:17,Y:8	MW	RH-MW-3	GW	RH-MW-3	Low-flow pump	N	2	X	X	-	-	X	X	X	X	X	X	X	-	X	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Distal End of Plume	X:17,Y:8	MW	RH-MW-7	GW	RH-MW-7	Low-flow pump	N	2	X	X	-	-	X	-	-	-	-	X	X	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Southern Plume Edge	X:11,Y:4	MW	EMW-28	GW	EMW-28	Low-flow pump	N	2	X	X	-	-	X	-	-	X	-	X	X	-	-	VOCs + EPH	Characterize nature and extent of groundwater contamination. Sample located along southern edge of plume.
Southern Plume Edge	X:9,Y:3	MW	BMW-1	GW	BMW-1	Low-flow pump	N	2	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Southern Plume Edge	X:10,Y:3	MW	BMW-4	GW	BMW-4	Low-flow pump	N	2	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Southern Plume Edge	X:10,Y:3	MW	BMW07-1	GW	BMW07-1	Low-flow pump	N	2	X	X	-	-	X	-	-	X	-	X	X	-	-	VOCs + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body - BNSF Property	X:11,Y:5	MW	F3	GW	F3	Low-flow pump	Unknown		X	X	-	-	X	-	X	X	-	X	X	-	-	VOCs + Metals + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body - BNSF Property	X:11,Y:5	MW	E1	GW	E1	Low-flow pump	Unknown		X	X	-	-	X	-		X	-	X	X	-	-	VOCs + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body - BNSF Property	X:12,Y:5	MW	D5	GW	D5	Low-flow pump	Unknown		X	X	-	-	X	-	X	X	-	X	X	-	-	VOCs + Metals + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body - BNSF Property	X:12,Y:6	MW	BL-GW-5	GW	BL-GW-5	Low-flow pump	Unknown		X	X	-	-	X	-	X	X	-	X	X	-	-	VOCs + Metals + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body - BNSF Property	X:12,Y:7	MW	BNMW-20	GW	BNMW-20	Low-flow pump	Unknown		X	X	-	-	X	-	X	X	-	X	X	-	-	VOCs + Metals + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body - BNSF Property	X:13,Y:7	MW	BNMW-7	GW	BNMW-7	Low-flow pump	Unknown		X	X	-	-	X	-	X	X	-	X	X	-	-	VOCs + Metals + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body - BNSF Property	X:13,Y:6	MW	BNMW-21	GW	BNMW-21	Low-flow pump	Unknown		X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Plume Body - BNSF Property	X:14,Y:6	MW	BNMW-9	GW	BNMW-9	Low-flow pump	Unknown		X	X	-	-	X	-	X	X	-	X	X	-	-	VOCs + Metals + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sampled KJ/BN in 2014 for PCE
Plume Body - BNSF Property	X:14,Y:6	MW	BNMW-23	GW	BNMW-23	Peristaltic	Unknown	1	X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sampled KJ/BN in 2014 for PCE
Plume Body - BNSF Property	X:14,Y:6	MW	BNMW-24	GW	BNMW-24	Low-flow pump	Unknown		X	X	-	-	X	-	X	X	-	X	X	-	-	VOCs + Metals + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sampled KJ/BN in 2014 for PCE
Plume Body - BNSF Property	X:13,Y:7	MW	BNMW-8	GW	BNMW-8	Low-flow pump	Unknown		X	X	-	-	X	-	X	X	-	X	X	-	-	VOCs + Metals + EPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Distal End of Plume	X:15,Y:7	MW	Weston-MW-2	GW	Weston-MW-2	Low-flow pump	N		X	X	-	-	X	X	X	X	X	X	X	-	-	Full	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
Southern Plume Edge	X:3,Y:-2	MW	GWIC-281548	GW	GWIC-281548	Low-flow pump	Y		X	X	-	-	X	-	-	X	-	X	X	-	-	VOCs + Metals + EPH	Characterize nature and extent of groundwater contamination. Southern area - 2" monitoring well to 15' bgs - needs development. Owned by MDT GWIC #281548 - http://mbmggwic.mtech.edu/sqlserver/v11/reports/SiteSummary.asp?gwicid=281548
						57	9																
Waste Samples	-	Water	-	Purge Water	BP-W-Sequential (01+)	NA	NA		-	-	-	-	-	-	-	-	-	-	-	X			TBD during waste characterization discussions with DEQ
												Subtotals	94	40	39	57	31						

NOTES:

VOCs 8260 (Low Level/Long List	Groundwater analysis method for VOCs by EPA 8260B, Low-level MDLs, long list VOCs - collect with bottles/preservatives according to Table 2
SVOCs 8270 (PAHs) [2]	Groundwater analysis method for SVOCs including PAHs by EPA 8270 - collect with bottles/preservatives according to Table 2
Metals [3]	Groundwater analysis method for 19 dissolved metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, thallium, vanadium, and zinc by EPA Method 200.7 and mercury by CVAA Mercury/EPA Method 245.1 - collect with bottles/preservatives according to Table 2
EPH/VPH [4]	Groundwater analysis method for EPH by SW8015M and MA-EPH fractionization; VPH by MA-VPH - collect with bottles/preservatives according to Table 2
MNA [5]	MNA analyses to include sulfate/sulfite by E300.0, nitrate/nitrite by E353.2, dissolved organic carbon by SW9060, chloride by E300, and mehtane/ethene/ethane by SW3810/RSK175 - collect with bottles/preservatives according to Table 2
Fluid Levels [6]	Fluid levels collected according to Groundwater Sampling Work Plan July 2017 Memo
Field Parameters [7]	Field parameter analyses will be collected though a groundwater multi-meter according to Groundwater Sampling Work Plan July 2017 Memo
TCLP [8]	Waste analyses will be determined in conjunction with DEQ according to the anticipated characterization of the waste.
Sample Method Comparison[9]	Sample method comparison will involve collecting two VOCs samples with different sample methods (low-flow peristaltic pump and low-flow down-well pump)

TABLE 4-2. SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Analysis	Method	Sample Container Type and Volume	Holding Time[a]	Preservation Type[b, c]
Water				
VOC	SW8260B	3-40 mL VOA vial with HCL	14 days	HCl
				Store at or below 6 Degrees
EPH Screen	MA-EPH	2-1000 mL amber glass bottles with HCl	14/40 days	Store at or below 6 Degrees
				HCl to pH <2
VPH	MA-VPH	3-40 mL VOA vials with HCl	14 days	Store at or below 6 Degrees
				HCl
SVOC	EPA 8270 by SW3520	2-1000 mL amber glass/teflon bottles	7/40 days	Add 80 mg sodium thiosulfate to chlorinated samples.
				Unpreserved, Store at or below 6 Degrees
Low Level PAH	EPA 8270 PAH SIM	2-1000 mL amber glass/teflon bottles	7/40 days	Add 80 mg sodium thiosulfate to chlorinated samples.
Metals	E245.1/E200.7_8	250-mL plastic	6 months/28 days Hg	Add HNO_3 to pH <2
Dissolved Metals	EPA 6020	250-mL plastic, filtered, with HNO3	15 minutes to filter/preserve (6 months analysis)	Filter, then place in preserved containers; HNO3 to pH <2
Dissolved CVAA Mercury	EPA 245.1	250-mL plastic, filtered, with HNO3	15 minutes to filter/preserve (28 days analysis)	Filter, then place in preserved containers; HNO3 to pH <2
MNA: Sulfate	E300.0	250 mL plastic	28 days	Unpreserved, Store at or below 6 Degrees
MNA: Nitrate+Nitrite	E353.2	250mL plastic, H2SO4 preserved	28 days	Store at or below 6 Degrees; H_2SO_4 to pH <2
Organic Carbon	SW9060	250mL amber glass, H2SO4 preserved	28 days	Store at or below 6 Degrees; H2SO4 to pH <2
Chloride	E300.0	250ml plastic	28 days	Unpreserved, Store at or below 6 Degrees
Methane, ethane, ethene	SW3810/RSK175	3-40ml clear with TSP	14 days	TSP cool to above freezing but not less then 6 deg
INVESTIGATION DERIVED WASTE CHARACTERIZATION - LIQUID				
VOC	SW8260B	250 mL amber glass	14 days to leach and 14 days to analyze	Unpreserved, Store at or below 6 Degrees
TPH	MA-EPH Screen	2-1000 mL amber glass bottles with HCl	14/40 days	Store at or below 6 Degrees
				HCl to pH <2
	MA-VPH	3-40 mL VOA vials with HCl	14 days	Store at or below 6 Degrees
				HCl
TCLP Metals	SW 6010B(RCRA Metals)/SW 7470A (Mercury- Hg)	250-mL amber glass	6 months/28 days Hg	Unpreserved, Store at or below 6 Degrees

TABLE 4-2. SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS

Analysis	Method	Sample Container Type and Volume	Holding Time[a]	Preservation Type[b, c]
Cyanide (total)	SM 4500-CN-E	250-mL plastic with NaOH	14 days	Place in preserved containers; NaOH
Sulfide (total)	SM 4500S2D	250-mL plastic with NaOH and zinc acetate	15 minutes to filter/preserve (28 days analysis)	Place in preserved containers; NaOH + Zn acetate

Notes:

[a] The first number (or number alone) refers to the maximum number of days from sampling to extraction and the second number refers to the maximum number of days from extraction to analysis.

[b] Temperatures are listed in degrees Celsius.

[c] Preservatives will be supplied by the laboratory, but must be added in the field unless noted as pre-preserved.

ASA - American Society of Agronomy
EPH - extractable petroleum hydrocarbons
H_2SO_4 - sulfuric acid
HCL - hydrochloric acid
Hg - Mercury
HNO_3 - nitric acid
L - liter
MA - Massachusetts
mL - milliliter
NaOH - sodium hydroxide
oz - ounce
PAH - polynuclear aromatic hydrocarbon
PCB - polychlorinated biphenyl
SPLP - synthetic precipitation leaching procedure
SVOC - semivolatile organic compound
TCLP - toxicity characteristic leaching procedure
VOA - volatile organic analysis
VOC - volatile organic compound
VPH - volatile petroleum hydrocarbons
Zn - zinc

TABLE 3. CONSTITUENT LISTS, ANALYTICAL METHODS, AND METHOD DETECTION LIMITS FOR GROUNDWATER
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

	Analyte	CAS No.	Pace Analytical Laboratories MDL (ug/L)	Pace Analytical Laboratories PRL (ug/L)	DEQ-7 Human Health Standard (ug/L)	US EPA Tapwater RSL (ug/L)	Comparison of Laboratory MDL to Screening Levels
SVOCs by EPA Method 8270	Acenaphthene	83-32-9	0.00368	0.04	70	530	MDL less than DEQ-7
	Acenaphthylene	208-96-8	0.00728	0.04	-	-	-
	Anthracene	120-12-7	0.00429	0.04	2100	1800	MDL less than DEQ-7
	Benzo(a)anthracene	56-55-3	0.00383	0.04	0.5	0.03	MDL less than DEQ-7
	Benzo(a)pyrene	50-32-8	0.00519	0.04	0.05	0.025	MDL less than DEQ-7
	Benzo(b)fluoranthene	205-99-2	0.00450	0.04	0.5	0.25	MDL less than DEQ-7
	Benzo(e)pyrene	192-97-2	0.00351	0.04	-	-	-
	Benzo(g,h,i)perylene	191-24-2	0.00365	0.04	-	-	-
	Benzo(k)fluoranthene	207-08-9	0.00400	0.04	5	2.5	MDL less than DEQ-7
	Chrysene	218-01-9	0.00378	0.04	50	25	MDL less than DEQ-7
	Dibenz(a,h)anthracene	53-70-3	0.00375	0.04	-	-	-
	Fluoranthene	206-44-0	0.00583	0.04	20	800	MDL less than DEQ-7
	Fluorene	96-73-7	0.00444	0.04	50	290	MDL less than DEQ-7
	Indeno(1,2,3-cd)pyrene	193-39-5	0.00391	0.04	0.5	0.25	MDL less than DEQ-7
	Naphthalene	91-20-3	0.00482	0.04	100	0.17	MDL less than DEQ-7
	Phenanthrene	85-01-8	0.0063	0.04	-	-	-
	Pyrene	129-00-0	0.00529	0.04	20	120	MDL less than DEQ-7
	1-Methylnaphthalene	90-12-0	0.00565	0.04	-	1.1	MDL less than EPA RSL
	2-Chloronaphthalene	91-58-7	0.00525	0.04	800	750	MDL less than DEQ-7
	2-Methylnaphthalene	91-57-6	0.00690	0.04	-	36	MDL less than EPA RSL
	Dibenzofuran	132-64-9	0.00536	0.04	-	7.9	MDL less than EPA RSL
	Perylene	198-55-0	0.00469	0.04	-	-	-
	1,2,4-Trichlorobenzene	120-82-1	52.9	330	70	1.2	MDL less than DEQ-7
	1,2-Dichlorobenzene	95-50-1	49.3	330	600	300	MDL less than DEQ-7
	1,2-Diphenylhydrazine	122-66-7	21.6	330	0.3	0.078	MDL exceeds DEQ-7
	1,3-Dichlorobenzene	541-73-1	45.1	330	600	-	MDL less than DEQ-7
	1,4-Dichlorobenzene	106-46-7	51.7	330	75	0.48	MDL less than DEQ-7
	1-Methylnaphthalene	90-12-0	38.5	330	-	1.1	MDL exceeds EPA RSL
	2,4,5-Trichlorophenol	95-95-4	35.7	330	300	1200	MDL less than DEQ-7
	2,4,6-Trichlorophenol	88-06-2	17.4	330	30	4.1	MDL less than DEQ-7

TABLE 3. CONSTITUENT LISTS, ANALYTICAL METHODS, AND METHOD DETECTION LIMITS FOR GROUNDWATER
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

	2,4-Dichlorophenol	120-83-2	34.2	330	10	46	MDL exceeds DEQ-7
	2,4-Dimethylphenol	105-67-9	47.9	330	100	360	MDL less than DEQ-7
	2.4-Dinitrophenol	51-28-5	30.9	330	-	-	-
	2,4-Dinitrotoluene	121-14-2	25.7	330	0.49	0.24	MDL exceeds DEQ-7
	2.6-Dinitrotoluene	606-20-2	42.9	330	-	-	-
	2-Chloronaphthalene	91-58-7	36.5	330	800	750	MDL less than DEQ-7
	2-Chlorophenol	95-57-8	41.4	330	30	91	MDL exceeds DEQ-7
	2-Methylnaphthalene	91-57-6	37.0	330	-	36	MDL exceeds EPA RSL
	2-Methylphenol(o-Cresol)	95-48-7	37.0	330	-	-	-
	2-Nitroaniline	88-74-4	58.6	330	-	190	MDL less than EPA RSL
	2-Nitrophenol	88-75-5	40.1	330	-	-	-
	3&4-Methylphenol	108-39-4 106-44-5	39.7	660	-	-	-
	3,3'-Dichlorobenzidine	91-94-1	42.8	330	-	-	-
	3-Nitroaniline	99-09-2	37.8	330	-	-	-
	4,6-Dinitro-2-methylphenol	534-52-1	34.4	1700	2	1.5	MDL exceeds DEQ-7
	4-Bromophenylphenyl ether	101-55-3	20.4	330	-	-	-
	4-Chloro-3-methylphenol	59-50-7	24.9	330	500	1400	MDL less than DEQ-7
	4-Chloroaniline	106-47-8	57.4	330	-	0.37	MDL exceeds EPA RSL
	4-Chlorophenylphenyl ether	7005-72-3	19.4	330	-	-	-
	4-Nitroaniline	100-01-6	37.9	330	-	3.8	MDL exceeds EPA RSL
	4-Nitrophenol	100-02-7	37.3	330	50	-	MDL less than DEQ-7
	Acenaphthene	83-32-9	16.6	330	70	530	MDL less than DEQ-7
	Acenaphthylene	208-96-8	17.5	330	-	-	-
	Anthracene	120-12-7	17.0	330	2100	1800	MDL less than DEQ-7
SVOCs by SW 3550	Benzo(a)anthracene	56-55-3	10.0	330	0.5	0.03	MDL exceeds DEQ-7
	Benzo(a)pyrene	50-32-8	20.1	330	0.05	0.025	MDL exceeds DEQ-7
	Benzo(b)fluoranthene	205-99-2	21.3	330	0.5	0.25	MDL exceeds DEQ-7
	Benzo(g,h,i)perylene	191-24-2	40.0	330	-	-	-
	Benzo(k)fluoranthene	207-08-9	19.0	330	5	2.5	MDL exceeds DEQ-7
	Butylbenzylphthalate	85-68-7	40.5	330	1	16	MDL exceeds DEQ-7
	Carbazole	86-74-8	18.5	330	-	-	-
	Chrysene	218-01-9	10.0	330	50	25	MDL less than DEQ-7
	Di-n-butylphthalate	84-74-2	19.2	330	20	900	MDL less than DEQ-7
	Di-n-octylphthalate	117-84-0	38.4	330	-	200	MDL less than EPA RSL

TABLE 3. CONSTITUENT LISTS, ANALYTICAL METHODS, AND METHOD DETECTION LIMITS FOR GROUNDWATER
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

	Dibenz(a,h)anthracene	53-70-3	32.9	330	-	-	-
	Dibenzofuran	132-64-9	12.9	330	-	7.9	MDL exceeds EPA RSL
	Diethylphthalate	84-66-2	17.9	330	600	15000	MDL less than DEQ-7
	Dimethylphthalate	131-11-3	18.3	300	2000	-	MDL less than DEQ-7
	Fluoranthene	206-44-0	19.4	330	20	800	MDL less than DEQ-7
	Fluorene	86-73-7	10.0	330	50	290	MDL less than DEQ-7
	Hexachloro-1,3-butadiene	87-68-3	46.9	330	-	-	-
	Hexachlorobenzene	118-74-1	17.8	330	0.2	0.0098	MDL exceeds DEQ-7
	Hexachloroethane	67-72-1	56.1	330	30	0.33	MDL exceeds DEQ-7
	Indeno(1,2,3-cd)pyrene	193-39-5	17.0	330	0.5	0.25	MDL exceeds DEQ-7
	Isophorone	78-59-1	38.9	330	400	78	MDL less than DEQ-7
	N-Nitroso-di-n-propylamine	621-64-7	45.6	330	-	-	-
	N-Nitrosodimethylamine	62-75-9	58.7	330	0.0069	0.00011	MDL exceeds DEQ-7
	N-Nitrosodiphenylamine	86-30-6	17.4	330	33	12	MDL less than DEQ-7
	Naphthalene	91-20-3	46.5	330	100	0.17	MDL less than DEQ-7
	Nitrobenzene	98-95-3	60.3	330	10	0.14	MDL exceeds DEQ-7
	Pentachlorophenol	87-86-5	35.4	670	1	0.041	MDL exceeds DEQ-7
	Phenanthrene	85-01-8	18.0	330	-	-	-
	Phenol	108-95-2	42.6	330	4000	5800	MDL less than DEQ-7
	Pyrene	129-00-0	10.0	330	20	120	MDL less than DEQ-7
	bis(2-Chloroethoxy)methane	111-91-1	51.5	330	-	59	MDL less than EPA RSL
	bis(2-Chloroethyl) ether	111-44-4	48.1	330	-	-	-
	bis(2-Chloroisopropyl)ether	108-60-1	53.9	330	-	-	-
	bis(2-Ethylhexyl)phthalate	117-81-7	42.1	330	6	5.6	MDL exceeds DEQ-7
	Aluminum, dissolved	7429-90-5	1.92	10	-	-	-
	Antimony, dissolved	7440-36-0	0.0321	0.5	6	-	MDL less than DEQ-7
	Arsenic, dissolved	7440-38-2	0.0914	0.5	10	-	MDL less than DEQ-7
	Barium, dissolved	7440-39-3	0.0192	0.3	1000	-	MDL less than DEQ-7
	Beryllium, dissolved	7440-41-7	0.0304	0.2	4	-	MDL less than DEQ-7
	Bismuth, dissolved	7440-69-9	0.0386	0.5	-	-	-
	Boron, dissolved	7440-42-8	0.554	5	-	-	-
	Cadmium, dissolved	7440-43-9	0.0127	0.08	5	-	MDL less than DEQ-7
	Calcium, dissolved	7440-70-2	9.76	40	-	-	-
	Chromium, dissolved	7440-47-3	0.140	0.5	100	-	MDL less than DEQ-7
	Cobalt, dissolved	7440-48-4	0.0211	0.5	-	-	-

TABLE 3. CONSTITUENT LISTS, ANALYTICAL METHODS, AND METHOD DETECTION LIMITS FOR GROUNDWATER
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Metals by EPA Method 6020	Copper, dissolved	7440-50-8	0.405	1	1300	-	MDL less than DEQ-7
	Iron, dissolved	7439-89-6	18.5	50	-	-	-
	Lead, dissolved	7439-92-1	0.0116	0.1	15	-	MDL less than DEQ-7
	Lithium, dissolved	7439-93-2	0.0475	0.5	-	-	-
	Magnesium, dissolved	7439-95-4	1.99	10	-	-	-
	Manganese, dissolved	7439-96-5	0.127	0.5	-	-	-
	Molybdenum, dissolved	7439-98-7	0.0649	0.5	-	-	-
	Nickel, dissolved	7440-02-0	0.0990	0.5	100	-	MDL less than DEQ-7
	Palladium, dissolved	7440-05-3	0.0697	0.5	-	-	-
	Platinum, dissolved	7440-06-4	0.0250	0.5	-	-	-
	Potassium, dissolved	7440-09-7	8.48	50	-	-	-
	Selenium, dissolved	7782-49-2	0.130	0.5	50	-	MDL less than DEQ-7
	Silica, dissolved	7631-86-9	28.9	107	-	-	-
	Silicon, dissolved	7740-21-3	13.5	50	-	-	-
	Silver, dissolved	7440-22-4	0.00920	0.5	100	-	MDL less than DEQ-7
	Sodium, dissolved	7440-23-5	10.4	50	-	-	-
	Strontium, dissolved	7440-24-6	0.0257	0.5	-	-	-
	Thallium, dissolved	7440-28-0	0.00716	0.1	2	-	MDL less than DEQ-7
	Tin, dissolved	7440-31-5	0.110	0.5	-	-	-
	Titanium, dissolved	7440-32-6	0.377	1	-	-	-
	Vanadium, dissolved	7440-62-2	0.0847	1	-	-	-
	Zinc, dissolved	7440-66-6	0.778	5	2000	-	MDL less than DEQ-7
	Uranium, dissolved	7440-61-1	0.0138	0.5	30	-	MDL less than DEQ-7
	1,1,1,2-Tetrachloroethane	630-20-6	0.166	1	-	0.57	MDL less than EPA RSL
	1,1,1-Trichloroethane	71-55-6	0.170	1	200	8000	MDL less than DEQ-7
	1,1,2,2-Tetrachloroethane	79-34-5	0.225	1	2	0.076	MDL less than DEQ-7
	1,1,2-Trichloroethane	79-00-5	0.152	1	3	0.28	MDL less than DEQ-7
	1,1,2-Trichlorotrifluoroethar	76-13-1	0.320	1	-	10000	MDL less than EPA RSL
	1,1-Dichloroethane	75-34-3	0.171	1	-	2.8	MDL less than EPA RSL
	1,1-Dichloroethene	75-35-4	0.277	1	7	280	MDL less than DEQ-7
	1,1-Dichloropropene	563-58-6	0.227	1	-	-	-
	1,2,3-Trichlorobenzene	87-61-6	0.215	1	-	7	MDL less than EPA RSL
	1,2,3-Trichloropropane	96-18-4	0.284	4	-	0.00075	MDL exceeds EPA RSL
	1,2,4-Trichlorobenzene	120-82-1	0.213	1	70	1.2	MDL less than DEQ-7
	1,2,4-Trimethylbenzene	95-63-6	0.178	1	-	56	MDL less than EPA RSL

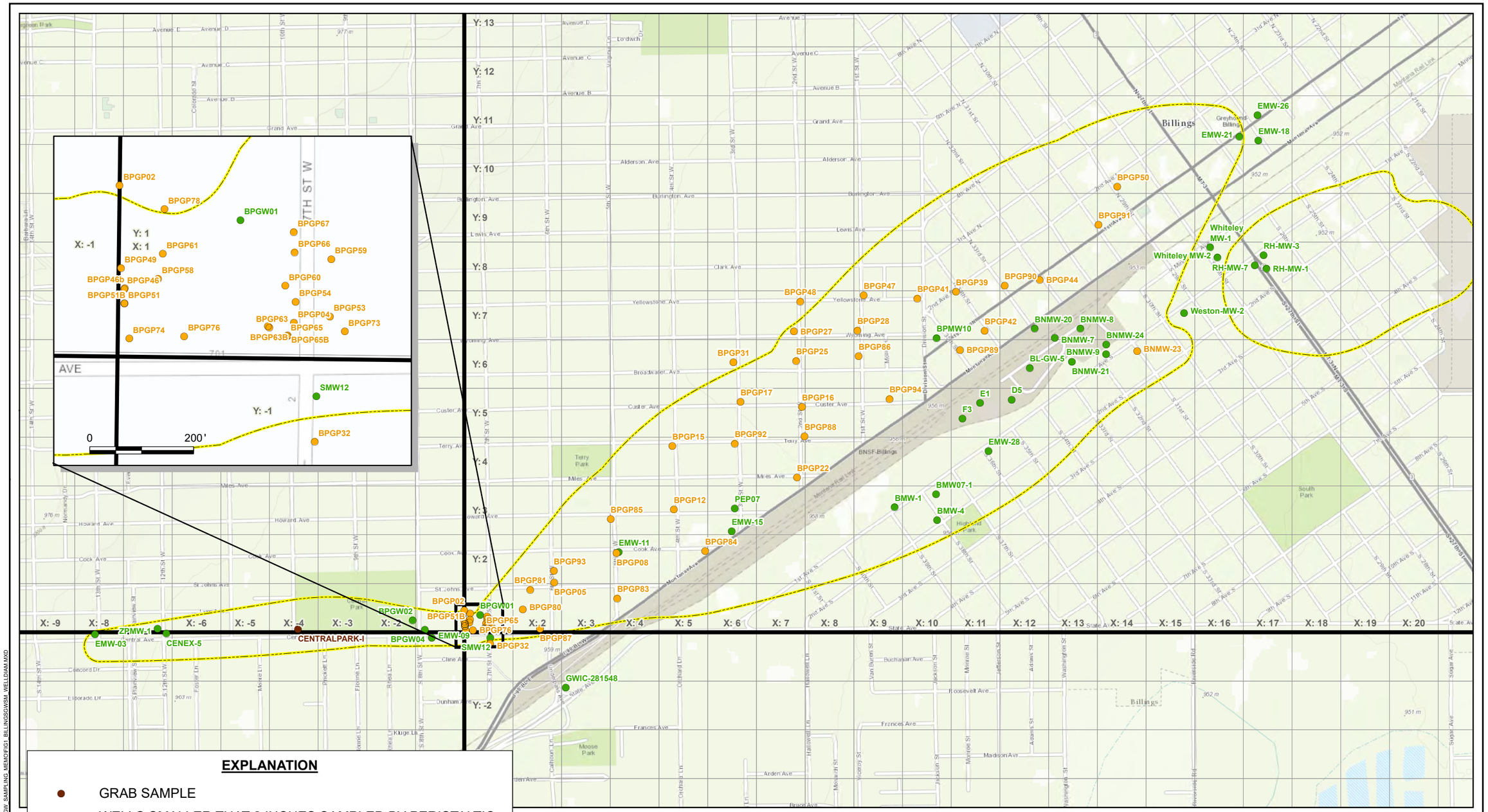
TABLE 3. CONSTITUENT LISTS, ANALYTICAL METHODS, AND METHOD DETECTION LIMITS FOR GROUNDWATER
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

	1,2-Dibromo-3-chloropropar	96-12-8	0.600	4	0.2	0.00033	MDL exceeds DEQ-7
	1,2-Dibromoethane	106-93-4	0.200	1	0.017	0.0075	MDL exceeds DEQ-7
	1,2-Dichlorobenzene	95-50-1	0.171	1	600	300	MDL less than DEQ-7
	1,2-Dichloroethane	107-06-2	0.170	1	4	0.17	MDL less than DEQ-7
	1,2-Dichloropropane	78-87-5	0.222	4	5	0.14	MDL less than DEQ-7
	1,3,5-Trimethylbenzene	108-67-8	0.269	1	-	60	MDL less than EPA RSL
	1,3-Dichlorobenzene	541-73-1	0.115	1	600	-	MDL less than DEQ-7
	1,3-Dichloropropane	142-28-9	0.096	1	-	370	MDL less than EPA RSL
	1,4-Dichlorobenzene	106-46-7	0.211	1	75	0.48	MDL less than DEQ-7
	2,2-Dichloropropane	594-20-7	0.128	4	-	-	-
	2-Butanone (MEK)	78-93-3	1.10	5	-	-	-
	2-Chlorotoluene	95-49-8	0.295	1	-	240	MDL less than EPA RSL
	4-Chlorotoluene	106-43-4	0.255	1	-	250	MDL less than EPA RSL
	4-Methyl-2-pentanone (MIB	108-10-1	0.432	5	-	-	-
	Acetone	67-64-1	2.01	20	-	14000	MDL less than EPA RSL
	Allyl chloride	107-05-1	0.250	4	-	0.73	MDL less than EPA RSL
	Benzene	71-43-2	0.155	1	5	0.46	MDL less than DEQ-7
	Bromobenzene	108-86-1	0.337	1	-	62	MDL less than EPA RSL
	Bromochloromethane	74-97-5	0.186	1	-	83	MDL less than EPA RSL
	Bromodichloromethane	75-27-4	0.240	1	-	0.13	MDL exceeds EPA RSL
	Bromoform	75-25-2	0.274	4	80	3.3	MDL less than DEQ-7
	Bromomethane	74-83-9	0.443	4	10	7.5	MDL less than DEQ-7
VOCs by EPA Method 8260	Carbon tetrachloride	56-23-5	0.197	1	3	0.46	MDL less than DEQ-7
	Chlorobenzene	108-90-7	0.114	1	100	78	MDL less than DEQ-7
	Chloroethane	75-00-3	0.342	1	-	21000	MDL less than EPA RSL
	Chloroform	67-66-3	0.210	1	70	0.22	MDL less than DEQ-7
	Chloromethane	74-87-3	0.246	4	600	190	MDL less than DEQ-7
	cis-1,2-Dichloroethene	156-59-2	0.120	1	70	36	MDL less than DEQ-7
	cis-1,3-Dichloropropene	10061-01-5	0.150	4	4	-	MDL less than DEQ-7
	Dibromochloromethane	124-48-1	0.157	1	8	0.87	MDL less than DEQ-7
	Dibromomethane	74-95-3	0.194	4	-	8.3	MDL less than EPA RSL
	Dichlorodifluoromethane	75-71-8	0.226	1	1000	200	MDL less than DEQ-7
	Dichlorofluoromethane	75-43-4	0.214	1	-	-	-
	Diethyl ether	60-29-7	0.194	4	-	3900	MDL less than EPA RSL
	Ethylbenzene	100-41-4	0.152	1	700	1.5	MDL less than DEQ-7

TABLE 3. CONSTITUENT LISTS, ANALYTICAL METHODS, AND METHOD DETECTION LIMITS FOR GROUNDWATER
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

	Hexachloro-1,3-butadiene	87-68-3	0.178	1	-	-	-
	Isopropylbenzene (Cumene)	98-82-8	0.253	1	-	-	-
	MTBE	1634-04-4	0.149	1	30	14	MDL less than DEQ-7
	Methylene Chloride	75-09-2	0.293	4	5	11	MDL less than DEQ-7
	Naphthalene	91-20-3	0.204	4	100	0.17	MDL less than DEQ-7
	Styrene	100-42-5	0.286	1	100	1200	MDL less than DEQ-7
	Tetrachloroethene	127-18-4	0.253	1	5	11	MDL less than DEQ-7
	Tetrahydrofuran	109-99-9	1.50	10	-	3400	MDL less than EPA RSL
	Toluene	108-88-3	0.145	1	1000	1100	MDL less than DEQ-7
	Trichloroethene	79-01-6	0.052	0.4	5	0.49	MDL less than DEQ-7
	Trichlorofluoromethane	75-69-4	0.326	1	-	5200	MDL less than EPA RSL
	Vinyl chloride	75-01-4	0.069	0.2	0.2	0.019	MDL less than DEQ-7
	Xylenes, Total	1330-20-7	0.205	3	10000	190	MDL less than DEQ-7
	m-Xylene	108-38-3 106-42-3	0.110	2	10000	190	MDL less than DEQ-7
	n-Butylbenzene	104-51-8	0.160	1	-	1000	MDL less than EPA RSL
	n-Propylbenzene	103-65-1	0.233	1	-	660	MDL less than EPA RSL
	o-Xylene	95-47-6	0.205	1	10000	190	MDL less than DEQ-7
	p-Isopropyltoluene	99-87-6	0.194	1	-	-	-
	sec-Butylbenzene	135-98-8	0.189	1	-	2000	MDL less than EPA RSL
	tert-Butylbenzene	98-06-6	0.223	1	-	690	MDL less than EPA RSL
	trans-1,2-Dichloroethene	156-60-5	0.162	1	100	360	MDL less than DEQ-7
	trans-1,3-Dichloropropene	10061-02-6	0.147	4	2	-	MDL less than DEQ-7

Notes:



Trihydro CORPORATION
1252 Commerce Drive
Laramie, WY 82070
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(P) 307/745.7474 (F) 307/745.7729

FIGURE 1

GROUNDWATER WELLS TO BE SAMPLED DELINEATED BY WELL DIAMETER

BILLINGS PCE GROUNDWATER FACILITY BILLINGS, MONTANA

Drawn By: ST	Checked By: PH	Scale: 1 " = 1,000 '	Date: 7/7/17	File: Fig1_BillingsGWSM_WellDiam.mxd

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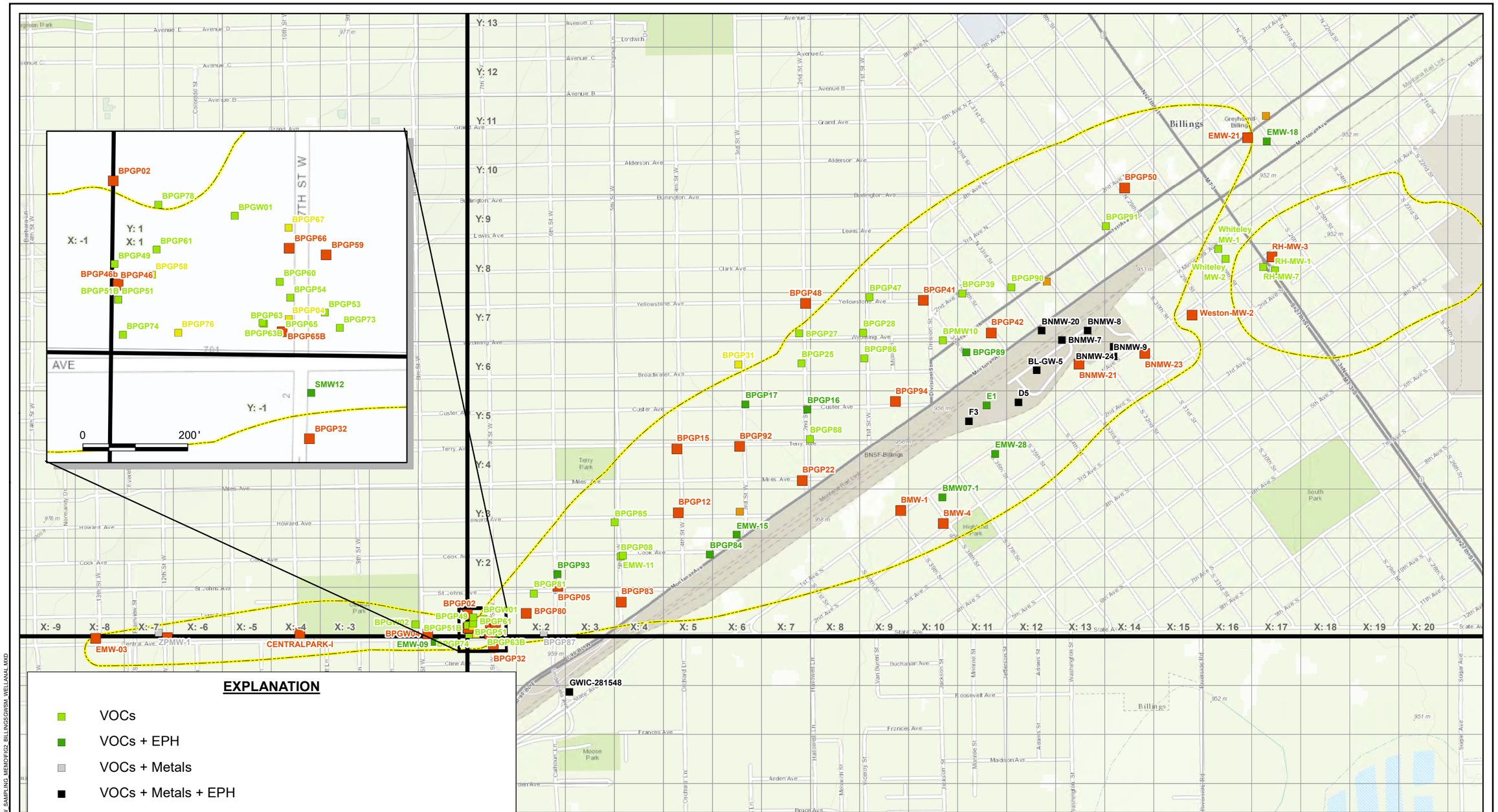

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FIGURE 2

GROUNDWATER WELLS TO BE SAMPLED DELINEATED BY ANALYTE

BILLINGS PCE GROUNDWATER FACILITY BILLINGS, MONTANA

Drawn By: ST	Checked By: PH	Scale: 1 " = 1,000 '	Date: 6/23/17	File: Fig2_BillingsGWSM_WellAnal.mxd

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CITY OF BILLINGS PUBLIC WORKS DEPARTMENT
NON HAZARDOUS INDUSTRIAL WASTE/OTHER WASTE
DISCHARGE AUTHORIZATION
Attached to Manifest # _____

SAMPLING AND SITE INSPECTION

Type of Waste:		**Estimated Gallons:**
Sampling location (s):	Sampling Equipment Used:	Sample Type : Composite / Grab
Potentially Toxic Materials: a. From MSDS _____ b. From City Sewer Ordinance _____		COMMENTS:

WITNESS

I certify that I was present at the time the above sample was taken and verify the information noted.

_____ ____

Signature of Authorized Agent Date Time

SAMPLER

I certify that I have obtained a representative sample of the above described waste.

_____

WWTP Representative Date Time

GENERATOR OF WASTE Cell:

Name of Company:	Contact Name/ Phone # :
Location:	Mailing Address**:**
Type of Industry / Business Activities:	

The Generator of the waste materials delivered to the Public Works Department Water Reclamation Facility **this _____ day of _____, 20____** acknowledges that acceptance of the waste material at the Water Reclamation Facility does not constitute a release by the City of Billings, Public Works Department, of further or future liability which may result from this waste alone, or this waste in combination with other accepted waste, at the Water Reclamation Facility, if said waste, or combination thereof, are hazardous waste materials, or exhibit the characteristics of a hazardous waste material. Furthermore, the Generator of such materials acknowledges and agrees that it will reimburse the City of Billings Public Works Department for any costs which may be incurred as a result of the acceptance of the waste of the Generator at the Water Reclamation Facility or by any resulting hazardous waste disposal liability which may be imposed at the facility as a result of any such acceptance.

SIGNATURE OF AUTHORIZED AGENT & TITLE: _____ DATE: _____

WASTE CHARACTERIZATION

Constituent	TCLP	TCLP	Local Limits	**Local Limits**	Constituent	TCLP	TCLP	Local Limits	**Local Limits**
	Concentration, mg/L	Limits mg/L	Value	Units		Concentration mg/L	Limits mg/L	Mass lbs/day	Limits lbs/day
1. Arsenic		5.0	1.33	lbs/day	11. Silver		5.0	1.80	mg/l
2. Barium		100			12. Zinc		N/A	24.87	mg/l
3. Cadmium		1.0	0.03	mg/l	13. TPH		N/A	100	mg/l
4. Chromium		5.0	27.25	mg/l	14. Benzene		0.5	0.75	mg/l
4.a. Chromium VI			3.39	mg/l	15. BETX		N/A	0.75	mg/l
5. Copper			5.18	mg/l	16. pH		2 - 12.5	2-12.5	s.u.
6. Lead		5.0	1.04	mg/l	17. Flashpoint ,°C		>60 ○C		
7. Mercury		0.2	0.0057	mg/l	18. R-Cyanide, ppm		250 mg/kg	0.66	mg/l
8. Molybdenum					19. R-Sulfide, ppm		500 mg/kg		
9. Nickel			8.87	mg/l	20. Methylene chloride			0.80	mg/l
10. Selenium		1.0	3.87	lbs/day	21. Tetrachloroethene			1.6	mg/l

✓Hauled waste, which exceeds any above listed constituent(s), shall not be disposed of at the WWTP.
✓If suspected to be present Herbicides/Pesticides, Organochlorine Pesticides, Volatile Organics, Semi-Volatile Organics may be required monitoring and must meet the limitations as listed under 40 CFR 261.24.

Environmental Affairs Approval	**Y/N**	**Signature:**	**Date:**
Water Quality Division Approval	**Y/N**	**Signature:**	**Date:**

Syris Trahan

From: Stanley, Susan <StanleyS@ci.billings.mt.us>
Sent: Thursday, July 13, 2017 7:50 AM
To: Syris Trahan
Subject: RE: Waste Characterization

Yes.

Susan

From: Syris Trahan [mailto:STrahan@trihydro.com]
Sent: Wednesday, July 12, 2017 4:07 PM
To: Stanley, Susan <StanleyS@ci.billings.mt.us>
Subject: Waste Characterization

Hi Susan,

Thanks for speaking with me today regarding the waste characterization required by the City of Billings Wastewater Treatment Plant. Just to confirm what we discussed:

- TCLP analysis should be run for analytes 1-12 on the NON HAZARDOUS INDUSTRIAL WASTE/OTHER WASTE DISCHARGE AUTHORIZATION form (arsenic through zinc).
- The other analytes, including TPH, benzene, BETX, methylene chloride, and tetrachloroethene, can be run by any 40 CFR 136-compliant method
- Limits are in mg/L, but may also be compared to lbs/day if the constituent concentration significantly affects the local discharge limits
- For R-cyanide and R-sulfide, analyses should be run for total cyanide and total sulfide, respectively.

Thanks again for your time and patience.

Cheers,

Syris Trahan
Engineer

Trihydro
CORPORATION

OUR SAFETY IS MY RESPONSIBILITY

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Helena, Montana 59601
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(406) 558-4181 (Fax)
strahan@trihydro.com

Connect with us on:

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APPENDIX C-2

SECOND QUARTER 2018 GROUNDWATER SAMPLING SCHEDULE MEMO

memorandum

To:	Mr. Mike Gipson, Montana DEQ
From:	Mr. Andrew Vann, Trihydro Corporation
cc:	Mr. Syris Trahan, Ms. Sarah Seitz, Trihydro Corporation
Date:	May 4, 2018
Re:	Second Quarter 2018 Groundwater Sampling Schedule, Billings PCE Groundwater CECRA Facility, Billings, Montana

1.0 INTRODUCTION

Trihydro Corporation (Trihydro) is conducting a Remedial Investigation (RI) on behalf of the Montana Department of Environmental Quality (DEQ) at the Billings PCE Groundwater Comprehensive Environmental Cleanup and Responsibility Act (CECRA) Facility (Facility), in Billings, Montana. The RI's objectives include filling data gaps, identifying potential source areas, evaluating the nature and extent of groundwater contamination, evaluating the potential migration of chlorinated solvents to indoor air, and investigating the potential for harm to human health and the environment. The primary contaminants of potential concern are chlorinated solvents including tetrachloroethene (PCE) and its degradation products (trichloroethene (TCE), cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride); however, other potential contaminants are also being evaluated along with field and monitored natural attenuation (MNA) parameters.

This memo presents the rationale and justification for revisions to the groundwater sampling schedule. It contains a brief summary of work conducted pertaining to groundwater investigations to date, summary presentations of recently collected analytical data, as well as proposed groundwater monitoring activities to improve the current understanding of the nature and extent of groundwater contamination at the Facility. This memo is accompanied by July and August 2017 groundwater analytical report tables (Tables 1 through 6), 2018 groundwater sampling tables (Tables 7 and 8), and a figure of the proposed groundwater sampling locations for 2018 (Figure 1).

2.0 RECENT GROUNDWATER INVESTIGATION ACTIVITIES

In July and August 2017, Trihydro conducted a preliminary groundwater sampling event of 89 previously-installed monitoring wells across the facility. Groundwater samples were analyzed for a variety of constituents, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), Resource Conservation and Recovery Act (RCRA) metals, extractable petroleum hydrocarbons (EPH), volatile petroleum hydrocarbons (VPH) and a range of monitored natural attenuation (MNA) parameters.

From November 2017 through February 2018, Trihydro conducted a direct-push investigation, during which 51 PCE screening groundwater samples were collected from temporary monitoring points. PCE screening samples were analyzed using a modified EPA Method 8260 VOC analysis, which only

evaluated the concentration of PCE in the sample. The monitoring points were installed in locations designed to delineate the edge of groundwater contamination exceeding the DEQ-7 standard for PCE (5 µg/L), or to evaluate potential source areas (Section 8.2.1, Figure 8 – 1 of the Remedial Investigation Workplan).

On February 5, 2018, Trihydro submitted the Alluvial and Bedrock Groundwater Monitoring Well Location Rationale memo to DEQ. The memo used groundwater data from the July 2017 groundwater monitoring event, as well as the groundwater PCE screening sampling event, to select locations for additional monitoring wells to further characterize the nature and extent of groundwater contamination at the Facility.

In addition to the groundwater sampling, Trihydro has installed 27 alluvial groundwater monitoring wells and 2 bedrock groundwater monitoring wells in March and April 2018, and anticipates installing up to 8 additional alluvial groundwater monitoring wells in April to early May 2018. New approximate monitoring well locations are included on Figure 1. Installation rationale and analytical suites for each well are presented in the text below, and are summarized in Table 7. When individual groundwater monitoring wells are noted in this memo, they are accompanied by a notation on the Facility grid location, which is shown on Figure 1 (i.e. X:1,Y:1).

3.0 GROUNDWATER ANALYTICAL RESULTS

During the July 2017 groundwater monitoring event, a broad cross-section of monitoring wells were sampled for an extensive suite of compounds, as described above. This served as a preliminary screening tool to identify previously unknown or uncharacterized contaminants, in addition to the known, extensive, chlorinated solvent contamination. The following analyses were conducted at monitoring wells across the Facility:

- **EPH by the Montana-Modified Massachusetts Method**
  Samples from 51 wells were evaluated for EPH during the investigation. Of those, EPH was only detected in 13 samples, of which only 4 exceeded the screening level of 1,000 µg/L. After fractionation, none of the wells contained extractable petroleum fractions exceeding RBCA Risk-Based-Screening Levels. EPH results are presented in Table 1.
- **VPH by the Montana-Modified Massachusetts Method**
  Samples from 51 wells were also evaluated for VPH during the investigation. Of those, samples from 9 wells contained contaminants exceeding an applicable screening level. Wells with exceedances of screening levels, and the contaminants observed, were:
  - BPGP02 – benzene, C5-C8 aliphatics, and C9-C12 aliphatics (X:1,Y:1)
  - BPGP46 – C5-C8 aliphatics (X:1,Y:1)
  - BPGP59 – C5-C8 aliphatics (X:1,Y:1)

- BPGP66 – C5-C8 aliphatics (X:1,Y:1)
- BPGP78 – benzene (X:1,Y:1)
- BPGP80 – C5-C8 aliphatics (X:2,Y:1)
- BPGP89 – benzene, C5-C8 aliphatics (X:11,Y:6)
- EMW-09 – C5-C8 aliphatics, C9-C12 aliphatics (X:-1,Y:-1)
- GSMW-5 – benzene, C5-C8 aliphatics, and C9-C12 aliphatics (X:3,Y:-2)

VPH results are presented in Table 2.

- **VOCs by EPA Method 8260**
  All groundwater monitoring wells sampled during the July 2017 event were evaluated for VOCs. Of the 89 wells sampled, 69 contained PCE exceeding the DEQ-7 human health standard of 5 µg/L. Only 10 of the wells – BNMW-17 (X:13,Y:7), BPGP31 (X:6,Y:6), BPGP48 (X:7,Y:7), BPGP91 (X:14,Y:9), EMW-03 (X:-8,Y:-1), EMW-09 (X:-1,Y:-1), EMW-18 (X:17,Y:11), EMW-21 (X:16,Y:11), EMW-26 (X:17,Y:11), and Whiteley MW-2 (X:16,Y:8) – did not contain detectable PCE, or other VOCs in concentrations exceeding applicable screening levels.
- **SVOCs by EPA Method 8270**
  Samples from 31 wells were evaluated for SVOCs during the investigation. Of those wells, SVOCs were detected in only 3 wells, and only one exceedance of a generic screening level was observed. Monitoring well BPGP78 contained 1-methylnaphthalene exceeding the RBCA RBSL. SVOC results are presented in Table 4.
- **Dissolved Metals by EPA Methods 200.8 and 245.1**
  Samples from 38 wells were evaluated for RCRA metals, including mercury, during the investigation. No samples contained contaminants in excess of their respective DEQ-7 standard or RBCA RBSL. Manganese was found in excess of the EPA Tapwater RSL in 14 wells at the Facility:
  - BMW-1 (X:9,Y:3)
  - BNMW-9 (X:14,Y:6)
  - BNMW-17 (X:13,Y:7)
  - BNMW-23 (X:14,Y:6)
  - BPGP22 (X:7,Y:4)
  - BPGP46 (X:1,Y:1)

- BPGP59 (X:1,Y:1)
- BPGP66 (X:1,Y:1)
- BPGP78 (X:1,Y:1)
- BPGP80 (X:2,Y:1)
- CENEX-5 (X:-7,Y:-1)
- EMW-03 (X:-8,Y:-1)
- GSMW-5 (X:3,Y:-2)
- ZPMW-1 (X:-7,Y:1)

Metals results are presented in Table 5.

MNA Parameters

MNA parameters measured during the July 2017 Groundwater sampling event include carbon, chloride, ethane, ethylene and methane, nitrogen, nitrate and nitrite, and sulfate. Twenty-nine monitoring wells were sampled for MNA parameters during the event. While these parameters do not generally have human health standards or RBSLs in groundwater, they can provide insight into the presence of breakdown products of solvents (chloride), the presence of carbon sources that are being degraded by naturally occurring bacteria (methane), and the depletion of terminal electron receptors in the subsurface (sulfate). MNA Parameter results are presented in Table 6.

These results will be evaluated and analyzed further in the facility Remedial Investigation report to be completed in 2018.

4.0 UPDATES TO THE GROUNDWATER SAMPLING SCHEDULE

Two additional groundwater sampling events are scheduled to be conducted in 2018. The following section contains proposed updates to the groundwater sampling schedule contained in Table 1 of the July 2017 Groundwater Sampling Work Plan. The purpose of updating the sampling rationale is to incorporate new monitoring wells into the scheduled groundwater sampling plan, obtain adequate spatial distribution of analytical samples in areas of unknown contaminant concentrations, and streamline analytical suites in locations where specific contaminants have not been observed. The proposed updated sampling rationale table is presented in Table 7. Trihydro proposes the following revisions to the schedule:

- Existing Monitoring Well Network
  - Eliminate sampling at BNMW-24 (X:14,Y:6): While this well contained PCE in excess of DEQ-7 standards (5.9 µg/L) during the July 2017 groundwater monitoring event, it is bounded quite closely by upgradient well BNMW-21 (X:13,Y:6), and downgradient well BNMW-23 (X:14,Y:6), and does not currently provide significant spatial contaminant distribution data that is not already provided by adjacent wells.
  - Eliminate sampling at BPGP04 (X:1,Y:1), BPGP54 (X:1,Y:1) and BPGP66 (X:1,Y:1). These wells are located due east of 711 Central Avenue, and contained PCE at 219, 1,210 and 4,290 µg/L, respectively, during the July 2017 groundwater monitoring event. However, these wells have upgradient (BPGP63 at X:1,Y:1), cross-gradient (BPGP60, BPGP65, BPGP67 in X:1,Y:1), and downgradient (BPGP59 and BPGP53 in X:1,Y:1) wells located within 30-50 feet that adequately serve to characterize the immediate source area near Big Sky Linen. Additionally, there are data from several previous sampling events available for these wells. The PCE concentration in well BPGP04 reached a peak of 4,280 µg/L in 2007 and was 219 µg/L in 2017. TCE concentrations have been below DEQ-7 standards since 2010. The PCE concentration in well BPGP54 peaked at 6,320 µg/L in 2009, and was 1,210 µg/L in 2017. TCE concentrations fluctuated between 42 and 69 µg/L since 2007, before hitting a low of 15.5 in 2017. PCE concentrations in well BPGP66 have been relatively stable from 2011 to 2017, ranging from 2,200 µg/L in 2014, to 4,290 in 2017. TCE concentrations reached a peak of 270 µg/L in 2014, and were 94.2 µg/L in 2017. None of these wells have other detections of chlorinated solvent degradation products.
  - Eliminate sampling at BPGP32 (X:1,Y:-1). This well is located on the southern edge of the plume near the Big Sky Linen source area, and contained PCE at 1.8 µg/L during the July 2017 groundwater monitoring event. However, a more northerly well, SMW12 (X:1,Y:-1), contained PCE at 4.4 µg/L, and better serves as a sentry well for the southern plume boundary, rendering BPGP32 redundant.
  - Eliminate sampling at EMW-15 (X:6,Y:3). This well is located within the plume body, and contained PCE at 136 µg/L during the July 2017 groundwater monitoring event. However, the well is also within 350 feet of an upgradient (BPGP84 at X:5,Y:2) and cross-gradient (PEP07 at X:6,Y:3) monitoring well, and therefore does not provide significant spatial contaminant distribution data that is not already provided by adjacent wells.

- Eliminate sampling at BPGP88 (X:7,Y:5). This well is located within the plume body, and contained PCE at 12.1 µg/L during the July 2017 groundwater monitoring event. However, the well is also within 700 feet an upgradient monitoring well (BPGP92 at X:6,Y:4). It is also located within 420 feet of two cross-gradient monitoring wells (BPGP16 at X:7,Y:5, BPGP22 at X:7,Y:4), and therefore does not provide significant spatial contaminant distribution data that is not already provided by adjacent wells.
- Eliminate sampling at BPGP28 (X:9,Y:7). This well is located within the northern edge of the plume body, and contained PCE at 144 µg/L during the July 2017 groundwater monitoring event. It is also within 250 to 530 feet of upgradient (BPGP86 at X:9,Y:6), cross-gradient (BPGP47 at X:9,Y:7), and downgradient (BPGP41 at X:10,Y:7) monitoring wells, and therefore does not provide significant spatial contaminant distribution data that is not already provided by adjacent wells.
- Eliminate sampling at CENEX-5 (X:-7,Y:-1). This well is located within the eastern portion of the plume downgradient from the former Central Avenue Laundry and Cleaners site. This well contained PCE at 24.9 µg/L during the July 2017 groundwater monitoring event. However, this well is located within 95 feet of well ZPMW-1 (X:-7,Y:1), which contained PCE at 42.8 µg/L during the sampling event. The well therefore does not provide significant contaminant spatial data that is not already obtained from the adjacent well.
- Eliminate sampling at GSMW-5 (X:3,Y:-2). This well is located outside of the southern boundary of the PCE plume, and did not contained detectable PCE during the July 2017 groundwater monitoring event. New alluvial monitoring wells (MW-105 at X:4,Y:1 and MW-106 at X:4,Y:-1) better delineate the southern plume boundary.
- Eliminate sampling at BPGP63B (X:1,Y:1): This well is an EPA-installed well, intended to characterize bedrock contamination. However, this well appears to be the same depth as its alluvial counterpart, BPGP63 (X:1,Y:1). The well may have collapsed or become damaged by root intrusion in the subsurface, preventing sampling of deeper intervals.
- Eliminate sampling at EMW-11 (X:4,Y:2): This is a 4” well of unknown provenance. It is directly adjacent to BPGP08, and was sampled to provide a comparison between a larger well and the 0.75 inch wells installed by EPA. BPGP08 (X:4,Y:2) will be sampled instead.

- Eliminate sampling at EMW-21 (X:16,Y:11), EMW-26 (X:17,Y:11), Whiteley MW-1 (X:16,Y:8), and Whiteley MW-2 (X:16,Y:8): No compounds were detected in excess of applicable screening levels at these wells during the July 2017 sampling event. Monitoring wells exist upgradient of these wells to provide plume delineation. New monitoring wells have been/will be installed to better characterize plume boundaries, and will replace sampling at these wells.
- Eliminate sampling at BPGP90 (X:12,Y:8) since BPGP44 (X:12,Y:8) provides applicable groundwater characterization data nearby.
- Eliminate sampling at BPGP58 (X:1,Y:1): There are four other wells in the BSL source area that provide data on source area concentrations, including BPGP61 (X:1,Y:1), just north, which had a higher concentration during Q3 2017 sampling.

- EPH/VPH
  Reduce sampling of EPH and VPH in the existing monitoring well network to the nine previously noted wells where VPH fractions and/or benzene were detected in excess of their respective DEQ-7 standard/RBCA screening level (with the exception of GSMW-5, which will be removed from the sample schedule as noted above). Although EPH fractions did not exceed at any of these locations, EPH fractionation will provide a useful metric against which to compare VPH fraction exceedance. New alluvial and bedrock monitoring wells at the Facility have largely been installed to aid in delineating the groundwater contamination plume boundary, and/or to identify potential source area contributions to groundwater contamination. Extensive hydrocarbon impacts have not been identified throughout the Facility. However, less data is available along the plume boundary where new monitoring wells are being installed, and in potential source areas. To augment spatial understanding of hydrocarbon impacts, add EPH/VPH sampling to the following 13, newly installed monitoring wells. Sampling rationale for individual wells is presented in Table 7.
  - MW-101 (X:-8,Y:-1)
  - MW-103 (X:-2,Y:1)
  - MW-104 (X:3,Y:-1)
  - MW-105 (X:4,Y:1)
  - MW-108 (X:8,Y:1)
  - MW-109 (X:12,Y:3)
  - MW-111 (X:17,Y:7)

- MW-117 (X:15,Y:10)
- MW-119 (X:11,Y:10)
- MW-122 (X:2,Y:2)
- MW-126 (bedrock well at X:1,Y:1)
- MW-127 (bedrock well at X:1,Y:1)
- MW-128 (X:-3,Y:2)

- **VOCs**
  - Add sampling for VOCs to the 29 newly installed alluvial and bedrock monitoring wells.
  - Add VOC sampling to two existing wells at the Facility to delineate groundwater contamination upgradient of the former Central Avenue Laundry (CAL). The wells are SYS-EMW-3, an existing monitoring well at Sysco Food Services at 1509 Monad Road at X:-11,Y:-5, and REGAL-I-01, an irrigation well at 145 Regal Street at the 15th Street Center X:-10,Y:-3. Maintain VOC sampling at the remaining existing monitoring wells.
- **SVOCs**
  Reduce SVOC sampling in the existing monitoring well network to BPGP78 (X:1,Y:1), where the only SVOC exceedance of a RBCA RBSL was observed. Extensive SVOC impacts have not been identified throughout the Facility. However, less data are available along the plume boundary where new monitoring wells are being installed, and in potential source areas. To augment spatial understanding of contamination, add SVOC sampling to the 13 newly installed monitoring wells identified above for EPH/VPH sampling. Sampling rationale for individual wells is presented in Table 7.
- **Dissolved metals**
  Reduce metals sampling in the existing monitoring well network to the wells previously mentioned, where manganese was observed in excess of EPA Tapwater RSLs (with the exception BPGP66 at X:1,Y:1, CENEX-5 at X:-7,Y:-1, and GSMW-5 at X:3,Y:-2 which will be removed from the sample schedule as noted above). Extensive dissolved metals impacts have not been identified throughout the Facility. However, less data is available along the plume boundary where new monitoring wells are being installed, and in potential source areas. To augment spatial understanding of contamination, add dissolved metals sampling to the 13 newly installed monitoring wells identified above for EPH/VPH sampling. Sampling rationale for individual wells is presented in Table 7.
- **MNA Parameters**
  Reduce MNA Parameters to 17 monitoring wells site-wide, to provide a holistic overview of site conditions. Wells to be sampled include 5 of the new monitoring wells (MW-101 at X:-8,Y:-1, MW-108

at X:8,Y:1, MW-126 at X:1,Y:1, MW-127 at X:1,Y:1, and MW-128 at X:-3,Y:2), as well as 12 previously sampled wells. These 17 wells were selected to provide a sitewide overview of MNA parameters, including monitoring wells located along the longitudinal axis of the plume, along the upgradient and downgradient plume boundaries, and near potential source areas.

It is anticipated that up to eight additional wells not discussed in the Alluvial and Bedrock Monitoring Well Rationale Memo (Trihydro 2018) may be installed to delineate or identify potential source areas. These wells are:

- MW-128 – North of Central Park near anomalous VI sample location, to delineate potential groundwater impacts
- MW-129 – Along 1st Avenue South, to delineate potential upgradient sources
- MW-130 – Upgradient of CAL to delineate potential upgradient sources
- MW-131 – Delineate potential release from compromised sanitary sewer near former Rex's Cleaners (REX)
- MW-132 – Delineate contamination from potential sources downgradient of REX at distal edge of plume
- MW-133 – Delineate contamination from potential sources downgradient of REX at distal edge of plume.
- MW-134 - Delineate contamination from potential sources downgradient of REX at distal edge of plume.
- MW-135 – Along 1st Avenue South, to delineate potential upgradient sources

Sampling analytical suite and rationale for these 8 potential wells is included in Table 7.

The total quantity of wells sampled at the Facility will increase from 89 to approximately 107. The wells identified for removal from the sampling plan are to remain in place and are not proposed for abandonment. These wells may be added back to the Facility sampling schedule, as site conditions warrant or for future sampling events. Additional analytical methods may also be added to the sampling schedule if field parameters indicate differing conditions and in consultation with DEQ.

5.0 SCHEDULE

Trihydro is planning to prepare for sampling, coordinate with the laboratory, coordinate with property owners, and conduct groundwater sampling during the beginning of May 2018, with a likely field start date of May 7, 2018.

Attachments

776-036-001

TABLE 1. - THIRD QUARTER 2017 EXTRACTABLE PETROLEUM HYDROCARBONS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	C11-C22, Aromatic, Unadjusted (εg/L)	C19-C36, Aliphatic, Unadjusted (εg/L)	C9-C18, Aliphatic, Unadjusted (εg/L)	Total Extractable Hydrocarbon (εg/L)
20170801-IDW-01	08/01/17	--	--	--	413
BMW07-1	07/29/17	--	--	--	<221
BMW-1	07/29/17	--	--	--	<214
BMW-4	07/28/17	--	--	--	<237
BNMW-17	08/30/17	495	471	469	1440
BNMW-20	08/30/17	--	--	--	<208
BNMW-21	08/31/17	--	--	--	<416
BNMW-23	08/31/17	--	--	--	306
BNMW-24	08/30/17	--	--	--	409
BNMW-8	08/30/17	--	--	--	<204
BNMW-8 Dup	08/30/17	--	--	--	225
BNMW-9	08/30/17	--	--	--	703
BPGP02	08/31/17	--	--	--	690
BPGP05	07/26/17	--	--	--	<199
BPGP12	07/28/17	--	--	--	<209
BPGP15	07/28/17	--	--	--	<205
BPGP16	07/30/17	--	--	--	<190
BPGP17	07/30/17	--	--	--	<191
BPGP22	07/30/17	--	--	--	<209
BPGP32	07/26/17	--	--	--	<199
BPGP41	07/28/17	--	--	--	<206
BPGP42	07/28/17	--	--	--	<217
BPGP44	07/31/17	--	--	--	<212
BPGP46	07/27/17	--	--	--	<198
BPGP46b	07/27/17	--	--	--	<227
BPGP48	07/28/17	--	--	--	<208
BPGP50	07/30/17	--	--	--	<203
RBCA RBSLs Groundwater		1,100	1,000	1,400	NA
DEQ7 Groundwater Standard		NA	NA	NA	NA
EPA RSL Tapwater		NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte

TABLE 1. - THIRD QUARTER 2017 EXTRACTABLE PETROLEUM HYDROCARBONS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	C11-C22, Aromatic, Unadjusted (εg/L)	C19-C36, Aliphatic, Unadjusted (εg/L)	C9-C18, Aliphatic, Unadjusted (εg/L)	Total Extractable Hydrocarbon (εg/L)
BPGP59	07/26/17	--	--	--	<201
BPGP65B	07/27/17	--	--	--	<197
BPGP66	07/26/17	--	--	--	<214
BPGP78	07/27/17	--	--	--	259
BPGP80	07/26/17	--	--	--	<213
BPGP83	07/28/17	--	--	--	<203
BPGP84	07/31/17	--	--	--	<207
BPGP89	07/30/17	--	--	--	317
BPGP92	07/30/17	--	--	--	<223
BPGP92 Dup	07/30/17	--	--	--	<215
BPGP93	07/31/17	--	--	--	<204
BPGP94	07/30/17	--	--	--	<220
BPGW04	07/27/17	--	--	--	<196
CENEX-5	07/28/17	--	--	--	<209
EMW-03	07/28/17	--	--	--	<212
EMW-09	08/01/17	286	<195	<195	<584
EMW-15	07/31/17	--	--	--	<209
EMW-18	07/29/17	--	--	--	<204
EMW-21	07/28/17	237	<210	<210	<629
EMW-26	07/29/17	--	--	--	286
EMW-28	07/29/17	--	--	--	<261
EMW-32	08/31/17	--	--	--	<237
GSMW-5	07/31/17	<206	<206	<206	<617
PEP07	07/31/17	--	--	--	<212
RH-MW-3	07/28/17	--	--	--	<205
SD-I-01	08/01/17	--	--	--	<208
SMW12	07/31/17	--	--	--	<205
RBCA RBSLs Groundwater		1,100	1,000	1,400	NA
DEQ7 Groundwater Standard		NA	NA	NA	NA
EPA RSL Tapwater		NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte

TABLE 2. - THIRD QUARTER 2017 VOLATILE PETROLEUM HYDROCARBONS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Benzene (εg/L)	C5-C8, Aliphatic, Unadjusted (εg/L)	C9-C10, Aromatic, Unadjusted (εg/L)	C9-C12, Aliphatic, Unadjusted (εg/L)	Ethyl-benzene (εg/L)	m,p-Xylene (εg/L)	MTBE (εg/L)	Naphthalene (εg/L)	o-Xylene (εg/L)	Toluene (εg/L)	Total Purgeable Hydrocarbon (εg/L)	Xylenes, Total (εg/L)
20170801-IDW-01	08/01/17	<0.5	46.3	26.8	47.4	4.6	1.8	<1	<5	<0.5	<0.5	101	<2
BMW07-1	07/29/17	<1	35.8 J+	<20	<20	<1	<2	<1	<5	<1	<1	31.7 J+	<3
BMW-1	07/29/17	<1	45.4 J+	<20	<20	<1	<2	<1	<5	<1	<1	40.4 J+	<3
BMW-4	07/28/17	1.4	36.3	<20	<20	<1	<2	<1	<5	<1	<1	34	<3
BNMW-17	08/30/17	<1	<20	22.1	60.6	<1	<2	<1	6.5 J-	<1	<1	104 JB	<3
BNMW-20	08/30/17	<1	<20	<20	<20	<1	<2	<1	<5 UJ	<1	<1	<20	<3
BNMW-21	08/31/17	<1	21.2	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
BNMW-23	08/31/17	<1	298 J+	202 J+	280 J+	6.8 J+	<2	<1	<5	<1	<1	587 J+	<3
BNMW-24	08/30/17	<1	<20	<20	<20	<1	<2	<1	<5 UJ	<1	<1	<20	<3
BNMW-8	08/30/17	<1	<20	<20	<20	<1	<2	<1	<5 UJ	<1	<1	<20	<3
BNMW-8 Dup	08/30/17	<1	<20	<20	<20	<1	<2	<1	<5 UJ	<1	<1	<20	<3
BNMW-9	08/30/17	<1	<20	<20	<20	<1	<2	<1	<5 UJ	<1	<1	<20	<3
BPGP02	08/31/17	**147**	**1660**	819	**1430**	320	94.1	<5	38.9	6.8	12.7	3110	130
BPGP04	07/31/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP05	07/26/17	<1	176 J+	<20	<20	<1	<2	<1	<5	<1	<1	157 J+	<3
BPGP08	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP12	07/28/17	<1	208 J+	<20	<20	<1	<2	<1	<5	<1	<1	184 J+	<3
BPGP15	07/28/17	<1	21.6	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
BPGP16	07/30/17	<1	160 J+	<20	<20	<1	<2	<1	<5	<1	<1	142 J+	<3
BPGP17	07/30/17	<1	42 J+	<20	<20	<1	<2	<1	<5	<1	<1	37.1 J+	<3
BPGP22	07/30/17	<1	92 J+	<20	<20	<1	<2	<1	<5	<1	<1	81.7 J+	<3
BPGP25	07/28/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP27	07/28/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP27 Dup	07/28/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP28	07/28/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP29	07/28/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP31	07/31/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP32	07/26/17	<1	27.3	<20	<20	<1	<2	<1	<5	<1	<1	24.2	<3
BPGP41	07/28/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
BPGP42	07/28/17	<1	87.8 J+	<20	<20	<1	<2	<1	<5	<1	<1	77.6 J+	<3
BPGP44	07/31/17	<1	57.7 J+	<20	<20	<1	<2	<1	<5	<1	<1	51.4 J+	<3
BPGP46	07/27/17	<1	**1950**	63.3	70.6	<1	<2	14.1 J	<5	<1	<1	1720	<3
BPGP46b	07/27/17	<1 UJ	<20	<20	<20	<1 UJ	<2 UJ	<1 UJ	<5	<1 UJ	<1 UJ	<20	<3 UJ
BPGP47	07/28/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP48	07/28/17	<1 UJ	34.4	<20	<20	<1 UJ	<2 UJ	<1 UJ	<5	<1 UJ	<1 UJ	30.4	<3 UJ
BPGP49	07/27/17	1.6 J-	--	--	--	59.3 J-	<2 UJ	<1 UJ	7.6 J-	2.2 J-	1.5/ND(1.5)U*	--	<3 UJ
BPGP50	07/30/17	<1	26.8 J+	<20	<20	<1	<2	<1	<5	<1	<1	24 J+	<3
RBCA RBSLs Groundwater		5	650	1,100	1,400	700	NA	30	100	NA	1,000	NA	10,000
DEQ7 Groundwater Standard		5	NA	NA	NA	700	10,000	30	100	10,000	1,000	NA	10,000
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
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TABLE 2. - THIRD QUARTER 2017 VOLATILE PETROLEUM HYDROCARBONS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Benzene (εg/L)	C5-C8, Aliphatic, Unadjusted (εg/L)	C9-C10, Aromatic, Unadjusted (εg/L)	C9-C12, Aliphatic, Unadjusted (εg/L)	Ethyl-benzene (εg/L)	m,p-Xylene (εg/L)	MTBE (εg/L)	Naphthalene (εg/L)	o-Xylene (εg/L)	Toluene (εg/L)	Total Purgeable Hydrocarbon (εg/L)	Xylenes, Total (εg/L)
BPGP51	07/27/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP51B	07/27/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP53	07/27/17	<5 UJ	--	--	--	<5 UJ	<10 UJ	<5 UJ	<20 UJ	<5 UJ	<5 UJ	--	<15 UJ
BPGP54	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP58	07/31/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP59	07/26/17	0.55 J+	**1190 J+**	<20	<20	<1	<2	<1	<5	<1	<1	1060 J+	<3
BPGP60	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP60 Dup	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP61	07/27/17	1.8 J-	--	--	--	<1 UJ	6.9 J-	<1 UJ	11.4 J-	<1 UJ	<1 UJ	--	6.9 J-
BPGP63	07/27/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP63B	07/27/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP65	07/27/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP65B	07/27/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
BPGP66	07/26/17	<2.5	**920 J+**	<100	<100	<2.5	<2.5	<5	<4	<2.5	<2.5	850 J+	<3
BPGP67	07/31/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP74	07/27/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP76	07/31/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP78	07/27/17	**8.7**	544	193	355	81.5	<2.5	<5	<4	<2.5	<2.5	890	<3
BPGP80	07/26/17	<1	**784 J+**	<20	<20	<1	<2	<1	<5	<1	<1	698 J+	<3
BPGP81	07/31/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP83	07/28/17	<1	264 J+	<20	<20	<1	<2	<1	<5	<1	<1	234 J+	<3
BPGP84	07/31/17	<1	151 J	<20 UJ	<20 UJ	<1	<2	<1 UJ	<5 UJ	<1	<1	134 J	<3
BPGP85	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP86	07/28/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP87	07/31/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP88	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP89	07/30/17	**250 J-**	**1070 J-**	140 J-	403 J-	196	8.9	<1 UJ	<5 UJ	1.2 J-	6.5 J-	1850 J-	8.9
BPGP90	07/30/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP91	07/29/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP92	07/30/17	<1	160 J+	<20	<20	<1	<2	<1	<5	<1	<1	142 J+	<3
BPGP92 Dup	07/30/17	<1	171 J+	<20	<20	<1	<2	<1	<5	<1	<1	151 J+	<3
BPGP93	07/31/17	<1	27.3 J+	<20	<20	<1	<2	<1	<5	<1	<1	24.2 J+	<3
BPGP94	07/30/17	<1	36.9 J+	<20	<20	<1	<2	<1	<5	<1	<1	32.7 J+	<3
BPGW01	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGW04	07/27/17	<1	50.6 JB	25.1	34.8	<1	<2	<1	<5	<1	<1	87.1	<3
BPGW04P	07/27/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
CENEX-5	07/28/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
RBCA RBSLs Groundwater		5	650	1,100	1,400	700	NA	30	100	NA	1,000	NA	10,000
DEQ7 Groundwater Standard		5	NA	NA	NA	700	10,000	30	100	10,000	1,000	NA	10,000
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
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NA - No applicable screening levels for this analyte
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TABLE 2. - THIRD QUARTER 2017 VOLATILE PETROLEUM HYDROCARBONS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Benzene (εg/L)	C5-C8, Aliphatic, Unadjusted (εg/L)	C9-C10, Aromatic, Unadjusted (εg/L)	C9-C12, Aliphatic, Unadjusted (εg/L)	Ethyl-benzene (εg/L)	m,p-Xylene (εg/L)	MTBE (εg/L)	Naphthalene (εg/L)	o-Xylene (εg/L)	Toluene (εg/L)	Total Purgeable Hydrocarbon (εg/L)	Xylenes, Total (εg/L)
EMW-03	07/28/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
EMW-03P	07/28/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
EMW-09	08/01/17	<2	**857**	856	**1440**	264 J	42.4	<25	45.6	4.9	<2	2540	47.2
EMW-11	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
EMW-11P	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
EMW-15	07/31/17	3.8 J	216 J	<20 UJ	24.9 J	<1	<2	<1 UJ	<5 UJ	<1	<1	222 J	<3
EMW-15P	07/31/17	2.8	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
EMW-18	07/29/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
EMW-21	07/28/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
EMW-21P	07/28/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
EMW-26	07/29/17	<1	<20 UJ	<20 UJ	<20 UJ	<1	<2	<1 UJ	<5 UJ	<1	<1	<20 UJ	<3
EMW-28	07/29/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
EMW-32	08/31/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
GSMW-5	07/31/17	5.3 J-	**720 J-**	846 J-	**1720 J-**	700 J-	43.7 J-	4.4 J-	57 J-	2.4 J-	2.1 J-	3220 J-	45.7 J-
PEP07	07/31/17	<1	207 J+	<20	<20	<1	<2	<1	<5	<1	<1	183 J+	<3
RH-MW-1	07/30/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
RH-MW-3	07/28/17	<1	28.8 J+	<20	<20	<1	<2	<1	<5	<1	<1	25.5 J+	<3
RH-MW-3P	07/28/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
RH-MW-7	07/30/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
RH-MW-7 Dup	07/30/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
SD-I-01	08/01/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
SD-I-02	08/01/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
SD-I-02 Dup	08/01/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
SMW12	07/31/17	<2.5	<100	<100	<100	<2.5	<2.5	<5	<4	<2.5	<2.5	<100	<3
Whiteley MW-1	07/30/17	<1	--	--	--	203	4.4	<1	<4	11.4	1.8	--	15.8
Whiteley MW-2	07/30/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
ZPMW-1	08/01/17	2.3	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
RBCA RBSLs Groundwater		5	650	1,100	1,400	700	NA	30	100	NA	1,000	NA	10,000
DEQ7 Groundwater Standard		5	NA	NA	NA	700	10,000	30	100	10,000	1,000	NA	10,000
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
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TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Acetone (εg/L)	Allyl Chloride (εg/L)	Benzene (εg/L)	Bromo- benzene (εg/L)	Bromo- chloro- methane (εg/L)	Bromo- dichloro- methane (εg/L)	Bromoform (εg/L)	Bromo- methane (εg/L)	2-Butanone (εg/L)	n-Butyl- benzene (εg/L)	sec-Butylbenzene (εg/L)	tert-Butyl- benzene (εg/L)
20170801-IDW-01	08/01/17	--	--	<0.5	--	--	--	--	--	--	--	--	--
BMW07-1	07/29/17	70.3 JB	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BMW-1	07/29/17	44.4/ND(44.4)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BMW-4	07/28/17	<20	<4	1.4	<1	<1	<1	<4	<4	<5	<1	<1	<1
BNMW-17	08/30/17	24/ND(24)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BNMW-20	08/30/17	40.5 JB	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BNMW-21	08/31/17	29.6/ND(29.6)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BNMW-23	08/31/17	32.9/ND(32.9)U*	<4	<1	<1	<1	<1	<4	<4	<5	1.6	2.6	<1
BNMW-24	08/30/17	<20	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BNMW-8	08/30/17	<20 UJ	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BNMW-8 Dup	08/30/17	52.1 JB	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BNMW-9	08/30/17	<20	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP02	08/31/17	29.4/ND(29.4)U*	<4	**147**	<1	<1	<1	<4	<4	<5	3.4	8.1	<1
BPGP04	07/31/17	74	<4	<1	<1	<1	4.4	<4	<4	<5	<1	<1	<1
BPGP05	07/26/17	<80	<4	<1	<1	<1	2.1	<4	<4	<5	<1	<1	<1
BPGP08	07/26/17	<80	<4	<1	<1	<1	2.1	<4	<4	<5	<1	<1	<1
BPGP12	07/28/17	78.7/ND(78.7)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP15	07/28/17	32.1/ND(32.1)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP16	07/30/17	62.5/ND(62.5)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP17	07/30/17	33.3/ND(33.3)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP22	07/30/17	59.8/ND(59.8)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP25	07/28/17	26.2/ND(26.2)U*	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP27	07/28/17	56.8/ND(56.8)U*	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP27 Dup	07/28/17	20.6/ND(20.6)U*	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP28	07/28/17	49.7/ND(49.7)U*	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP29	07/28/17	54.5/ND(54.5)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP31	07/31/17	30.5 J-	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP32	07/26/17	<80	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP41	07/28/17	60.1/ND(60.1)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP42	07/28/17	40.1/ND(40.1)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP44	07/31/17	55	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP46	07/27/17	<80	<4	<1	<1	<1	<1	<4	<4	<5	2.9 J+	7.6 J+	<1
BPGP46b	07/27/17	<20 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP47	07/28/17	36.8/ND(36.8)U*	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP48	07/28/17	38.9/ND(38.9)U*	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP49	07/27/17	55/ND(55)U*	<4 UJ	1.6 J-	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<4 UJ	18.8 J-	1.4 J-	3.5 J-	<1 UJ
BPGP50	07/30/17	<20	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP51	07/27/17	26.7/ND(26.7)U*	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP51B	07/27/17	32.2/ND(32.2)U*	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<4 UJ	<5 UJ	<1 UJ	2.7 J	<1 UJ
RBCA RBSLs Groundwater		NA	NA	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	NA	5	NA	NA	10	80	10	NA	NA	NA	NA
EPA RSL Tapwater		14,000	NA	NA	62	83	NA	NA	NA	5,600	1,000	2,000	690

Notes:
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RBCA - Risk-Based Corrective Action
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RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
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TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Carbon tetrachloride (εg/L)	Chlorobenzene (εg/L)	Chloroethane (εg/L)	Chloroform (εg/L)	Chloromethane (εg/L)	2-Chloro- toluene (εg/L)	4-Chloro- toluene (εg/L)	1,2-Dibromo 3-chloro- propane (εg/L)	Dibromo-chloromethane (εg/L)	1,2- Dibromo-ethane (εg/L)	Dibromomethane (εg/L)	1,2-Di- chloro-benzene (εg/L)
20170801-IDW-01	08/01/17	--	--	--	--	--	--	--	--	--	--	--	--
BMW07-1	07/29/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BMW-1	07/29/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<10.3
BMW-4	07/28/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<11.1
BNMW-17	08/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BNMW-20	08/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BNMW-21	08/31/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<11.5
BNMW-23	08/31/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<11.2
BNMW-24	08/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BNMW-8	08/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BNMW-8 Dup	08/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BNMW-9	08/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BPGP02	08/31/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<10.8
BPGP04	07/31/17	<1	<1	<1	32.8	<4	<1	<1	<4	<1	<1	<4	<11.4
BPGP05	07/26/17	<1	<1	<1	17.7	<4	<1	<1	<4	<1	<1	<4	<10.4
BPGP08	07/26/17	<1	<1	<1	10.9	<4	<1	<1	<4	<1	<1	<4	<1
BPGP12	07/28/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<10.2
BPGP15	07/28/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<10.4
BPGP16	07/30/17	<1	<1	<1	7.4	<4	<1	<1	<4	<1	<1	<4	<1
BPGP17	07/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BPGP22	07/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<11.4
BPGP25	07/28/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
BPGP27	07/28/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
BPGP27 Dup	07/28/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
BPGP28	07/28/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
BPGP29	07/28/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BPGP31	07/31/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<10.9
BPGP32	07/26/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<42.6
BPGP41	07/28/17	<1	<1	<1	2.7	<4	<1	<1	<4	<1	<1	<4	<11.2
BPGP42	07/28/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<10.9 UJ
BPGP44	07/31/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<10.4
BPGP46	07/27/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	1.7 J+
BPGP46b	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
BPGP47	07/28/17	<1 UJ	<1 UJ	<1 UJ	3 JB	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
BPGP48	07/28/17	<1 UJ	<1 UJ	<1 UJ	1.2/ND(1.2)U*	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<10.8 UJ
BPGP49	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	9.1 J-
BPGP50	07/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<10.9
BPGP51	07/27/17	<1 UJ	<1 UJ	<1 UJ	11.1 J-	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
BPGP51B	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	0.017	NA	NA
DEQ7 Groundwater Standard		3	100	NA	70	30	NA	NA	0.2	4	0.004	NA	600
EPA RSL Tapwater		NA	NA	21,000	NA	NA	240	250	NA	NA	NA	8	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,3-Di- chloro-benzene (εg/L)	1,4-Di- chloro-benzene (εg/L)	Dichloro- difluoro-methane (εg/L)	1,1-Dichloro-ethane (εg/L)	1,2- Dichloro-ethane (εg/L)	1,1-Dichloro-ethene (εg/L)	cis-1,2- Dichloro-ethene (εg/L)	trans-1,2-Dichloro- ethene (εg/L)	Dichlorofluoromethane (εg/L)	1,2-Dichloro-propane (εg/L)	1,3-Dichloro-propane (εg/L)	2,2-Dichloro-propane (εg/L)
20170801-IDW-01	08/01/17	--	--	--	--	--	--	--	--	--	--	--	--
BMW07-1	07/29/17	<1	<1	<1	<1	<1	<1	29.9	<1	<1	<4	<1	<4
BMW-1	07/29/17	<10.3	<10.3	<1	<1	<1	<1	15.2	<1	<1	<4	<1	<4
BMW-4	07/28/17	<11.1	<11.1	<1	<1	<1 UJ	<1	20	<1	<1	<4	<1	<4
BNMW-17	08/30/17	<1	<1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
BNMW-20	08/30/17	<1	<1	<1	<1	<1	<1	8.4	<1	<1	<4	<1	<4
BNMW-21	08/31/17	<11.5	<11.5	<1	<1	<1	<1	12.6	<1	<1	<4	<1	<4
BNMW-23	08/31/17	<11.2	<11.2	<1	<1	<1	<1	6.4	1.5	<1	<4	<1	<4
BNMW-24	08/30/17	<1	<1	<1	<1	<1	<1	3.2	<1	<1	<4	<1	<4
BNMW-8	08/30/17	<1	<1	<1	<1	<1	<1	7.1	<1	<1	<4	<1	<4
BNMW-8 Dup	08/30/17	<1	<1	<1	<1	<1	<1	7.5	<1	<1	<4	<1	<4
BNMW-9	08/30/17	<1	<1	<1	<1	<1	<1	4.5	<1	<1	<4	<1	<4
BPGP02	08/31/17	<10.8	<10.8	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
BPGP04	07/31/17	<11.4	<11.4	<1	<1	<1	<1	1.2	<1	<1	<4	<1	<4
BPGP05	07/26/17	<10.4	<10.4	<1	<1	<1	<1	4.7 J+	<1	<1	<4	<1	<4
BPGP08	07/26/17	<1	<1	<1	<1	<1	<1	23 J+	<1	<1	<4	<1	<4
BPGP12	07/28/17	<10.2	<10.2	<1	<1	<1	<1	4.5	<1	<1	<4	<1	<4
BPGP15	07/28/17	<10.4	<10.4	<1	<1	<1	<1	1.6	<1	<1	<4	<1	<4
BPGP16	07/30/17	<1	<1	<1	<1	<1	<1	6.5	<1	<1	<4	<1	<4
BPGP17	07/30/17	<1	<1	<1	<1	<1 UJ	<1	11.4	<1	<1	<4	<1	<4
BPGP22	07/30/17	<11.4	<11.4	<1	<1	<1 UJ	<1	65.6	<1	<1	<4	<1	<4
BPGP25	07/28/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	5.2 J	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP27	07/28/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP27 Dup	07/28/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP28	07/28/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	3.2 J	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP29	07/28/17	<1	<1	<1	<1	<1	<1	18.4	<1	<1	<4	<1	<4
BPGP31	07/31/17	<10.9	<10.9	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP32	07/26/17	<42.6	<42.6	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
BPGP41	07/28/17	<11.2	<11.2	<1	<1	<1 UJ	<1	<1	<1	<1	<4	<1	<4
BPGP42	07/28/17	<10.9 UJ	<10.9 UJ	<1	<1	<1	<1	21.7	<1	<1	<4	<1	<4
BPGP44	07/31/17	<10.4	<10.4	<1	<1	<1 UJ	<1	12.1	<1	<1	<4	<1	<4
BPGP46	07/27/17	<10.4	<10.4	<1	<1	<1	<1	**118 J+**	<1	<1	<4	<1	<4
BPGP46b	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	1 J-	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP47	07/28/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP48	07/28/17	<10.8 UJ	<10.8 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP49	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	8.4 J-	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP50	07/30/17	<10.9	<10.9	<1	<1	<1	<1	10.8	<1	<1	<4	<1	<4
BPGP51	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	1.3 J-	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP51B	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
RBCA RBSLs Groundwater		NA	NA	NA	NA	4	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		600	75	1,000	NA	4	7	70	100	NA	5	NA	NA
EPA RSL Tapwater		NA	NA	NA	2.7	NA	NA	NA	NA	NA	NA	370	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,1-Dichloro-propene (εg/L)	Cis-1,3- dichloro-propene (εg/L)	trans-1,3-Dichloro- propene (εg/L)	Diethyl ether (εg/L)	Ethyl- benzene (εg/L)	Hexachloro-butadiene (εg/L)	Isopropyl-benzene (εg/L)	p-Isopropyl-toluene (εg/L)	4-Methyl- 2-Pentanone (εg/L)	Methylene Chloride (εg/L)	MTBE (εg/L)	Naphthalene (εg/L)
20170801-IDW-01	08/01/17	--	--	--	--	4.6	--	--	--	--	--	<1	<5
BMW07-1	07/29/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<5
BMW-1	07/29/17	<1	<4	<4	<4	<1	<10.3	<1	<1	<5	<4	<1	<5
BMW-4	07/28/17	<1	<4	<4	<4 UJ	<1	<11.1	<1	<1	<5	<4	<1	<5
BNMW-17	08/30/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	6.5 J-
BNMW-20	08/30/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<5 UJ
BNMW-21	08/31/17	<1	<4	<4	<4	<1	<11.5	<1	<1	<5	<4	<1	<5
BNMW-23	08/31/17	<1	<4	<4	<4	6.8 J+	<11.2	2.7	<1	<5	<4	<1	<5
BNMW-24	08/30/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<5 UJ
BNMW-8	08/30/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<5 UJ
BNMW-8 Dup	08/30/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<5 UJ
BNMW-9	08/30/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<5 UJ
BPGP02	08/31/17	<1	<4	<4	<4	320	<10.8	55.8	1.2	<5	<4	<5	38.9
BPGP04	07/31/17	<1	<4	<4	<4	<1	<11.4 UJ	<1	<1	<5	<4	<1	<4
BPGP05	07/26/17	<1	<4	<4	<4	<1	<10.4	<1	<1	<5	<4	<1	<5
BPGP08	07/26/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGP12	07/28/17	<1	<4	<4	<4	<1	<10.2	<1	<1	<5	<4	<1	<5
BPGP15	07/28/17	<1	<4	<4	<4	<1	<10.4	<1	<1	<5	<4	<1	<5
BPGP16	07/30/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<5
BPGP17	07/30/17	<1	<4	<4	<4 UJ	<1	<1	<1	<1	<5	<4	<1	<5
BPGP22	07/30/17	<1	<4	<4	<4 UJ	<1	<11.4	<1	<1	<5	<4	<1	<5
BPGP25	07/28/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP27	07/28/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP27 Dup	07/28/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP28	07/28/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP29	07/28/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGP31	07/31/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<10.9 UJ	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP32	07/26/17	<1	<4	<4	<4	<1	<42.6	<1	<1	<5	<4	<1	<5
BPGP41	07/28/17	<1	<4	<4	<4 UJ	<1	<11.2	<1	<1	<5	<4	<1	<5
BPGP42	07/28/17	<1	<4	<4	<4	<1	<10.9	<1	<1	<5	<4	<1	<5
BPGP44	07/31/17	<1	<4	<4	<4 UJ	<1	<10.4 UJ	<1	<1	<5	<4	<1	<5
BPGP46	07/27/17	<1	<4	<4	<4	<1	<10.4	2.4 J+	<1	<5	<4	14.1 J	<5
BPGP46b	07/27/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<5
BPGP47	07/28/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP48	07/28/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<10.8	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<5
BPGP49	07/27/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	59.3 J-	<1 UJ	18.5 J-	3.2 J-	<5 UJ	<4 UJ	<1 UJ	7.6 J-
BPGP50	07/30/17	<1	<4	<4	<4	<1	<10.9	<1	<1	<5	<4	<1	<5
BPGP51	07/27/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP51B	07/27/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	1.8 J	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<4 UJ
RBCA RBSLs Groundwater		NA	NA	NA	NA	700	NA	NA	NA	NA	NA	30	100
DEQ7 Groundwater Standard		NA	4	2	NA	700	5	NA	NA	NA	5	30	100
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	450	NA	1,200	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	n-Propyl-benzene (εg/L)	Styrene (εg/L)	1,1,1,2-Tetrachloro- ethan (εg/L)	1,1,2,2-Tetrachloro- ethan (εg/L)	Tetrachloro-ethene (εg/L)	Tetrahydrofuran (εg/L)	Toluene (εg/L)	1,2,3- Trichloro-benzene (εg/L)	1,2,4- Trichloro-benzene (εg/L)	1,1,1- Trichloro-ethane (εg/L)	1,1,2- Trichloro-ethane (εg/L)	Trichloro- ethene (εg/L)
20170801-IDW-01	08/01/17	--	--	--	--	--	--	<0.5	--	--	--	--	--
BMW07-1	07/29/17	<1	<1	<1	<1	**57.8**	<10 UJ	<1	<1	<1	<1	<1	**26.6**
BMW-1	07/29/17	<1	<1	<1	<1	**124**	<10	<1	<1	<10.3	<1	<1	**17**
BMW-4	07/28/17	<1	<4	<1	<1	**55.9**	<10	<1	<1	<11.1	<1	<1	**13.9**
BNMW-17	08/30/17	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<0.4
BNMW-20	08/30/17	<1	<1	<1	<1	**25.8**	<10	<1	<1	<1	<1	<1	**6.5**
BNMW-21	08/31/17	<1	<1	<1	<1	**20.2**	<10	<1	<1	<11.5	<1	<1	**5.8**
BNMW-23	08/31/17	8.4	<1	<1	<1	4.9	<10	<1	<1	<11.2	<1	<1	**16.6**
BNMW-24	08/30/17	<1	<1	<1	<1	**5.9**	<10	<1	<1	<1	<1	<1	2.3
BNMW-8	08/30/17	<1	<1	<1	<1	**8.2**	<10	<1	<1	<1	<1	<1	4.3
BNMW-8 Dup	08/30/17	<1	<1	<1	<1	**8.6**	<10	<1	<1	<1	<1	<1	4.6
BNMW-9	08/30/17	<1	<1	<1	<1	**5.4**	<10	<1	<1	<1	<1	<1	3.4
BPGP02	08/31/17	132	<1	<1	<1	2.3	<10	12.7	<1	<10.8	<1	<1	1.7
BPGP04	07/31/17	<1	<1	<1	<1	**219**	<10	<1	<1	<11.4 UJ	<1	<1	2.9
BPGP05	07/26/17	<1	<1	<1	<1	**460**	<10	<1	<1	<10.4	<1	<1	**29**
BPGP08	07/26/17	<1	<1	<1	<1	**330**	<10	<1	<1	<1	<1	<1	**34.7**
BPGP12	07/28/17	<1	<1	<1	<1	**632**	<10	<1	<1	<10.2	<1	<1	**35.8**
BPGP15	07/28/17	<1	<1	<1	<1	**34.1**	<10	<1	<1	<10.4	<1	<1	4.6
BPGP16	07/30/17	<1	<1	<1	<1	**492**	<10	<1	<1	<1	<1	<1	**26.9**
BPGP17	07/30/17	<1	<4	<1	<1	**115**	<10	<1	<1	<1	<1	<1	**22.1**
BPGP22	07/30/17	<1	<4	<1	<1	**214**	<10	<1	<1	<11.4	<1	<1	**75.9**
BPGP25	07/28/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	**173**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	**19.4**
BPGP27	07/28/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	**10.7**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	1.1
BPGP27 Dup	07/28/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	**12.8**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	1.3
BPGP28	07/28/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	**144**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	**14.8**
BPGP29	07/28/17	<1	<1	<1	<1	**141**	<10	<1	<1	<1	<1	<1	**40.5**
BPGP31	07/31/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<10 UJ	<1 UJ	<1 UJ	<10.9 UJ	<1 UJ	<1 UJ	<0.4 UJ
BPGP32	07/26/17	<1	<1	<1	<1	1.8	<10	<1	<1	<42.6	<1	<1	<0.4
BPGP41	07/28/17	<1	<4	<1	<1	**37.2**	<10	<1	<1	<11.2	<1	<1	2.9
BPGP42	07/28/17	<1	<1	<1	<1	**247**	<10	<1	<1	<10.9	<1	<1	**36.7**
BPGP44	07/31/17	<1	<4	<1	<1	**170**	<10	<1	<1	<10.4 UJ	<1	<1	**29.3**
BPGP46	07/27/17	1.7 J+	<1	**1.4 J+**	<1	**17200**	<10	<1	<1	<10.4	<1	<1	**232**
BPGP46b	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	**183**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	**66.4 J-**
BPGP47	07/28/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	**41.7**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	3.9
BPGP48	07/28/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4	<10 UJ	<1 UJ	<1 UJ	<10.8	<1 UJ	<1 UJ	<0.4
BPGP49	07/27/17	44.5 J-	<4 UJ	<1 UJ	<1 UJ	**47400**	<10 UJ	1.5/ND(1.5)U*	<1 UJ	<1 UJ	2.1 J-	<1 UJ	**22.3 J-**
BPGP50	07/30/17	<1	<1	<1	<1	**87.6**	<10	<1	<1	<10.9	<1	<1	**17.9**
BPGP51	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	**7020**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	4.3 J-
BPGP51B	07/27/17	4.6 J	<4 UJ	<1 UJ	<1 UJ	**121**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	1.4
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	1,000	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	100	NA	2	5	NA	1,000	NA	70	200	3	5
EPA RSL Tapwater		660	NA	0.57	NA	NA	NA	NA	7	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Trichloro-fluoromethane (εg/L)	1,2,3- Trichloro-propane (εg/L)	1,1,2- Trichloro-trifluoro- ethane (εg/L)	1,2,4- Trimethyl-benzene (εg/L)	1,3,5-Trimethyl-benzene (εg/L)	Vinyl Chloride (εg/L)	m,p-Xylene (εg/L)	o-Xylene (εg/L)	Xylenes, Total (εg/L)
20170801-IDW-01	08/01/17	--	--	--	--	--	--	1.8	<0.5	<2
BMW07-1	07/29/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BMW-1	07/29/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BMW-4	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BNMW-17	08/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BNMW-20	08/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BNMW-21	08/31/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BNMW-23	08/31/17	<1	<4	<1	8.3	<1	<0.2	<2	<1	<3
BNMW-24	08/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BNMW-8	08/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BNMW-8 Dup	08/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BNMW-9	08/30/17	<1	<4	<1	<1	<1	**0.24**	<2	<1	<3
BPGP02	08/31/17	<1	<4	<1	**122**	50.1	<0.2	94.1	6.8	130
BPGP04	07/31/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP05	07/26/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP08	07/26/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP12	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP15	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP16	07/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP17	07/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP22	07/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP25	07/28/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
BPGP27	07/28/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
BPGP27 Dup	07/28/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
BPGP28	07/28/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
BPGP29	07/28/17	<1	<4	<1	<1	<1	**3.1 J+**	<2	<1	<3
BPGP31	07/31/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
BPGP32	07/26/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP41	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP42	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP44	07/31/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP46	07/27/17	<1	<4	<1	2.4 J+	1 J+	<0.2	<2	<1	<3
BPGP46b	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
BPGP47	07/28/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
BPGP48	07/28/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
BPGP49	07/27/17	<1 UJ	<4 UJ	<1 UJ	3.3 J-	<1 UJ	<0.2 UJ	<2 UJ	2.2 J-	<3 UJ
BPGP50	07/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP51	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
BPGP51B	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	10,000
DEQ7 Groundwater Standard		10,000	NA	NA	NA	NA	0.2	10,000	10,000	10,000
EPA RSL Tapwater		NA	0.62	NA	15	120	NA	NA	NA	NA

Notes:
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RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
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-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Acetone (εg/L)	Allyl Chloride (εg/L)	Benzene (εg/L)	Bromo- benzene (εg/L)	Bromo- chloro- methane (εg/L)	Bromo- dichloro- methane (εg/L)	Bromoform (εg/L)	Bromo- methane (εg/L)	2-Butanone (εg/L)	n-Butyl- benzene (εg/L)	sec-Butylbenzene (εg/L)	tert-Butyl- benzene (εg/L)
BPGP53	07/27/17	<100 UJ	<20 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<20 UJ	<20 UJ	<25 UJ	<5 UJ	<5 UJ	<5 UJ
BPGP54	07/26/17	<80	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP58	07/31/17	44.3	<4	<1	<1	<1	<1	<4	<4	<5	<1	4.5	<1
BPGP59	07/26/17	<80	<4	0.55 J+	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP60	07/26/17	<80	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP60 Dup	07/26/17	84.7 J+	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP61	07/27/17	64.8/ND(64.8)U*	<4 UJ	1.8 J-	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<4 UJ	63.9 J-	17.8 J-	16.7 J-	<1 UJ
BPGP63	07/27/17	37.6/ND(37.6)U*	<4 UJ	<1 UJ	<1 UJ	<1 UJ	2.8 J-	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP63B	07/27/17	39.9/ND(39.9)U*	<4 UJ	<1 UJ	<1 UJ	<1 UJ	3.2 J-	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP65	07/27/17	30.7/ND(30.7)U*	<4 UJ	<1 UJ	<1 UJ	<1 UJ	1.9 J-	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP65B	07/27/17	<80	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP66	07/26/17	<80	<4	<2.5	<1	<1	<1	<4	<4	<5	<1	1.4 J+	<1
BPGP67	07/31/17	73.6	<4	<1	<1	<1	<1	<4	<4 UJ	<5	<1	<1	<1
BPGP74	07/27/17	20.2/ND(20.2)U*	<4 UJ	<1 UJ	<1 UJ	<1 UJ	2.9 J-	<4 UJ	<4 UJ	<5 UJ	<1 UJ	<1 UJ	<1 UJ
BPGP76	07/31/17	52.2	<4	<1	<1	<1	5.7	<4	<4	<5	<1	<1	<1
BPGP78	07/27/17	69/ND(69)U*	<4	**8.7**	<1	<1	<1	<4	<4 UJ	22.5	2.3	6	<1
BPGP80	07/26/17	<80	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP81	07/31/17	55.4	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP83	07/28/17	94/ND(94)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP84	07/31/17	47.8	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP85	07/26/17	<80	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP86	07/28/17	23.3/ND(23.3)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP87	07/31/17	23.7	<4	<1	<1	<1	2	<4	<4	<5	<1	<1	<1
BPGP88	07/26/17	24.3/ND(24.3)U*	<4	<1	<1	<1	5.3	<4	<4	<5	<1	<1	<1
BPGP89	07/30/17	178 JB	<4	**250 J-**	<1	<1	<1	<4	<4	<5	<1	3.3	<1
BPGP90	07/30/17	37.6/ND(37.6)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP91	07/29/17	35.5/ND(35.5)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP92	07/30/17	33.4/ND(33.4)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP92 Dup	07/30/17	74.5 JB	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP93	07/31/17	49.4	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGP94	07/30/17	22.2/ND(22.2)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGW01	07/26/17	<80	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
BPGW04	07/27/17	21.8/ND(21.8)U*	<4	<1	<1	<1	<1	<4	<4 UJ	<5	<1	<1	<1
BPGW04P	07/27/17	<80	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
CENEX-5	07/28/17	50.1/ND(50.1)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
EMW-03	07/28/17	92.5/ND(92.5)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
EMW-03P	07/28/17	63.4/ND(63.4)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
EMW-09	08/01/17	<40	<8	<2	<2	<2	<2	<8	<8	36.3	8.6	20.4	<2
EMW-11	07/26/17	65.8	<4	<1	<1	<1	<1	<4	<4 UJ	<5	<1	<1	<1
RBCA RBSLs Groundwater		NA	NA	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	NA	5	NA	NA	10	80	10	NA	NA	NA	NA
EPA RSL Tapwater		14,000	NA	NA	62	83	NA	NA	NA	5,600	1,000	2,000	690

Notes:
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RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
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TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Carbon tetrachloride (εg/L)	Chlorobenzene (εg/L)	Chloroethane (εg/L)	Chloroform (εg/L)	Chloromethane (εg/L)	2-Chloro- toluene (εg/L)	4-Chloro- toluene (εg/L)	1,2-Dibromo 3-chloro- propane (εg/L)	Dibromo-chloromethane (εg/L)	1,2- Dibromo-ethane (εg/L)	Dibromomethane (εg/L)	1,2-Di- chloro-benzene (εg/L)
BPGP53	07/27/17	<5 UJ	<5 UJ	<5 UJ	28 J	<20 UJ	<5 UJ	<5 UJ	<20 UJ	<5 UJ	<5 UJ	<20 UJ	<5 UJ
BPGP54	07/26/17	<1	<1	<1	3	<4	<1	<1	<4	<1	<1	<4	<1
BPGP58	07/31/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	1.1
BPGP59	07/26/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<10.5
BPGP60	07/26/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BPGP60 Dup	07/26/17	<1	<1	<1	<1	6.6 J+	<1	<1	<4	<1	<1	<4	<1
BPGP61	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
BPGP63	07/27/17	<1 UJ	<1 UJ	<1 UJ	25.3 J-	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
BPGP63B	07/27/17	<1 UJ	<1 UJ	<1 UJ	28.9 J-	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
BPGP65	07/27/17	<1 UJ	<1 UJ	<1 UJ	18.3 J-	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
BPGP65B	07/27/17	<1	<1	<1	8.1	<4	<1	<1	<4	<1	<1	<4	<11.1
BPGP66	07/26/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<11.4
BPGP67	07/31/17	<1	<1	<1 UJ	<1	<4	<1	<1	<4	<1	<1	<4	<11
BPGP74	07/27/17	<1 UJ	<1 UJ	<1 UJ	31.6 J-	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<4 UJ	<1 UJ
BPGP76	07/31/17	<1	<1	<1	40.1	<4	<1	<1	<4	<1	<1	<4	<11
BPGP78	07/27/17	<1	<1	<1	<1	<4 UJ	<1	<1	<4	<1	<1	<4	<10.3
BPGP80	07/26/17	<1	<1	<1	1.2	5.9 J+	<1	<1	<4	<1	<1	<4	<11.2
BPGP81	07/31/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BPGP83	07/28/17	<1	<1	<1	6.9 JB	<4	<1	<1	<4	<1	<1	<4	<10.9
BPGP84	07/31/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BPGP85	07/26/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BPGP86	07/28/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BPGP87	07/31/17	<1	<1	<1	14	<4	<1	<1	<4	<1	<1	<4	<1
BPGP88	07/26/17	<1	<1	<1	39	<4	<1	<1	<4	<1	<1	<4	<1
BPGP89	07/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BPGP90	07/30/17	<1	<1	<1	1.6	<4	<1	<1	<4	<1	<1	<4	<1
BPGP91	07/29/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BPGP92	07/30/17	<1	<1	<1	1.5	<4	<1	<1	<4	<1	<1	<4	<11.5
BPGP92 Dup	07/30/17	<1	<1	<1	1.6	<4	<1	<1	<4	<1	<1	<4	<12
BPGP93	07/31/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BPGP94	07/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<11.6
BPGW01	07/26/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
BPGW04	07/27/17	<1	<1	<1	4.5	<4 UJ	<1	<1	<4	<1	<1	<4	<10.4
BPGW04P	07/27/17	<1	<1	<1	5.4	<4	<1	<1	<4	<1	<1	<4	<1
CENEX-5	07/28/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<10.3
EMW-03	07/28/17	<1	<1	<1	<1	4.7	<1	<1	<4	<1	<1	<4	<11.4
EMW-03P	07/28/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
EMW-09	08/01/17	<2	<2	<2	<2	<8	<2	<2	<8	<2	<2	<8	<2
EMW-11	07/26/17	<1	<1	<1	<1	<4 UJ	<1	<1	<4	<1	<1	<4	<1
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	0.017	NA	NA
DEQ7 Groundwater Standard		3	100	NA	70	30	NA	NA	0.2	4	0.004	NA	600
EPA RSL Tapwater		NA	NA	21,000	NA	NA	240	250	NA	NA	NA	8	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,3-Di- chloro- benzene (εg/L)	1,4-Di- chloro- benzene (εg/L)	Dichloro- difluoro- methane (εg/L)	1,1-Dichloro- ethane (εg/L)	1,2- Dichloro- ethane (εg/L)	1,1-Dichloro- ethene (εg/L)	cis-1,2- Dichloro- ethene (εg/L)	trans-1,2- Dichloro- ethene (εg/L)	Dichlorofluoromet hane (εg/L)	1,2-Dichloro- propane (εg/L)	1,3-Dichloro- propane (εg/L)	2,2-Dichloro- propane (εg/L)
BPGP53	07/27/17	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<20 UJ	<5 UJ	<20 UJ
BPGP54	07/26/17	<1	<1	<1	<1	<1	<1	2.5 J+	<1	<1	<4	<1	<4
BPGP58	07/31/17	<11.4	<11.4	<1	<1	<1	<1	25	<1	<1	<4	<1	<4
BPGP59	07/26/17	<10.5	<10.5	<1	<1	<1	<1	11.6 J+	<1	<1	<4	<1	<4
BPGP60	07/26/17	<1	<1	<1	<1	<1	<1	5.1 J+	<1	<1	<4	<1	<4
BPGP60 Dup	07/26/17	<1	<1	<1	<1	<1	<1	4.9 J+	<1	<1	<4	<1	<4
BPGP61	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	65 J-	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP63	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	14 J-	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP63B	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	4.9 J-	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP65	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	3.1 J-	<1 UJ	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP65B	07/27/17	<11.1	<11.1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
BPGP66	07/26/17	<11.4	<11.4	<1	<1	<1	<1	8.6 J+	<1	<1	<4	<1	<4
BPGP67	07/31/17	<11	<11	<1	<1	<1	<1	34.1	<1	<1	<4	<1	<4
BPGP74	07/27/17	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	1.9 J-	**108 J-**	1.2 J-	<1 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP76	07/31/17	<11	<11	<1	<1	<1	<1	4.9	<1	<1	<4	<1	<4
BPGP78	07/27/17	<10.3	<10.3	<1	<1	<1	<1	22.1	<1	<1	<4	<1	<4
BPGP80	07/26/17	<11.2	<11.2	<1	<1	<1	<1	29.8 J+	<1	<1	<4	<1	<4
BPGP81	07/31/17	<1	<1	<1	<1	<1	<1	12.7	<1	<1	<4	<1	<4
BPGP83	07/28/17	<10.9	<10.9	<1	<1	<1	<1	6.4	<1	<1	<4	<1	<4
BPGP84	07/31/17	<1	<1	<1	<1	<1 UJ	<1	38.2	<1	<1	<4	<1	<4
BPGP85	07/26/17	<1	<1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
BPGP86	07/28/17	<1	<1	<1	<1	<1	<1	8.5	<1	<1	<4	<1	<4
BPGP87	07/31/17	<1	<1	<1	<1	<1	<1	1.2	<1	<1	<4	<1	<4
BPGP88	07/26/17	<1	<1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
BPGP89	07/30/17	<1	<1	<1	<1	<1	<1	**120**	<1	<1	<4	<1	<4
BPGP90	07/30/17	<1	<1	<1	<1	<1	<1	10.4	<1	<1	<4	<1	<4
BPGP91	07/29/17	<1	<1	<1	<1	<1	<1	9.2	<1	<1	<4	<1	<4
BPGP92	07/30/17	<11.5	<11.5	<1	<1	<1 UJ	<1	6.9	<1	<1	<4	<1	<4
BPGP92 Dup	07/30/17	<12	<12	<1	<1	<1	<1	6.6	<1	<1	<4	<1	<4
BPGP93	07/31/17	<1	<1	<1	<1	1.5	<1	6.4	<1	<1	<4	<1	<4
BPGP94	07/30/17	<11.6	<11.6	<1	<1	<1 UJ	<1	32.6	<1	<1	<4	<1	<4
BPGW01	07/26/17	<1	<1	<1	<1	<1	<1	**120 J+**	<1	<1	<4	<1	<4
BPGW04	07/27/17	<10.4	<10.4	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
BPGW04P	07/27/17	<1	<1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
CENEX-5	07/28/17	<10.3	<10.3	<1	<1	<1	<1	1.7	<1	<1	<4	<1	<4
EMW-03	07/28/17	<11.4	<11.4	<1	<1	<1 UJ	<1	<1	<1	<1	<4	<1	<4
EMW-03P	07/28/17	<1	<1	<1	<1	<1 UJ	<1	<1	<1	<1	<4	<1	<4
EMW-09	08/01/17	<2	<2	<2	<2	<2	<2	<2	<2	<2	<8	<2	<8
EMW-11	07/26/17	<1	<1	<1	<1	<1	<1	**175**	<1	<1	<4	<1	<4
RBCA RBSLs Groundwater		NA	NA	NA	NA	4	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		600	75	1,000	NA	4	7	70	100	NA	5	NA	NA
EPA RSL Tapwater		NA	NA	NA	2.7	NA	NA	NA	NA	NA	NA	370	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,1-Dichloro-propene (εg/L)	Cis-1,3- dichloro-propene (εg/L)	trans-1,3-Dichloro- propene (εg/L)	Diethyl ether (εg/L)	Ethyl- benzene (εg/L)	Hexachloro-butadiene (εg/L)	Isopropyl-benzene (εg/L)	p-Isopropyl-toluene (εg/L)	4-Methyl- 2-Pentanone (εg/L)	Methylene Chloride (εg/L)	MTBE (εg/L)	Naphthalene (εg/L)
BPGP53	07/27/17	<5 UJ	<20 UJ	<20 UJ	<20 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<25 UJ	<20 UJ	<5 UJ	<20 UJ
BPGP54	07/26/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGP58	07/31/17	<1	<4	<4	<4	<1	<11.4 UJ	4.7	<1	<5	<4	<1	<4
BPGP59	07/26/17	<1	<4	<4	<4	<1	<10.5	<1	<1	<5	<4	<1	<5
BPGP60	07/26/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGP60 Dup	07/26/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGP61	07/27/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	60.7 J-	8.2 J-	<5 UJ	<4 UJ	<1 UJ	11.4 J-
BPGP63	07/27/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP63B	07/27/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP65	07/27/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP65B	07/27/17	<1	<4	<4	<4	<1	<11.1	<1	<1	<5	<4	<1	<5
BPGP66	07/26/17	<1	<4	<4	<4	<2.5	<11.4	<1	<1	<5	<4	<5	<4
BPGP67	07/31/17	<1	<4	<4	<4	<1	<11 UJ	<1	<1	<5	<4	<1	<4
BPGP74	07/27/17	<1 UJ	<4 UJ	<4 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<5 UJ	<4 UJ	<1 UJ	<4 UJ
BPGP76	07/31/17	<1	<4	<4	<4	<1	<11 UJ	<1	<1	<5	<4	<1	<4
BPGP78	07/27/17	<1	<4	<4	<4	81.5	<10.3	15.1	1	<5	<4	<5	<4
BPGP80	07/26/17	<1	<4	<4	<4	<1	<11.2	<1	<1	<5	<4	<1	<5
BPGP81	07/31/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGP83	07/28/17	<1	<4	<4	<4	<1	<10.9	<1	<1	<5	<4	<1	<5
BPGP84	07/31/17	<1	<4	<4	<4 UJ	<1	<1	<1	<1	<5	<4	<1 UJ	<5 UJ
BPGP85	07/26/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGP86	07/28/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGP87	07/31/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGP88	07/26/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGP89	07/30/17	<1	<4	<4	<4	196	<1	17.8	<1	<5	<4	<1 UJ	<5 UJ
BPGP90	07/30/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGP91	07/29/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGP92	07/30/17	<1	<4	<4	<4 UJ	<1	<11.5	<1	<1	<5	<4	<1	<5
BPGP92 Dup	07/30/17	<1	<4	<4	<4	<1	<12	<1	<1	<5	<4	<1	<5
BPGP93	07/31/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<5
BPGP94	07/30/17	<1	<4	<4	<4 UJ	<1	<11.6	<1	<1	<5	<4	<1	<5
BPGW01	07/26/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
BPGW04	07/27/17	<1	<4	<4	<4	<1	<10.4	<1	<1	<5	<4	<1	<5
BPGW04P	07/27/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
CENEX-5	07/28/17	<1	<4	<4	<4	<1	<10.3	<1	<1	<5	<4	<1	<5
EMW-03	07/28/17	<1	<4	<4	<4 UJ	<1	<11.4	<1	<1	<5	<4	<1	<5
EMW-03P	07/28/17	<1	<4	<4	<4 UJ	<1	<1	<1	<1	<5	<4	<1	<4
EMW-09	08/01/17	<2	<8	<8	<8	264 J	<2	79.9	<2	<10	<8	<25	45.6
EMW-11	07/26/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
RBCA RBSLs Groundwater		NA	NA	NA	NA	700	NA	NA	NA	NA	NA	30	100
DEQ7 Groundwater Standard		NA	4	2	NA	700	5	NA	NA	NA	5	30	100
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	450	NA	1,200	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
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TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	n-Propyl-benzene (εg/L)	Styrene (εg/L)	1,1,1,2-Tetrachloro- ethan (εg/L)	1,1,2,2-Tetrachloro- ethan (εg/L)	Tetrachloro-ethene (εg/L)	Tetrahydrofuran (εg/L)	Toluene (εg/L)	1,2,3- Trichloro-benzene (εg/L)	1,2,4- Trichloro-benzene (εg/L)	1,1,1- Trichloro-ethane (εg/L)	1,1,2- Trichloro-ethane (εg/L)	Trichloro- ethene (εg/L)
BPGP53	07/27/17	<5 UJ	<20 UJ	<5 UJ	<5 UJ	**1060**	<50 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	4.1
BPGP54	07/26/17	<1	<1	<1	<1	**1210**	<10	<1	<1	<1	<1	<1	**15.5**
BPGP58	07/31/17	2.5	<1	<1	<1	**9020**	<10	<1	<1	<11.4 UJ	<1	<1	**228**
BPGP59	07/26/17	<1	<1	<1	<1	**3460**	<10	<1	<1	<10.5	<1	<1	**185**
BPGP60	07/26/17	<1	<1	<1	<1	**2470**	<10	<1	<1	<1	<1	<1	**42.4**
BPGP60 Dup	07/26/17	<1	<1	<1	<1	**2230**	<10	<1	<1	<1	<1	<1	**43**
BPGP61	07/27/17	7 J-	<4 UJ	<1 UJ	<1 UJ	**22100**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	**444 J-**
BPGP63	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	**3570**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	**24.6 J-**
BPGP63B	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	**2260**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	**9.9 J-**
BPGP65	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	**853**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	**8.2 J-**
BPGP65B	07/27/17	<1	<1	<1	<1	**11.2**	<10	<1	<1	<11.1	<1	<1	0.57
BPGP66	07/26/17	<1	<1	<1	<1	**4290**	<10	<2.5	<1	<11.4	<1	<1	**94.2**
BPGP67	07/31/17	<1	<4	<1	<1	**1020**	<10	<1	<1	<11 UJ	<1	<1	**174**
BPGP74	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	**11800**	<10 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	<1 UJ	**126 J-**
BPGP76	07/31/17	<1	<1	<1	<1	**127**	<10	<1	<1	<11 UJ	<1	<1	**7.2**
BPGP78	07/27/17	38	<4	<1	<1	<4	<10	<2.5	<1	<10.3	<1	1.6	1.3
BPGP80	07/26/17	<1	<1	<1	<1	**2140**	<10	<1	<1	<11.2	<1	<1	**161**
BPGP81	07/31/17	<1	<1	<1	<1	**385**	<10	<1	<1	<1	<1	<1	**50.2**
BPGP83	07/28/17	<1	<1	<1	<1	**687**	<10	<1	<1	<10.9	<1	<1	**22**
BPGP84	07/31/17	<1	<4	<1	<1	**440 J-**	<10	<1	<1	<1	<1	<1	**35.2**
BPGP85	07/26/17	<1	<1	<1	<1	**10**	<10	<1	<1	<1	<1	<1	2.4
BPGP86	07/28/17	<1	<1	<1	<1	**341**	<10	<1	<1	<1	1.1	<1	**31.1**
BPGP87	07/31/17	<1	<1	<1	<1	**318**	<10	<1	<1	<1	<1	<1	3.9
BPGP88	07/26/17	<1	<4	<1	<1	**12.1**	<10	<1	<1	<1	<1	<1	1
BPGP89	07/30/17	25.2	<1	<1	<1	<1	<10	6.5 J-	<1	<1	<1	<1	2.1
BPGP90	07/30/17	<1	<1	<1	<1	**156**	<10	<1	<1	<1	<1	<1	**21.8**
BPGP91	07/29/17	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<0.4
BPGP92	07/30/17	<1	<4	<1	<1	**466**	<10	<1	<1	<11.5	<1	<1	**50.6**
BPGP92 Dup	07/30/17	<1	<1	<1	<1	**478**	<10	<1	<1	<12	1.6	<1	**48**
BPGP93	07/31/17	<1	<1	<1	<1	**76.1**	<10	<1	<1	<1	<1	<1	**9.9**
BPGP94	07/30/17	<1	<4	<1	<1	**30.4**	<10	<1	<1	<11.6	<1	<1	**13.5**
BPGW01	07/26/17	<1	<1	<1	<1	**215**	<10	<1	<1	<1	<1	<1	**117**
BPGW04	07/27/17	1.3	<4	<1	<1	4.1	<10	<1	<1	<10.4	<1	<1	<0.4
BPGW04P	07/27/17	<1	<1	<1	<1	4.9	<10	<1	<1	<1	<1	<1	<0.4
CENEX-5	07/28/17	<1	<1	<1	<1	**24.9**	<10	<1	<1	<10.3	<1	<1	3
EMW-03	07/28/17	<1	<4	<1	<1	<4	<10	<1	<1	<11.4	<1	<1	<0.4
EMW-03P	07/28/17	<1	<4	<1	<1	<4	<10	<1	<1	<1	<1	<1	<0.4
EMW-09	08/01/17	209	<8	<2	<2	<8	<20	<2	<2	<2	<2	<2	<0.8
EMW-11	07/26/17	<1	<4	<1	<1	**14.2**	<10	<1	<1	<1	<1	<1	**126**
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	1,000	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	100	NA	2	5	NA	1,000	NA	70	200	3	5
EPA RSL Tapwater		660	NA	0.57	NA	NA	NA	NA	7	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
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RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Trichloro-fluoromethane (εg/L)	1,2,3- Trichloro-propane (εg/L)	1,1,2- Trichloro-trifluoro- ethane (εg/L)	1,2,4- Trimethyl-benzene (εg/L)	1,3,5-Trimethyl-benzene (εg/L)	Vinyl Chloride (εg/L)	m,p-Xylene (εg/L)	o-Xylene (εg/L)	Xylenes, Total (εg/L)
BPGP53	07/27/17	<5 UJ	<20 UJ	<5 UJ	<5 UJ	<5 UJ	<1 UJ	<10 UJ	<5 UJ	<15 UJ
BPGP54	07/26/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP58	07/31/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP59	07/26/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP60	07/26/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP60 Dup	07/26/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP61	07/27/17	<1 UJ	<4 UJ	<1 UJ	**34.9 J-**	<1 UJ	<0.2 UJ	6.9 J-	<1 UJ	6.9 J-
BPGP63	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
BPGP63B	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
BPGP65	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	<0.2 UJ	<2 UJ	<1 UJ	<3 UJ
BPGP65B	07/27/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP66	07/26/17	<1	<4	<1	<1	<1	<0.2	<2.5	<2.5	<3
BPGP67	07/31/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP74	07/27/17	<1 UJ	<4 UJ	<1 UJ	<1 UJ	<1 UJ	**0.83 J-**	<2 UJ	<1 UJ	<3 UJ
BPGP76	07/31/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP78	07/27/17	<1	<4	<1	<1	<1	<0.2	<2.5	<2.5	<3
BPGP80	07/26/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP81	07/31/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP83	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP84	07/31/17	<1	<4	<1	<1	<1	**3.5**	<2	<1	<3
BPGP85	07/26/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP86	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP87	07/31/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP88	07/26/17	<1 UJ	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP89	07/30/17	<1	<4	<1	5.5	<1	<0.2	8.9	1.2 J-	8.9
BPGP90	07/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP91	07/29/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP92	07/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP92 Dup	07/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP93	07/31/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGP94	07/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGW01	07/26/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGW04	07/27/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
BPGW04P	07/27/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
CENEX-5	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
EMW-03	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
EMW-03P	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
EMW-09	08/01/17	<2	<8	<2	**128**	<2	<0.4	42.4	4.9	47.2
EMW-11	07/26/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	10,000
DEQ7 Groundwater Standard		10,000	NA	NA	NA	NA	0.2	10,000	10,000	10,000
EPA RSL Tapwater		NA	0.62	NA	15	120	NA	NA	NA	NA

Notes:
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RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
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TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Acetone (εg/L)	Allyl Chloride (εg/L)	Benzene (εg/L)	Bromo- benzene (εg/L)	Bromo- chloro- methane (εg/L)	Bromo- dichloro- methane (εg/L)	Bromoform (εg/L)	Bromo- methane (εg/L)	2-Butanone (εg/L)	n-Butyl- benzene (εg/L)	sec-Butylbenzene (εg/L)	tert-Butyl- benzene (εg/L)
EMW-11P	07/26/17	<80	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
EMW-15	07/31/17	72.1	<4	3.8 J	<1	<1	<1	<4	<4	<5	<1	1.7	<1
EMW-15P	07/31/17	117	<4	2.8	<1	<1	<1	<4	<4	<5	<1	1.6	<1
EMW-18	07/29/17	31.7/ND(31.7)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
EMW-21	07/28/17	62.5/ND(62.5)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
EMW-21P	07/28/17	74.7/ND(74.7)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
EMW-26	07/29/17	85.3 JB	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
EMW-28	07/29/17	23.2/ND(23.2)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
EMW-32	08/31/17	20.6/ND(20.6)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
GSMW-5	07/31/17	<100 UJ	<20 UJ	5.3 J-	<5 UJ	<5 UJ	<5 UJ	<20 UJ	<20 UJ	<25 UJ	<5 UJ	<5 UJ	<5 UJ
PEP07	07/31/17	27.5	<4	<1	<1	<1	<1	<4	<4 UJ	<5	<1	<1	<1
RH-MW-1	07/30/17	38.3/ND(38.3)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
RH-MW-3	07/28/17	59.1/ND(59.1)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
RH-MW-3P	07/28/17	97.1/ND(97.1)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
RH-MW-7	07/30/17	52.6/ND(52.6)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
RH-MW-7 Dup	07/30/17	<20 UJ	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
SD-I-01	08/01/17	<20	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
SD-I-02	08/01/17	<20	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
SD-I-02 Dup	08/01/17	<20	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
SMW12	07/31/17	<20	<4	<2.5	<1	<1	<1	<4	<4	<5	<1	<1	<1
Whiteley MW-1	07/30/17	41.9/ND(41.9)U*	<4	<1	<1	<1	<1	<4	<4	<5	1.9	10.1	1.2
Whiteley MW-2	07/30/17	57.9/ND(57.9)U*	<4	<1	<1	<1	<1	<4	<4	<5	<1	<1	<1
ZPMW-1	08/01/17	39.7	<4	2.3	<1	<1	<1	<4	<4	<5	<1	<1	<1
RBCA RBSLs Groundwater		NA	NA	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	NA	5	NA	NA	10	80	10	NA	NA	NA	NA
EPA RSL Tapwater		14,000	NA	NA	62	83	NA	NA	NA	5,600	1,000	2,000	690

Notes:
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J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
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TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Carbon tetrachloride (εg/L)	Chlorobenzene (εg/L)	Chloroethane (εg/L)	Chloroform (εg/L)	Chloromethane (εg/L)	2-Chloro- toluene (εg/L)	4-Chloro- toluene (εg/L)	1,2-Dibromo 3-chloro- propane (εg/L)	Dibromo-chloromethane (εg/L)	1,2- Dibromo-ethane (εg/L)	Dibromomethane (εg/L)	1,2-Di- chloro-benzene (εg/L)
EMW-11P	07/26/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
EMW-15	07/31/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
EMW-15P	07/31/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
EMW-18	07/29/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
EMW-21	07/28/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<10.6
EMW-21P	07/28/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
EMW-26	07/29/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<10.9
EMW-28	07/29/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
EMW-32	08/31/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
GSMW-5	07/31/17	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<20 UJ	<5 UJ	<5 UJ	<20 UJ	<5 UJ	<5 UJ	<20 UJ	<5 UJ
PEP07	07/31/17	<1	<1	<1 UJ	<1	<4	<1	<1	<4	<1	<1	<4	<10.6
RH-MW-1	07/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
RH-MW-3	07/28/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<10.6
RH-MW-3P	07/28/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
RH-MW-7	07/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
RH-MW-7 Dup	07/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
SD-I-01	08/01/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<11.1
SD-I-02	08/01/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
SD-I-02 Dup	08/01/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
SMW12	07/31/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
Whiteley MW-1	07/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
Whiteley MW-2	07/30/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
ZPMW-1	08/01/17	<1	<1	<1	<1	<4	<1	<1	<4	<1	<1	<4	<1
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	0.017	NA	NA
DEQ7 Groundwater Standard		3	100	NA	70	30	NA	NA	0.2	4	0.004	NA	600
EPA RSL Tapwater		NA	NA	21,000	NA	NA	240	250	NA	NA	NA	8	NA

Notes:
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RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
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TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,3-Di- chloro-benzene (εg/L)	1,4-Di- chloro-benzene (εg/L)	Dichloro- difluoro-methane (εg/L)	1,1-Dichloro-ethane (εg/L)	1,2- Dichloro-ethane (εg/L)	1,1-Dichloro-ethene (εg/L)	cis-1,2- Dichloro-ethene (εg/L)	trans-1,2-Dichloro- ethene (εg/L)	Dichlorofluoromethane (εg/L)	1,2-Dichloro-propane (εg/L)	1,3-Dichloro-propane (εg/L)	2,2-Dichloro-propane (εg/L)
EMW-11P	07/26/17	<1	<1	<1	<1	<1	<1	**124 J+**	<1	<1	<4	<1	<4
EMW-15	07/31/17	<1	<1	<1	<1	<1 UJ	<1	**119**	<1	<1	<4	<1	<4
EMW-15P	07/31/17	<1	<1	<1	<1	<1 UJ	<1	**104**	<1	<1	<4	<1	<4
EMW-18	07/29/17	<1	<1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
EMW-21	07/28/17	<10.6	<10.6	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
EMW-21P	07/28/17	<1	<1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
EMW-26	07/29/17	<10.9	<10.9	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
EMW-28	07/29/17	<1	<1	<1	<1	<1	<1	5.2	<1	<1	<4	<1	<4
EMW-32	08/31/17	<1	<1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
GSMW-5	07/31/17	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<20 UJ	<5 UJ	<20 UJ
PEP07	07/31/17	<10.6	<10.6	<1	<1	<1	<1	6.2	<1	<1	<4	<1	<4
RH-MW-1	07/30/17	<1	<1	<1	<1	<1	<1	36.6	<1	<1	<4	<1	<4
RH-MW-3	07/28/17	<10.6	<10.6	<1	<1	<1 UJ	<1	31.6	1.1	<1	<4	<1	<4
RH-MW-3P	07/28/17	<1	<1	<1	<1	<1	<1	32.8	<1	<1	<4	<1	<4
RH-MW-7	07/30/17	<1	<1	<1	<1	<1	<1	30.4	<1	<1	<4	<1	<4
RH-MW-7 Dup	07/30/17	<1	<1	<1	<1	<1	<1	33	<1	<1	<4	<1	<4
SD-I-01	08/01/17	<11.1	<11.1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
SD-I-02	08/01/17	<1	<1	<1	<1	<1 UJ	<1	<1	<1	<1	<4	<1	<4
SD-I-02 Dup	08/01/17	<1	<1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
SMW12	07/31/17	<1	<1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
Whiteley MW-1	07/30/17	<1	<1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
Whiteley MW-2	07/30/17	<1	<1	<1	<1	<1	<1	<1	<1	<1	<4	<1	<4
ZPMW-1	08/01/17	<1	<1	<1	<1	1	<1	<1	<1	<1	<4	<1	<4
RBCA RBSLs Groundwater		NA	NA	NA	NA	4	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		600	75	1,000	NA	4	7	70	100	NA	5	NA	NA
EPA RSL Tapwater		NA	NA	NA	2.7	NA	NA	NA	NA	NA	NA	370	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,1-Dichloro-propene (εg/L)	Cis-1,3- dichloro-propene (εg/L)	trans-1,3-Dichloro- propene (εg/L)	Diethyl ether (εg/L)	Ethyl- benzene (εg/L)	Hexachloro-butadiene (εg/L)	Isopropyl-benzene (εg/L)	p-Isopropyl-toluene (εg/L)	4-Methyl- 2-Pentanone (εg/L)	Methylene Chloride (εg/L)	MTBE (εg/L)	Naphthalene (εg/L)
EMW-11P	07/26/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
EMW-15	07/31/17	<1	<4	<4	<4 UJ	<1	<1	<1	<1	<5	<4	<1 UJ	<5 UJ
EMW-15P	07/31/17	<1	<4	<4	<4 UJ	<1	<1	<1	<1	<5	<4	<1	<4
EMW-18	07/29/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<5
EMW-21	07/28/17	<1	<4	<4	<4	<1	<10.6	<1	<1	<5	<4	<1	<5
EMW-21P	07/28/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
EMW-26	07/29/17	<1	<4	<4	<4	<1	<10.9	<1	<1	<5	<4	<1 UJ	<5 UJ
EMW-28	07/29/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<5
EMW-32	08/31/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<5
GSMW-5	07/31/17	<5 UJ	<20 UJ	<20 UJ	<20 UJ	700 J-	<5 UJ	26.6 J-	<5 UJ	<25 UJ	<20 UJ	4.4 J-	57 J-
PEP07	07/31/17	<1	<4	<4	<4	<1	<10.6 UJ	<1	<1	<5	<4	<1	<5
RH-MW-1	07/30/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
RH-MW-3	07/28/17	<1	<4	<4	<4 UJ	<1	<10.6	<1	<1	<5	<4	<1	<5
RH-MW-3P	07/28/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
RH-MW-7	07/30/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
RH-MW-7 Dup	07/30/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
SD-I-01	08/01/17	<1	<4	<4	<4	<1	<11.1 UJ	<1	<1	<5	<4	<1	<5
SD-I-02	08/01/17	<1	<4	<4	<4 UJ	<1	<1	<1	<1	<5	<4	<1	<4
SD-I-02 Dup	08/01/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
SMW12	07/31/17	<1	<4	<4	<4	<2.5	<1	<1	<1	<5	<4	<5	<4
Whiteley MW-1	07/30/17	<1	<4	<4	<4	203	<1	39.1	<1	<5	<4	<1	<4
Whiteley MW-2	07/30/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
ZPMW-1	08/01/17	<1	<4	<4	<4	<1	<1	<1	<1	<5	<4	<1	<4
RBCA RBSLs Groundwater		NA	NA	NA	NA	700	NA	NA	NA	NA	NA	30	100
DEQ7 Groundwater Standard		NA	4	2	NA	700	5	NA	NA	NA	5	30	100
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	450	NA	1,200	NA	NA	NA

Notes:
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RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
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TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	n-Propyl-benzene (εg/L)	Styrene (εg/L)	1,1,1,2-Tetrachloro- ethan (εg/L)	1,1,2,2-Tetrachloro- ethan (εg/L)	Tetrachloro-ethene (εg/L)	Tetrahydrofuran (εg/L)	Toluene (εg/L)	1,2,3- Trichloro-benzene (εg/L)	1,2,4- Trichloro-benzene (εg/L)	1,1,1- Trichloro-ethane (εg/L)	1,1,2- Trichloro-ethane (εg/L)	Trichloro- ethene (εg/L)
EMW-11P	07/26/17	<1	<1	<1	<1	**35.2**	<10	<1	<1	<1	<1	<1	**165**
EMW-15	07/31/17	<1	<4	<1	<1	**136**	<10	<1	<1	<1	<1	<1	**107**
EMW-15P	07/31/17	<1	<4	<1	<1	**132**	<10	<1	<1	<1	<1	<1	**92.9**
EMW-18	07/29/17	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<0.4
EMW-21	07/28/17	<1	<1	<1	<1	<1	<10	<1	<1	<10.6	<1	<1	<0.4
EMW-21P	07/28/17	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<0.4
EMW-26	07/29/17	<1	<1	<1	<1	<1	<10 UJ	<1	<1	<10.9	<1	<1	<0.4
EMW-28	07/29/17	<1	<1	<1	<1	**12.3**	<10 UJ	<1	<1	<1	<1	<1	2.6
EMW-32	08/31/17	<1	<1	<1	<1	2.4	<10	<1	<1	<1	<1	<1	<0.4
GSMW-5	07/31/17	77.5 J-	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<50 UJ	2.1 J-	<5 UJ	<5 UJ	<5 UJ	<5 UJ	<2 UJ
PEP07	07/31/17	<1	<4	<1	<1	**589**	<10	<1	<1	<10.6 UJ	1	<1	**18**
RH-MW-1	07/30/17	<1	<1	<1	<1	**130**	<10	<1	<1	<1	<1	<1	**21.9**
RH-MW-3	07/28/17	<1	<4	<1	<1	**29.2**	<10	<1	<1	<10.6	<1	<1	**11.2**
RH-MW-3P	07/28/17	<1	<1	<1	<1	**30.4**	<10	<1	<1	<1	<1	<1	**10.5**
RH-MW-7	07/30/17	<1	<1	<1	<1	**114**	<10	<1	<1	<1	<1	<1	**21.6**
RH-MW-7 Dup	07/30/17	<1	<1	<1	<1	**116**	<10	<1	<1	<1	<1	<1	**20.6**
SD-I-01	08/01/17	<1	<1	<1	<1	**7.2**	<10	<1	<1	<11.1 UJ	<1	<1	1.2
SD-I-02	08/01/17	<1	<4	<1	<1	**18.5**	<10	<1	<1	<1	<1	<1	0.79
SD-I-02 Dup	08/01/17	<1	<1	<1	<1	**21.9**	<10	<1	<1	<1	<1	<1	0.72
SMW12	07/31/17	<1	<4	<1	<1	4.4	<10	<2.5	<1	<1	<1	<1	<0.4
Whiteley MW-1	07/30/17	43.7	<1	<1	<1	<1	<10	1.8	<1	<1	<1	<1	<0.4
Whiteley MW-2	07/30/17	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<0.4
ZPMW-1	08/01/17	<1	<4	<1	<1	**42.8**	<10	<1	<1	<1	<1	<1	4
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	1,000	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	100	NA	2	5	NA	1,000	NA	70	200	3	5
EPA RSL Tapwater		660	NA	0.57	NA	NA	NA	NA	7	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
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RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
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TABLE 3. - THIRD QUARTER 2017 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Trichloro-fluoromethane (εg/L)	1,2,3- Trichloro-propane (εg/L)	1,1,2- Trichloro-trifluoro- ethane (εg/L)	1,2,4- Trimethyl-benzene (εg/L)	1,3,5-Trimethyl-benzene (εg/L)	Vinyl Chloride (εg/L)	m,p-Xylene (εg/L)	o-Xylene (εg/L)	Xylenes, Total (εg/L)
EMW-11P	07/26/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
EMW-15	07/31/17	<1	<4	<1	<1	<1	**0.54**	<2	<1	<3
EMW-15P	07/31/17	<1	<4	<1	<1	<1	**0.52**	<2	<1	<3
EMW-18	07/29/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
EMW-21	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
EMW-21P	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
EMW-26	07/29/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
EMW-28	07/29/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
EMW-32	08/31/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
GSMW-5	07/31/17	<5 UJ	<20 UJ	<5 UJ	**274 J-**	<5 UJ	<1 UJ	43.7 J-	2.4 J-	45.7 J-
PEP07	07/31/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
RH-MW-1	07/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
RH-MW-3	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
RH-MW-3P	07/28/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
RH-MW-7	07/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
RH-MW-7 Dup	07/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
SD-I-01	08/01/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
SD-I-02	08/01/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
SD-I-02 Dup	08/01/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
SMW12	07/31/17	<1	<4	<1	<1	<1	<0.2	<2.5	<2.5	<3
Whiteley MW-1	07/30/17	<1	<4	<1	**18.1**	<1	<0.2	4.4	11.4	15.8
Whiteley MW-2	07/30/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
ZPMW-1	08/01/17	<1	<4	<1	<1	<1	<0.2	<2	<1	<3
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	10,000
DEQ7 Groundwater Standard		10,000	NA	NA	NA	NA	0.2	10,000	10,000	10,000
EPA RSL Tapwater		NA	0.62	NA	15	120	NA	NA	NA	NA

Notes:
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RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 4. - THIRD QUARTER 2017 SEMIVOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Benzene (εg/L)	C5-C8, Aliphatic, Unadjusted (εg/L)	C9-C10, Aromatic, Unadjusted (εg/L)	C9-C12, Aliphatic, Unadjusted (εg/L)	Ethyl-benzene (εg/L)	m,p-Xylene (εg/L)	MTBE (εg/L)	Naphthalene (εg/L)	o-Xylene (εg/L)	Toluene (εg/L)	Total Purgeable Hydrocarbon (εg/L)	Xylenes, Total (εg/L)
20170801-IDW-01	08/01/17	<0.5	46.3	26.8	47.4	4.6	1.8	<1	<5	<0.5	<0.5	101	<2
BMW07-1	07/29/17	<1	35.8 J+	<20	<20	<1	<2	<1	<5	<1	<1	31.7 J+	<3
BMW-1	07/29/17	<1	45.4 J+	<20	<20	<1	<2	<1	<5	<1	<1	40.4 J+	<3
BMW-4	07/28/17	1.4	36.3	<20	<20	<1	<2	<1	<5	<1	<1	34	<3
BNMW-17	08/30/17	<1	<20	22.1	60.6	<1	<2	<1	6.5 J-	<1	<1	104 JB	<3
BNMW-20	08/30/17	<1	<20	<20	<20	<1	<2	<1	<5 UJ	<1	<1	<20	<3
BNMW-21	08/31/17	<1	21.2	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
BNMW-23	08/31/17	<1	298 J+	202 J+	280 J+	6.8 J+	<2	<1	<5	<1	<1	587 J+	<3
BNMW-24	08/30/17	<1	<20	<20	<20	<1	<2	<1	<5 UJ	<1	<1	<20	<3
BNMW-8	08/30/17	<1	<20	<20	<20	<1	<2	<1	<5 UJ	<1	<1	<20	<3
BNMW-8 Dup	08/30/17	<1	<20	<20	<20	<1	<2	<1	<5 UJ	<1	<1	<20	<3
BNMW-9	08/30/17	<1	<20	<20	<20	<1	<2	<1	<5 UJ	<1	<1	<20	<3
BPGP02	08/31/17	**147**	**1660**	819	**1430**	320	94.1	<5	38.9	6.8	12.7	3110	130
BPGP04	07/31/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP05	07/26/17	<1	176 J+	<20	<20	<1	<2	<1	<5	<1	<1	157 J+	<3
BPGP08	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP12	07/28/17	<1	208 J+	<20	<20	<1	<2	<1	<5	<1	<1	184 J+	<3
BPGP15	07/28/17	<1	21.6	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
BPGP16	07/30/17	<1	160 J+	<20	<20	<1	<2	<1	<5	<1	<1	142 J+	<3
BPGP17	07/30/17	<1	42 J+	<20	<20	<1	<2	<1	<5	<1	<1	37.1 J+	<3
BPGP22	07/30/17	<1	92 J+	<20	<20	<1	<2	<1	<5	<1	<1	81.7 J+	<3
BPGP25	07/28/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP27	07/28/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP27 Dup	07/28/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP28	07/28/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP29	07/28/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP31	07/31/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP32	07/26/17	<1	27.3	<20	<20	<1	<2	<1	<5	<1	<1	24.2	<3
BPGP41	07/28/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
BPGP42	07/28/17	<1	87.8 J+	<20	<20	<1	<2	<1	<5	<1	<1	77.6 J+	<3
BPGP44	07/31/17	<1	57.7 J+	<20	<20	<1	<2	<1	<5	<1	<1	51.4 J+	<3
BPGP46	07/27/17	<1	**1950**	63.3	70.6	<1	<2	14.1 J	<5	<1	<1	1720	<3
BPGP46b	07/27/17	<1 UJ	<20	<20	<20	<1 UJ	<2 UJ	<1 UJ	<5	<1 UJ	<1 UJ	<20	<3 UJ
BPGP47	07/28/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP48	07/28/17	<1 UJ	34.4	<20	<20	<1 UJ	<2 UJ	<1 UJ	<5	<1 UJ	<1 UJ	30.4	<3 UJ
BPGP49	07/27/17	1.6 J-	--	--	--	59.3 J-	<2 UJ	<1 UJ	7.6 J-	2.2 J-	1.5/ND(1.5)U*	--	<3 UJ
BPGP50	07/30/17	<1	26.8 J+	<20	<20	<1	<2	<1	<5	<1	<1	24 J+	<3
RBCA RBSLs Groundwater		5	650	1,100	1,400	700	NA	30	100	NA	1,000	NA	10,000
DEQ7 Groundwater Standard		5	NA	NA	NA	700	10,000	30	100	10,000	1,000	NA	10,000
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 4. - THIRD QUARTER 2017 SEMIVOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Benzene (εg/L)	C5-C8, Aliphatic, Unadjusted (εg/L)	C9-C10, Aromatic, Unadjusted (εg/L)	C9-C12, Aliphatic, Unadjusted (εg/L)	Ethyl-benzene (εg/L)	m,p-Xylene (εg/L)	MTBE (εg/L)	Naphthalene (εg/L)	o-Xylene (εg/L)	Toluene (εg/L)	Total Purgeable Hydrocarbon (εg/L)	Xylenes, Total (εg/L)
BPGP51	07/27/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP51B	07/27/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP53	07/27/17	<5 UJ	--	--	--	<5 UJ	<10 UJ	<5 UJ	<20 UJ	<5 UJ	<5 UJ	--	<15 UJ
BPGP54	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP58	07/31/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP59	07/26/17	0.55 J+	**1190 J+**	<20	<20	<1	<2	<1	<5	<1	<1	1060 J+	<3
BPGP60	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP60 Dup	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP61	07/27/17	1.8 J-	--	--	--	<1 UJ	6.9 J-	<1 UJ	11.4 J-	<1 UJ	<1 UJ	--	6.9 J-
BPGP63	07/27/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP63B	07/27/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP65	07/27/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP65B	07/27/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
BPGP66	07/26/17	<2.5	**920 J+**	<100	<100	<2.5	<2.5	<5	<4	<2.5	<2.5	850 J+	<3
BPGP67	07/31/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP74	07/27/17	<1 UJ	--	--	--	<1 UJ	<2 UJ	<1 UJ	<4 UJ	<1 UJ	<1 UJ	--	<3 UJ
BPGP76	07/31/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP78	07/27/17	**8.7**	544	193	355	81.5	<2.5	<5	<4	<2.5	<2.5	890	<3
BPGP80	07/26/17	<1	**784 J+**	<20	<20	<1	<2	<1	<5	<1	<1	698 J+	<3
BPGP81	07/31/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP83	07/28/17	<1	264 J+	<20	<20	<1	<2	<1	<5	<1	<1	234 J+	<3
BPGP84	07/31/17	<1	151 J	<20 UJ	<20 UJ	<1	<2	<1 UJ	<5 UJ	<1	<1	134 J	<3
BPGP85	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP86	07/28/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP87	07/31/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP88	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP89	07/30/17	**250 J-**	**1070 J-**	140 J-	403 J-	196	8.9	<1 UJ	<5 UJ	1.2 J-	6.5 J-	1850 J-	8.9
BPGP90	07/30/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP91	07/29/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGP92	07/30/17	<1	160 J+	<20	<20	<1	<2	<1	<5	<1	<1	142 J+	<3
BPGP92 Dup	07/30/17	<1	171 J+	<20	<20	<1	<2	<1	<5	<1	<1	151 J+	<3
BPGP93	07/31/17	<1	27.3 J+	<20	<20	<1	<2	<1	<5	<1	<1	24.2 J+	<3
BPGP94	07/30/17	<1	36.9 J+	<20	<20	<1	<2	<1	<5	<1	<1	32.7 J+	<3
BPGW01	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
BPGW04	07/27/17	<1	50.6 JB	25.1	34.8	<1	<2	<1	<5	<1	<1	87.1	<3
BPGW04P	07/27/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
CENEX-5	07/28/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
RBCA RBSLs Groundwater		5	650	1,100	1,400	700	NA	30	100	NA	1,000	NA	10,000
DEQ7 Groundwater Standard		5	NA	NA	NA	700	10,000	30	100	10,000	1,000	NA	10,000
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
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TABLE 4. - THIRD QUARTER 2017 SEMIVOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Benzene (εg/L)	C5-C8, Aliphatic, Unadjusted (εg/L)	C9-C10, Aromatic, Unadjusted (εg/L)	C9-C12, Aliphatic, Unadjusted (εg/L)	Ethyl-benzene (εg/L)	m,p-Xylene (εg/L)	MTBE (εg/L)	Naphthalene (εg/L)	o-Xylene (εg/L)	Toluene (εg/L)	Total Purgeable Hydrocarbon (εg/L)	Xylenes, Total (εg/L)
EMW-03	07/28/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
EMW-03P	07/28/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
EMW-09	08/01/17	<2	**857**	856	**1440**	264 J	42.4	<25	45.6	4.9	<2	2540	47.2
EMW-11	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
EMW-11P	07/26/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
EMW-15	07/31/17	3.8 J	216 J	<20 UJ	24.9 J	<1	<2	<1 UJ	<5 UJ	<1	<1	222 J	<3
EMW-15P	07/31/17	2.8	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
EMW-18	07/29/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
EMW-21	07/28/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
EMW-21P	07/28/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
EMW-26	07/29/17	<1	<20 UJ	<20 UJ	<20 UJ	<1	<2	<1 UJ	<5 UJ	<1	<1	<20 UJ	<3
EMW-28	07/29/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
EMW-32	08/31/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
GSMW-5	07/31/17	5.3 J-	**720 J-**	846 J-	**1720 J-**	700 J-	43.7 J-	4.4 J-	57 J-	2.4 J-	2.1 J-	3220 J-	45.7 J-
PEP07	07/31/17	<1	207 J+	<20	<20	<1	<2	<1	<5	<1	<1	183 J+	<3
RH-MW-1	07/30/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
RH-MW-3	07/28/17	<1	28.8 J+	<20	<20	<1	<2	<1	<5	<1	<1	25.5 J+	<3
RH-MW-3P	07/28/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
RH-MW-7	07/30/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
RH-MW-7 Dup	07/30/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
SD-I-01	08/01/17	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
SD-I-02	08/01/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
SD-I-02 Dup	08/01/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
SMW12	07/31/17	<2.5	<100	<100	<100	<2.5	<2.5	<5	<4	<2.5	<2.5	<100	<3
Whiteley MW-1	07/30/17	<1	--	--	--	203	4.4	<1	<4	11.4	1.8	--	15.8
Whiteley MW-2	07/30/17	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
ZPMW-1	08/01/17	2.3	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
RBCA RBSLs Groundwater		5	650	1,100	1,400	700	NA	30	100	NA	1,000	NA	10,000
DEQ7 Groundwater Standard		5	NA	NA	NA	700	10,000	30	100	10,000	1,000	NA	10,000
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
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-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
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TABLE 5. - THIRD QUARTER 2017 METALS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Aluminum, Dissolved (εg/L)	Antimony, Dissolved (εg/L)	Arsenic, Dissolved (εg/L)	Barium, Dissolved (εg/L)	Beryllium, Dissolved (εg/L)	Cadmium, Dissolved (εg/L)	Chromium, Dissolved (εg/L)	Cobalt, Dissolved (εg/L)	Copper, Dissolved (εg/L)	Iron, Dissolved (εg/L)	Lead, Dissolved (εg/L)	Manganese, Dissolved (εg/L)
BMW-1	07/29/17	11.5/ND(11.5)U*	<0.5	2.5	10	<0.2	0.099	<0.5	1	2.2	<50	<0.1	**544**
BMW-4	07/28/17	<10	<0.5	2.8	11.6	<0.2	<0.08	<0.5	<0.5	2.2	<50	<0.1	1
BNMW-17	08/30/17	39.9 JB	<0.5	7.4	227	<0.2	<0.08	1.3	<0.5	<1	1610	<0.1	**1520**
BNMW-20	08/30/17	29.2 JB	<0.5	2.1	11	<0.2	<0.08	1.7	<0.5	1.5	<50	<0.1	<0.5
BNMW-21	08/31/17	11.6	<0.5	1.9	14	<0.2	<0.08	1.4	<0.5	2.7	<50	0.24	0.61
BNMW-23	08/31/17	<10	<0.5	1.8	28.6	<0.2	<0.08	<0.5	2.3	<1	71.3	<0.1	**1540**
BNMW-24	08/30/17	60.2 JB	<0.5	1.8	30.6	<0.2	<0.08	<0.5	<0.5	2	<50	<0.1	1.8
BNMW-8	08/30/17	22.3 JB	<0.5	1.9	12.6	<0.2	<0.08	<0.5	<0.5	1.4	<50	<0.1	4.3
BNMW-8 Dup	08/30/17	32.7 JB	<0.5	2	13	<0.2	<0.08	<0.5	<0.5	1.1	<50	<0.1	4.5
BNMW-9	08/30/17	<10 UJ	<0.5	2.2	14.7	<0.2	0.15	<0.5	1.2	1.8	<50	<0.1	**989**
BPGP02	08/31/17	<10	<0.5	5.9	123	<0.2	<0.08	<0.5	<0.5	<1	339	0.28	366
BPGP05	07/26/17	<10	<0.5	1.5	30.2	<0.2	<0.08	0.75	<0.5	1.5	<50	<0.1	24.9 J-
BPGP12	07/28/17	<10	<0.5	2.1	15.8	<0.2	<0.08	0.69	<0.5	1.9	<50	<0.1	0.53/ND(0.53)U*
BPGP15	07/28/17	<10	<0.5	1.6	11.2	<0.2	<0.08	<0.5	<0.5	1.7	<50	<0.1	<0.5
BPGP22	07/30/17	<10	<0.5	2.6	13.1	<0.2	<0.08	<0.5	2.1	1.9	<50	<0.1	**629**
BPGP32	07/26/17	<10	<0.5	2.1	12.2	<0.2	<0.08	1.2	<0.5	1.4	<50	<0.1	<0.5 UJ
BPGP41	07/28/17	50.6 JB	<0.5	1.5	10.8	<0.2	<0.08	0.63	<0.5	2.4	70.2	<0.1	0.87
BPGP42	07/28/17	18.2	<0.5	2.1	8.8	<0.2	<0.08	<0.5	0.69	2.2	<50	<0.1	51.9
BPGP46	07/27/17	<10	<0.5	3.1	19	<0.2	<0.08	<0.5	1	<1	<50	<0.1	**885 J-**
BPGP48	07/28/17	14.2	<0.5	1.8	11.4	<0.2	<0.08	<0.5	<0.5	2.6	<50	<0.1	<0.5
BPGP50	07/30/17	11.8/ND(11.8)U*	<0.5	2.5	25.9	<0.2	<0.08	<0.5	<0.5	1.9	<50	<0.1	<0.5
BPGP59	07/26/17	15.1	<0.5	1.9	22.9	<0.2	<0.08	<0.5	3.6	1.9	<50	<0.1	**530 J-**
BPGP65B	07/27/17	<10	<0.5	1.7	10.8	<0.2	<0.08	<0.5	<0.5	1.7	<50	<0.1	57.2 J-
BPGP66	07/26/17	<10	<0.5	2	16.6	<0.2	<0.08	<0.5	1.7	1.6	<50	<0.1	**596 J-**
BPGP78	07/27/17	<10	<0.5	4.4	22.1	<0.2	<0.08	<0.5	1.1	<1	791	<0.1	**724 J-**
BPGP80	07/26/17	<10	<0.5	2	14	<0.2	<0.08	<0.5	3.1	2.2	<50	<0.1	**627 J-**
BPGP83	07/28/17	11	<0.5	2	11.4	<0.2	<0.08	<0.5	<0.5	1.4	<50	<0.1	<0.5
BPGP87	07/31/17	15.4/ND(15.4)U*	<0.5	2	19.4	<0.2	<0.08	1.2	<0.5	1.6	<50	<0.1	<0.5
BPGP92	07/30/17	15/ND(15)U*	<0.5	2.2	12.5	<0.2	<0.08	<0.5	0.95	1.9	<50	<0.1	129
BPGP92 Dup	07/30/17	<10	<0.5	2.2	12.7	<0.2	<0.08	<0.5	0.98	1.4	<50	<0.1	140
BPGP94	07/30/17	20.2/ND(20.2)U*	<0.5	2.5	12	<0.2	<0.08	0.68	<0.5	1.4	<50	<0.1	<0.5
BPGW04	07/27/17	<10	<0.5	1.9	69.6	<0.2	<0.08	1.7	<0.5	1.3	<50	<0.1	44.9 J-
CENEX-5	07/28/17	114	<0.5	1.6	28.7	<0.2	0.096	<0.5	<0.5	2.6	124	<0.1	**550**
EMW-03	07/28/17	18.5	<0.5	3	26.4	<0.2	<0.08	<0.5	1.1	1.5	<50	<0.1	**1060**
EMW-21	07/28/17	15.9	<0.5	5.2	42.5	<0.2	<0.08	0.56	2.5	<1	258	<0.1	242
EMW-32	08/31/17	<10	<0.5	1.2	40.8	<0.2	<0.08	1.4	<0.5	1.3	<50	<0.1	<0.5
GSMW-5	07/31/17	54.3/ND(54.3)U*	<0.5	4.9	139	<0.2	<0.08	<0.5	0.57	<1	1130	<0.1	**2140**
RH-MW-3	07/28/17	<10	<0.5	1.1	43.3	<0.2	0.11	<0.5	<0.5	2.5	<50	<0.1	67
SD-I-01	08/01/17	<10	<0.5	1.4	16.6	<0.2	<0.08	0.56	1.1	2.7	64.9	<0.1	70.8
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	6	10	1,000	4	5	100	NA	1,300	NA	15	NA
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	14,000	NA	430

Notes:
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RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
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J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
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TABLE 5. - THIRD QUARTER 2017 METALS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Mercury, Dissolved (εg/L)	Nickel, Dissolved (εg/L)	Selenium, Dissolved (εg/L)	Silver, Dissolved (εg/L)	Thallium, Dissolved (εg/L)	Vanadium, Dissolved (εg/L)	Zinc, Dissolved (εg/L)
BMW-1	07/29/17	<0.01	7.8	7.6	<0.5	<0.1	2.3	<5
BMW-4	07/28/17	<0.01	4.2	3.1	<0.5	<0.1	2.3	<5
BNMW-17	08/30/17	<0.01	1.9	1.2	<0.5	<0.1 UJ	6	<5
BNMW-20	08/30/17	<0.01	1.9	7.6	<0.5	<0.1 UJ	2.4	<5
BNMW-21	08/31/17	<0.01	3.7	7.5	<0.5	<0.1	1.8	<5
BNMW-23	08/31/17	<0.01	8.8	0.56	<0.5	<0.1	2.6	<5
BNMW-24	08/30/17	<0.01	2	4.9	<0.5	<0.1 UJ	1.7	<5
BNMW-8	08/30/17	<0.01	2.6	13.1	<0.5	<0.1 UJ	2	<5
BNMW-8 Dup	08/30/17	<0.01	2.5	12.8	<0.5	<0.1 UJ	2.1	<5
BNMW-9	08/30/17	<0.01	10.4	4.2	<0.5	<0.1 UJ	1.9	<5
BPGP02	08/31/17	<0.01	1.3	<0.5	<0.5	<0.1	1.4	<5
BPGP05	07/26/17	<0.01	1.6	2.5	<0.5	<0.1	1.2	<5
BPGP12	07/28/17	<0.01	2.9	10.8	<0.5	<0.1	1.7	<5
BPGP15	07/28/17	<0.01	4.1	7.9	<0.5	<0.1	1.3	<5
BPGP22	07/30/17	<0.01	7.4	6.2	<0.5	<0.1	1.9	<5
BPGP32	07/26/17	<0.01	2.3	2.8	<0.5	<0.1	1.6	<5
BPGP41	07/28/17	<0.01	2.5	10.3	<0.5	<0.1	1.2	<5
BPGP42	07/28/17	<0.01	5.9	9.1	<0.5	<0.1	1.6	<5
BPGP46	07/27/17	<0.01	3.3	2.6	<0.5	<0.1	1.3	<5
BPGP48	07/28/17	<0.01	12.2	21.5	<0.5	<0.1	1.7	<5
BPGP50	07/30/17	<0.01	5.3	9.5	<0.5	<0.1	2.8	<5
BPGP59	07/26/17	<0.01	6	5.7	<0.5	<0.1	1.8	<5
BPGP65B	07/27/17	<0.01	3.9	4.5	<0.5	<0.1	1.3	<5
BPGP66	07/26/17	<0.01	4.5	3.8	<0.5	<0.1	1.6	<5
BPGP78	07/27/17	<0.01	4.1	1.7	<0.5	<0.1	1.5	<5
BPGP80	07/26/17	<0.01	5.1	7.6	<0.5	<0.1	2.1	<5
BPGP83	07/28/17	<0.01	2.3	6.7	<0.5	<0.1	1.9	<5
BPGP87	07/31/17	<0.01	1.7	5.2	<0.5	<0.1	1.8	<5
BPGP92	07/30/17	<0.01	5.2	9.4	<0.5	<0.1	1.2	<5
BPGP92 Dup	07/30/17	<0.01	5.4	9.4	<0.5	<0.1	1.2	<5
BPGP94	07/30/17	<0.01	3.7	5	<0.5	<0.1	1.8	<5
BPGW04	07/27/17	<0.01	1.3	15.2	<0.5	<0.1	1.1	<5
CENEX-5	07/28/17	<0.01	5.1	11	<0.5	<0.1	2.3	<5
EMW-03	07/28/17	<0.01	5.7	11.3	<0.5	<0.1	4.4	<5
EMW-21	07/28/17	<0.01	5	2.4	<0.5	<0.1	3.7	<5
EMW-32	08/31/17	<0.01	1	9.4	<0.5	<0.1	1.3	<5
GSMW-5	07/31/17	<0.01	1.9	1.1	<0.5	<0.1	1.5	<5
RH-MW-3	07/28/17	<0.01	3.3	12.9	<0.5	<0.1	4.3	<5
SD-I-01	08/01/17	<0.01	5.1	9.6	<0.5	<0.1	1.4	69.6
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		2	100	50	100	2	NA	2,000
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 5. - THIRD QUARTER 2017 METALS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Aluminum, Dissolved (εg/L)	Antimony, Dissolved (εg/L)	Arsenic, Dissolved (εg/L)	Barium, Dissolved (εg/L)	Beryllium, Dissolved (εg/L)	Cadmium, Dissolved (εg/L)	Chromium, Dissolved (εg/L)	Cobalt, Dissolved (εg/L)	Copper, Dissolved (εg/L)	Iron, Dissolved (εg/L)	Lead, Dissolved (εg/L)	Manganese, Dissolved (εg/L)
ZPMW-1	08/01/17	15.4	<0.5	1.4	24.5	<0.2	<0.08	<0.5	1.8	1.2	80.3	<0.1	**462**
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	6	10	1,000	4	5	100	NA	1,300	NA	15	NA
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	14,000	NA	430

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 5. - THIRD QUARTER 2017 METALS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Mercury, Dissolved (εg/L)	Nickel, Dissolved (εg/L)	Selenium, Dissolved (εg/L)	Silver, Dissolved (εg/L)	Thallium, Dissolved (εg/L)	Vanadium, Dissolved (εg/L)	Zinc, Dissolved (εg/L)
ZPMW-1	08/01/17	<0.01	3.4	15.2	<0.5	<0.1	2	<5
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		2	100	50	100	2	NA	2,000
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

TABLE 6. - THIRD QUARTER 2017 MONITORED NATURAL ATTENUATION PARAMETERS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Carbon (mg/L)	Chloride (mg/L)	Ethane (εg/L)	Ethylene (εg/L)	Methane (εg/L)	Nitrogen, Nitrate & Nitrite (mg/L)	Sulfate (mg/L)
BMW-1	07/29/17	1.2	136	<10	<10	<10	9.3	1050
BMW-4	07/28/17	2.1	95	<10	<10	34.2	7.8	1240
BNMW-21	08/31/17	1.1	85.4	<10	<10	<10	17	1140
BNMW-23	08/31/17	3	89.5	<10	<10	11.1	2.5	1130
BPGP02	08/31/17	6.8	53.7	<10	<10	397	0.011	146
BPGP05	07/26/17	0.91	78.6 J+	<10	<10	<10	1.8	388 J+
BPGP12	07/28/17	1.1	92.7	<10	<10	<10	4	1170
BPGP15	07/28/17	1.6	<100	<10	<10	<10	4.6	1500
BPGP22	07/30/17	1.5	68	<10	<10	<10	2.4	1290
BPGP32	07/26/17	1.2	69.2 J+	<10	<10	<10	1.9	862 J+
BPGP41	07/28/17	1.8	80.1	<10	<10	<10	0.78	1600
BPGP42	07/28/17	1.1	85.8	<10	<10	<10	3.7	1230
BPGP46	07/27/17	1.1	71.9	<10	<10	16	2	403
BPGP48	07/28/17	3.3	94.1	<10	<10	<10	1.8	1890
BPGP50	07/30/17	<0.84	414	<10	<10	<10	3.3	1080
BPGP59	07/26/17	1.3	72.4 J+	<10	<10	55.9	1.1	542 J+
BPGP65B	07/27/17	1.3	47.6	<10	<10	<10	1.6	746
BPGP66	07/26/17	1.3	38.7 J+	<10	<10	40.1	0.5	337 J+
BPGP78	07/27/17	1.7	121 J+	<10	<10	309	0.033 JB	1190 J+
BPGP80	07/26/17	1.2	81.2 J+	<10	<10	51	4	962 J+
BPGP83	07/28/17	0.9	63.2	<10	<10	<10	4.9	633
BPGP92	07/30/17	1.2	71.6	<10	<10	<10	2.2	1030
BPGP92 Dup	07/30/17	1.2	74.7	<10	<10	<10	2.8	1090
BPGP94	07/30/17	1.1	103	<10	<10	<10	14.4	1200
BPGW04	07/27/17	<0.84	180 J+	<10	<10	<10	7.5	136 J+
CENEX-5	07/28/17	1.5	91.3	<10	<10	19.4	7.8	444
EMW-03	07/28/17	1	116	<10	<10	<10	10.5	383
EMW-21	07/28/17	11.3	218	<10	<10	1870	0.63	748
RH-MW-3	07/28/17	<0.84	158	<10	<10	<10	2.1	645
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	NA	NA	NA	NA	NA	NA
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte

TABLE 6. - THIRD QUARTER 2017 MONITORED NATURAL ATTENUATION PARAMETERS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Carbon (mg/L)	Chloride (mg/L)	Ethane (εg/L)	Ethylene (εg/L)	Methane (εg/L)	Nitrogen, Nitrate & Nitrite (mg/L)	Sulfate (mg/L)
SD-I-01	08/01/17	1.3	96.9	<10	<10	<10	8.2	1070
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	NA	NA	NA	NA	NA	NA
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte

TABLE 7. SECOND QUARTER 2018 GROUNDWATER SAMPLING DETAILS AND RATIONALE
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

							Investigation Type				Proposed Analyses						
Location Number	**General Location**	**Sample 2018**	**Grid Area**	**Location Type (s)**	**Sample Method**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Sampling Suite**	**Rationale / Comments**
Existing Monitoring Well Locations																	
BMW07-1	Southern Plume Edge	Y	X:10,Y:3	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BMW-1	Southern Plume Edge	Y	X:9,Y:3	MW	Low-flow pump	2	X	X	-	-	X	-	X	-	X	VOCs + Metals + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BMW-4	Southern Plume Edge	Y	X:10,Y:3	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BNMW-17	Plume Body - BNSF Property	Y	X:13,Y:7	MW	Low-flow pump	2	X				X	-	X	X	-	VOCs + EPH + VPH + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BNMW-20	Plume Body - BNSF Property	Y	X:12,Y:7	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BNMW-21	Plume Body - BNSF Property	Y	X:13,Y:6	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BNMW-23	Plume Body - BNSF Property	Y	X:14,Y:6	MW	Peristaltic	1	X	X	-	-	X	-	X	-	X	VOCs + Metals + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sampled KJ/BN in 2014 for PCE
BNMW-24	Plume Body - BNSF Property	N	X:14,Y:6	MW	Low-flow pump	2	X	X	-	-	-	-	-	-	-	-	Clustered tightly between BNMW-21 and BNMW-23, along with BNMW-09. Does not provide additional spacial resolution data, will not sample, sampling -21 and -23 instead.
BNMW-8	Plume Body - BNSF Property	Y	X:13,Y:7	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BNMW-9	Plume Body - BNSF Property	Y	X:14,Y:6	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Retained for sampling in 2018 to delineate vinyl chloride plume.
BPGP02	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	X	X	VOCs + EPH + VPH + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Q3 Exceedance of VPH Fractions.
BPGP04	BSL Source Area	N	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	-	-	-	-	-	-	Characterized by nearby wells, removed from sample 2018.
BPGP05	Plume Body	Y	X:2,Y:2	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP08	Plume Body	Y	X:4,Y:2	MW	Peristaltic	0.5	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Comparison of 4" well to 1/2" well at BPGP08.
BPGP12	Plume Body	Y	X:5,Y:3	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	X	VOCs + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP15	Northern Plume Edge	Y	X:5,Y:4	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP16	Plume Body	Y	X:7,Y:5	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP17	Plume Body	Y	X:6,Y:5	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP22	Plume Body	Y	X:7,Y:4	MW	Peristaltic	0.75	X	X	-	-	X	-	X	-	-	VOCs + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP25	Plume Body	Y	X:7,Y:6	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP27	Northern Plume Edge	Y	X:7,Y:7	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sample located in northern edge of plume.
BPGP28	Plume Body	N	X:9,Y:7	MW	Peristaltic	0.75	X	X	-	-	-	-	-	-	-	-	Characterized by nearby wells, removed from sample 2018.
BPGP29	Plume Body	Y	X:10,Y:7	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of vinyl chloride in GW plume.
BPGP31	Northern Plume Edge	Y	X:6,Y:6	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Previously observed PCE concentrations below DEQ-7 standard.
BPGP32	Southern Plume Edge	N	X:1,Y:-1	MW	Peristaltic	0.75	X	X	-	-	-	-	-	-	-	-	Adjacent to SMW12, which can capture upgradient source concerns; removed from sample 2018.
BPGP41	Plume Body	Y	X:10,Y:7	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP42	Plume Body	Y	X:11,Y:7	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	X	VOCs + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP44	Plume Body	Y	X:12,Y:8	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP46	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	X	X	-	VOCs + EPH + VPH + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Q3 Exceedance of VPH Fractions.
BPGP46b	BSL Source Area	N	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	-	-	-	-	-	-	Characterize nature and extent of groundwater concentration
BPGP47	Northern Plume Edge	Y	X:9,Y:7	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sample located in northern edge of plume.

TABLE 7. SECOND QUARTER 2018 GROUNDWATER SAMPLING DETAILS AND RATIONALE
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

							Investigation Type				Proposed Analyses						
Location Number	**General Location**	**Sample 2018**	**Grid Area**	**Location Type (s)**	**Sample Method**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Sampling Suite**	**Rationale / Comments**
BPGP48	Northern Plume Edge	Y	X:7,Y:7	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sample located in northern edge of plume. Previously observed PCE concentrations below DEQ-7 standard.
BPGP49	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP50	Distal End of Plume	Y	X:14,Y:10	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	X	VOCs + MNA	Characterize distal edge of groundwater contamination. Sample located within known extent of plume impacts.
BPGP51	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP51B	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Deeper well comparison to shallower screen
BPGP53	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP54	BSL Source Area	N	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	-	-	-	-	-	-	Characterized by nearby wells, removed from sample 2018.
BPGP58	BSL Source Area	N	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	-	-	-	-	-	-	Characterized by nearby wells, removed from sample 2018.
BPGP59	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	X	X	X	VOCs + EPH + VPH + Metals + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Q3 Exceedance of VPH Fractions.
BPGP60	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP61	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP63	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. East/northeast of sheet pile area.
BPGP63B	BSL Source Area	N	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	-	-	-	-	-	-	Same depth as BPGP63, removed from sample 2018.
BPGP65	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP65B	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP66	BSL Source Area	N	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	-	-	-	X	-	-	Characterized by nearby wells, removed from sample 2018.
BPGP67	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Approximately 10+ feet from BPGP66, but order of magnitude lower in concentration in 2015.
BPGP74	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Historically highest concentration well just north of sheetpile.
BPGP76	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP78	BSL Source Area	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	X	X	X	X	VOCs + SVOCs + EPH + VPH + Metals + MNA	Characterize nature and extent of groundwater contamination. Only exceedance of SVOCs in Q3 2017 at this location. Q3 Exceedance of VPH Fractions.
BPGP80	Plume Body	Y	X:2,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	X	X	-	VOCs + EPH + VPH + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Q3 2017 Exceedance of VPH Fractions.
BPGP81	Plume Body	Y	X:2,Y:1	MW	Peristaltic	1	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP83	Plume Body	Y	X:4,Y:1	MW	Peristaltic	1	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP84	Plume Body	Y	X:5,Y:2	MW	Peristaltic	1	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP85	Plume Body	Y	X:4,Y:3	MW	Peristaltic	1	X	X	-	-	X	-	-	-	--	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Standing water, well irrigated location possibly.
BPGP86	Plume Body	Y	X:9,Y:6	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP87	Plume Body	Y	X:2,Y:1	MW	Peristaltic	1	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP88	Plume Body	N	X:7,Y:5	MW	Peristaltic	1	X	X	-	-	-	-	-	-	-	-	Characterized by nearby wells, removed from sample 2018.
BPGP89	Plume Body	Y	X:11,Y:6	MW	Peristaltic	1	X	X	-	-	X	-	-	X	-	VOCs + EPH + VPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Q3 2017 Exceedance of VPH Fractions.
BPGP90	Plume Body	N	X:12,Y:8	MW	Peristaltic	1	X	X	-	-	-	-	-	-	--	-	Characterized by nearby wells, removed from sample 2018.
BPGP91	Distal End of Plume	Y	X:14,Y:9	MW	Peristaltic	1	X	X	-	-	X	-	-	-	-	VOCs	Characterize distal edge of groundwater contamination. Sample located within known extent of plume impacts.

TABLE 7. SECOND QUARTER 2018 GROUNDWATER SAMPLING DETAILS AND RATIONALE
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

							Investigation Type				Proposed Analyses						
Location Number	**General Location**	**Sample 2018**	**Grid Area**	**Location Type (s)**	**Sample Method**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Sampling Suite**	**Rationale / Comments**
BPGP92	Plume Body	Y	X:6,Y:4	MW	Peristaltic	1	X	X	-	-	X	-	-	-	X	VOCs + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP93	Plume Body	Y	X:2,Y:2	MW	Peristaltic	1	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Not found during groundwater inventory, but recent EPA replacement
BPGP94	Plume Body	Y	X:9,Y:5	MW	Peristaltic	1	X	X	-	-	X	-	-	-	X	VOCs + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGW01	BSL Source Area	Y	X:1,Y:1	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGW04	Western Edge BSL	Y	X:1,Y:1	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Former Tom's Conoco - known area of >9 ug/L PCE
CENEX-5	Western Edge - East CAL	N	X:-7,Y:-1	MW	Low-flow pump	2	X	X	-	-	-	-	-	-	-	-	Characterized by nearby wells, removed from sample 2018.
EMW-03	Western Edge - North CAL	Y	X:-8,Y:-1	MW	Low-flow pump	2	X	X	-	-	X	-	X	-	-	VOCs + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of petroleum or former petroleum sites.
EMW-09	Western Edge - Southwest BSL	Y	X:-1,Y:-1	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs + EPH + VPH	Characterize nature and extent of groundwater contamination. Sample immediately south/southwest of BSL and along the southern edge of Central Ave., which is a utility corridor. Q3 Exceedance of VPH Fractions.
EMW-11	Plume Body	N	X:4,Y:2	MW	Low-flow pump	4	X	X	-	-	-	-	-	-	-	-	Adjacent to BPGP08. Will sample BPGP08 instead, removed from sample 2018.
EMW-15	Plume Body	N	X:6,Y:3	MW	Low-flow pump	2	X	X	-	-	-	-	-	-	-	-	Characterized by nearby wells, removed from sample 2018.
EMW-18	Distal End of Plume	Y	X:17,Y:11	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	No solvents or other exceedances detected during Q3 2017, removed from sample 2018.
EMW-21	Distal End of Plume	N	X:16,Y:11	MW	Low-flow pump	2	X	X	-	-	-	-	-	-	-	-	Characterize distal edge of groundwater contamination. Well located downgradient of previously most downgradient well BPGP50. No detections of solvents or other exceedances during Q3
EMW-26	Distal End of Plume	N	X:17,Y:11	MW	Low-flow pump	2	X	X	-	-	-	-	-	-	-	-	No solvents or other exceedances detected during Q3 2017, removed from sample 2018.
EMW-28	Southern Plume Edge	Y	X:11,Y:4	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	--	VOCs	Characterize nature and extent of groundwater contamination. Sample located along southern edge of plume.
EMW-32	Plume Body - BNSF Property	Y	X:11,Y:5	MW	Low-flow pump	2	X	X			X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located along southern edge of plume.
GSMW-5	Southern Plume Edge	N	X:3,Y:-2	MW	Low-flow pump	2	X	X	-	-	-	-	-	-	-	-	Data from by new alluvial wells MW-105 and MW-106 will be sufficient, removed from sample 2018.
PEP07	Plume Body	Y	X:6,Y:3	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
RH-MW-1	Distal End of Plume	Y	X:17,Y:8	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. RH-MW-1 may be destroyed, and RH-MW-2 or similar may be used as an alternate
RH-MW-3	Distal End of Plume	Y	X:17,Y:8	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	X	VOCs + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
RH-MW-7	Distal End of Plume	Y	X:17,Y:8	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
SD-I-01	Western Edge - Irrigation	Y	X:-4,Y:1	IW	Peristaltic	8	X	X	X	-	X	-	-	-	X	VOCs + MNA	Characterize nature and extent of groundwater contamination. Upgradient of BSL used for irrigation at Central Park, but technically Billings School District property with softball field. Concern for risk. Discuss well depth and details with School District #2 of Billings.
SD-I-02	Western Edge - Irrigation	Y	X:-4,Y:1	IW	Peristaltic	6	X	X	X	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Upgradient of BSL used for irrigation at Washington Elementary School. Concern for risk. Discuss well depth and details with School District #2 for Billings
SMW12	Southern Plume Edge	Y	X:1,Y:-1	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts, well concentrations may be influenced by watering/irrigation of lawn. Well monuments for SMW12 and BPGP32 were filled with surface irrigation water at GW
Whiteley MW-1	Distal End of Plume	N	X:16,Y:8	MW	Low-flow pump	2	X	X	-	-	-	-	-	-	-	-	No solvents or other exceedances detected during Q3 2017, removed from sample 2018.
Whiteley MW-2	Distal End of Plume	N	X:16,Y:8	MW	Low-flow pump	2	X	X	-	-	-	-	-	-	-	-	No solvents or other exceedances detected during Q3 2017, removed from sample 2018.
ZPMW-1	Western Edge - East CAL	Y	X:-7,Y:1	MW	Low-flow pump	2	X	X	-	-	X	-	X	-	-	VOCs + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of petroleum or former petroleum sites.

TABLE 7. SECOND QUARTER 2018 GROUNDWATER SAMPLING DETAILS AND RATIONALE
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

							Investigation Type				Proposed Analyses						
Location Number	**General Location**	**Sample 2018**	**Grid Area**	**Location Type (s)**	**Sample Method**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Sampling Suite**	**Rationale / Comments**
New Monitoring Well Locations																	
MW-100	Upgradient of CAL	Y	X:-8,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Monitor upgradient source(s) southwest of CAL
MW-101	Near potential source area at CAL	Y	X:-8,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	X	VOCs + SVOCs + EPH + VPH + Metals + MNA	Delineate source area groundwater contamination. Evaluate potential for hydrocarbon impacts, metals mobilization, etc.
MW-102	Near potential source area at CAL	Y	X:-8,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate source area groundwater contamination.
MW-103	Southern edge of western plume	Y	X:-2,Y:1	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	-	VOCs + SVOCs + EPH + VPH + Metals	Delineate southern plume boundary at CAL
MW-104	Southern edge of main plume body	Y	X:3,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	-	VOCs + SVOCs + EPH + VPH + Metals	Southern plume boundary monitoring well. Evaluate potential for hydrocarbon impacts, metals mobilization, etc.
MW-105	Southern edge of main plume body	Y	X:4,Y:1	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	-	VOCs + SVOCs + EPH + VPH + Metals	Southern plume boundary monitoring well. Well had an odor and sheen when developed in April 2018.
MW-106	Southern edge of main plume body	Y	X:4,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Southern plume boundary monitoring well. Potential delineate sources located south of the railroad.
MW-107	Southern edge of main plume body	Y	X:6,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate southern plume boundary.
MW-108	Southern edge of main plume body	Y	X:8,Y:1	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	X	VOCs + SVOCs + EPH + VPH + Metals + MNA	Delineate southern plume boundary, Evaluate potential hydrocarbon impacts
MW-109	Southern edge of main plume body	Y	X:12,Y:3	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	-	VOCs + SVOCs + EPH + VPH + Metals	Delineate southern plume boundary. Downgradient of former LUST facilities
MW-110	Southern edge of main plume body	Y	X:14,Y:4	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate southern boundary of plume.
MW-111	Southern edge of main plume body	Y	X:17,Y:7	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	-	VOCs + SVOCs + EPH + VPH + Metals	Attempt to establish southern bound to PCE plume at former REX Cleaners. Evaluate potential for hydrocarbon impacts, metals mobilization, etc.
MW-112	Southern edge of main plume body	Y	X:19,Y:7	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Establish distal plume boundary
MW-113	Downgradient of potential source at REX	Y	X:20,Y:9	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Establish distal plume boundary
MW-114	Near potential source area at REX	Y	X:17,Y:8	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Establish GW concentrations at REX cleaners.
MW-115	Downgradient of potential source at REX	Y	X:20,Y:11	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Establish GW concentrations at REX cleaners.
MW-116	Upgradient of potential source at REX	Y	X:15,Y:8	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate distal plume edge from potential additional source area(s).
MW-117	Distal End of Plume	Y	X:15,Y:10	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	-	VOCs + SVOCs + EPH + VPH + Metals	Delineate distal plume edge. Evaluate potential for hydrocarbon impacts, metals mobilization, etc. Well had hydrocarbon odor and sheen during development.
MW-118	Northern Plume Edge	Y	X:13,Y:11	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Establish northern/distal plume boundary.
MW-119	Northern Plume Edge	Y	X:11,Y:10	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	-	VOCs + SVOCs + EPH + VPH + Metals	Establish northern plume boundary. Evaluate potential for hydrocarbon impacts, metals mobilization, etc.
MW-120	Northern Plume Edge	Y	X:9,Y:8	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Establish southern plume boundary
MW-121	Northern Plume Edge	Y	X:4,Y:4	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate northern plume boundary
MW-122	Northern Plume Edge	Y	X:2,Y:2	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	-	VOCs + SVOCs + EPH + VPH + Metals	Delineate northern plume boundary. Evaluate potential for hydrocarbon impacts, metals mobilization, etc.
MW-123	Northern Edge of Western Plume	Y	X:-3,Y:3	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate northern plume boundary at former Central Avenue Laundry
MW-124	Northern Edge of Western Plume	Y	X:-5,Y:2	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate northern plume boundary at former Central Avenue Laundry
MW-125	Southern Plume Edge	Y	X:2,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate southern plume boundary.
MW-126	Bedrock well at BSL	Y	X:1,Y:1	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	X	VOCs + SVOCs + EPH + VPH + Metals + MNA	Evaluate depth to bedrock, potential for DNAPL, bedrock transmissivity and structure.
MW-127	Bedrock well at BSL	Y	X:1,Y:1	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	X	VOCs + SVOCs + EPH + VPH + Metals + MNA	Evaluate depth to bedrock, potential for DNAPL, bedrock transmissivity and structure. THIS WELL MUST BE SAMPLED ON A WEEKEND TO AVOID BOTHERATION TO BUILDING OCCUPANTS
MW-128	Central portion of western lobe of plume NW of CAL	Y	X:-3,Y:2	MW	Low-flow pump	2	X	-	-	-	X	X	X	X	X	VOCs + SVOCs + EPH + VPH + Metals + MNA	Evaluate potential upgradient impacts near 202 9th St. West. Evaluate potential for hydrocarbon impacts, metals mobilization, etc.

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BILLINGS, MONTANA

							Investigation Type				Proposed Analyses						
Location Number	**General Location**	**Sample 2018**	**Grid Area**	**Location Type (s)**	**Sample Method**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Sampling Suite**	**Rationale / Comments**
MW-129	Along northern/northeastern edge of fence line in the back of the lot at 4017 1/2 1st Ave S. Mark	Y	X:8,Y:3	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Well along the back fence line nearest rail property to delineate PCE concentrations in central area of plume without many nearby monitoring wells.
MW-130	In City of Billings right-of-way approximately 300 feet south of the intersection of Industrial Ave and Daniel St. - on west side of Daniel Street just south of the first driveway into the older Sysco building.	Y	X:-11,Y:-4	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Up gradient understanding of PCE in area southwest of former Central Avenue Laundry
MW-131	City right-of-way on sidewalk or along Meadow Gold's northeast corner of their property in a small parking lot.	Y	X:17,Y:8	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Well in potential release area near sewer compromised area
MW-132	West of 2424 Minnesota Ave on west side of S 25th St. near power	Y	X:18, Y:9	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs + PCBs	Well to delineate PCE concentrations north of 1st Ave S.
MW-133	North of 2424 Minnesota Ave on south side of Minnesota Ave.	Y	X:18, Y:10	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs + PCBs	Well to delineate contaminant concentrations north of 1st Ave S. and down gradient of Former Pacific Hide & Steel area
MW-134	East of 26 S 24th St. in the ROW of the road on at 24th St.	Y	X:18, Y:10	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Well to delineate PCE concentrations north of 1st Ave S
MW-135	Along northeastern edge of fence line in the back of the lot at 4017 1/2 1st Ave S. Mark entire lot.	Y	X:9,Y:4	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Well along the back fence line nearest rail property to delineate PCE concentrations in central area of plume without many nearby monitoring wells.

TABLE 7. SECOND QUARTER 2018 GROUNDWATER SAMPLING DETAILS AND RATIONALE
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

							Investigation Type				Proposed Analyses						
Location Number	**General Location**	**Sample 2018**	**Grid Area**	**Location Type (s)**	**Sample Method**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Sampling Suite**	**Rationale / Comments**
SYS-EMW-3	Existing monitoring well on SYSCO property, upgradient of CAL	Y	X:-11,Y:-5	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate contaminant concentrations upgradient of CAL
REGAL-I-01	Irrigation Well upgradient of CAL, located at 145 Regal Street. Well location on SE corner of building along Industrial	Y	X:-10,Y:-3	IW	Peristaltic	6	X	-	-	-	X	-	-	-	-	VOCs	Delineate contaminant concentrations upgradient of CAL

GROUNDWATER RATIONALE NOTES AND SUMMARY TOTALS

Wells to be sampled	107
Wells for bladder pumps	59
Wells for peristaltic pumps	48

	VOCs 8260 (Low Level/Long List) [1]	SVOCs 8270 (PAHs) [2]	Metals [3]	EPH/VPH [4]	MNA [5]
Environmental Samples	107	14	23	21	17
Field Duplicates	6	1	2	2	-
Equipment Blanks	9	9	9	9	-
Field Blank	9	9	9	9	-
MS/MSD	6	1	2	2	-
Total	137	34	45	43	17

Notes:

VOCs 8260 (Low Level/Long List) [1]	Groundwater analysis method for VOCs by EPA 8260B, Low-level MDLs, long list VOCs - collect with bottles/preservatives according to Table 2
SVOCs 8270 (PAHs) [2]	Groundwater analysis method for SVOCs including PAHs by EPA 8270 - collect with bottles/preservatives according to Table 2
Metals [3]	Groundwater analysis method for 19 dissolved metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, thallium, vanadium, and zinc by EPA Method 200.7 and mercury by CVAA Mercury/EPA Method 245.1 - collect with bottles/preservatives according to Table 2
EPH/VPH [4]	Groundwater analysis method for EPH by SW8015M and MA-EPH fractionization; VPH by MA-VPH - collect with bottles/preservatives according to Table 2
MNA [5]	MNA analyses to include sulfate/sulfite by E300.0, nitrate/nitrite by E353.2, dissolved organic carbon by SW9060, chloride by E300, and methane/ethene/ethane by SW3810/RSK175 - collect with bottles/preservatives according to Table 2
Fluid Levels [6]	Fluid levels collected according to Groundwater Sampling Work Plan July 2017 Memo
Field Parameters [7]	Field parameter analyses will be collected though a groundwater multi-meter according to Groundwater Sampling Work Plan July 2017 Memo
TCLP [8]	Waste analyses will be determined in conjunction with DEQ according to the anticipated characterization of the waste.
Sample Method Comparison[9]	Sample method comparison will involve collecting two VOCs samples with different sample methods (low-flow peristaltic pump and low-flow down-well pump)

TABLE 8. GROUNDWATER SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Analysis	Method	Sample Container Type and Volume	Holding Time[a]	Preservation Type[b, c]
Water				
VOC	SW8260B	3-40 mL VOA vial with HCL	14 days	HCl Store at or below 6 Degrees
EPH Screen	MA-EPH	2-1000 mL amber glass bottles with HCl	14/40 days	Store at or below 6 Degrees HCl to pH <2
VPH	MA-VPH	3-40 mL VOA vials with HCl	14 days	Store at or below 6 Degrees HCl
SVOC	EPA 8270 by SW3520	2-1000 mL amber glass/teflon bottles	7/40 days	Add 80 mg sodium thiosulfate to chlorinated samples. Unpreserved, Store at or below 6 Degrees
Low Level PAH	EPA 8270 PAH SIM	2-1000 mL amber glass/teflon bottles	7/40 days	Add 80 mg sodium thiosulfate to chlorinated samples.
Metals	E245.1/E200.7_8	250-mL plastic	6 months/28 days Hg	Add HNO_3 to pH <2
Dissolved Metals	EPA 6020	250-mL plastic, filtered, with HNO3	15 minutes to filter/preserve (6 months analysis)	Filter, then place in preserved containers; HNO3 to pH <2
Dissolved CVAA Mercury	EPA 245.1	250-mL plastic, filtered, with HNO3	15 minutes to filter/preserve (28 days analysis)	Filter, then place in preserved containers; HNO3 to pH <2
MNA: Sulfate	E300.0	250 mL plastic	28 days	Unpreserved, Store at or below 6 Degrees
MNA: Nitrate+Nitrite	E353.2	250mL plastic, H2SO4 preserved	28 days	Store at or below 6 Degrees; H_2SO_4 to pH <2
Organic Carbon	SW9060	250mL amber glass, H2SO4 preserved	28 days	Store at or below 6 Degrees; H2SO4 to pH <2
Chloride	E300.0	250ml plastic	28 days	Unpreserved, Store at or below 6 Degrees
Methane, ethane, ethene	SW3810/RSK175	3-40ml clear with TSP	14 days	TSP cool to above freezing but not less then 6 deg
INVESTIGATION DERIVED WASTE CHARACTERIZATION - LIQUID				
VOC	SW8260B	250 mL amber glass	14 days to leach and 14 days to analyze	Unpreserved, Store at or below 6 Degrees
TPH	MA-EPH Screen	2-1000 mL amber glass bottles with HCl	14/40 days	Store at or below 6 Degrees HCl to pH <2
	MA-VPH	3-40 mL VOA vials with HCl	14 days	Store at or below 6 Degrees HCl
TCLP Metals[e]	SW 6010B(RCRA Metals)/SW 7470A (Mercury- Hg)	250-mL amber glass	6 months/28 days Hg	Unpreserved, Store at or below 6 Degrees
Hexavalent Chromium (Cr VI)	3500 CR-B for Hexavalent Chromium	250-mL plastic, unpreserved	24 hour analytical	Unpreserved, Store at or below 6 Degrees
Cyanide (total)	SM 4500-CN-E	250-mL plastic with NaOH	14 days	Place in preserved containers; NaOH
Sulfide (total)	SM 4500S2D	250-mL plastic with NaOH and zinc acetate	15 minutes to filter/preserve (28 days analysis)	Place in preserved containers; NaOH + Zn acetate
Flash Point	Flash Point	250-mL amber glass, unpreserved	14 days	Unpreserved, Store at or below 6 Degrees

Notes:

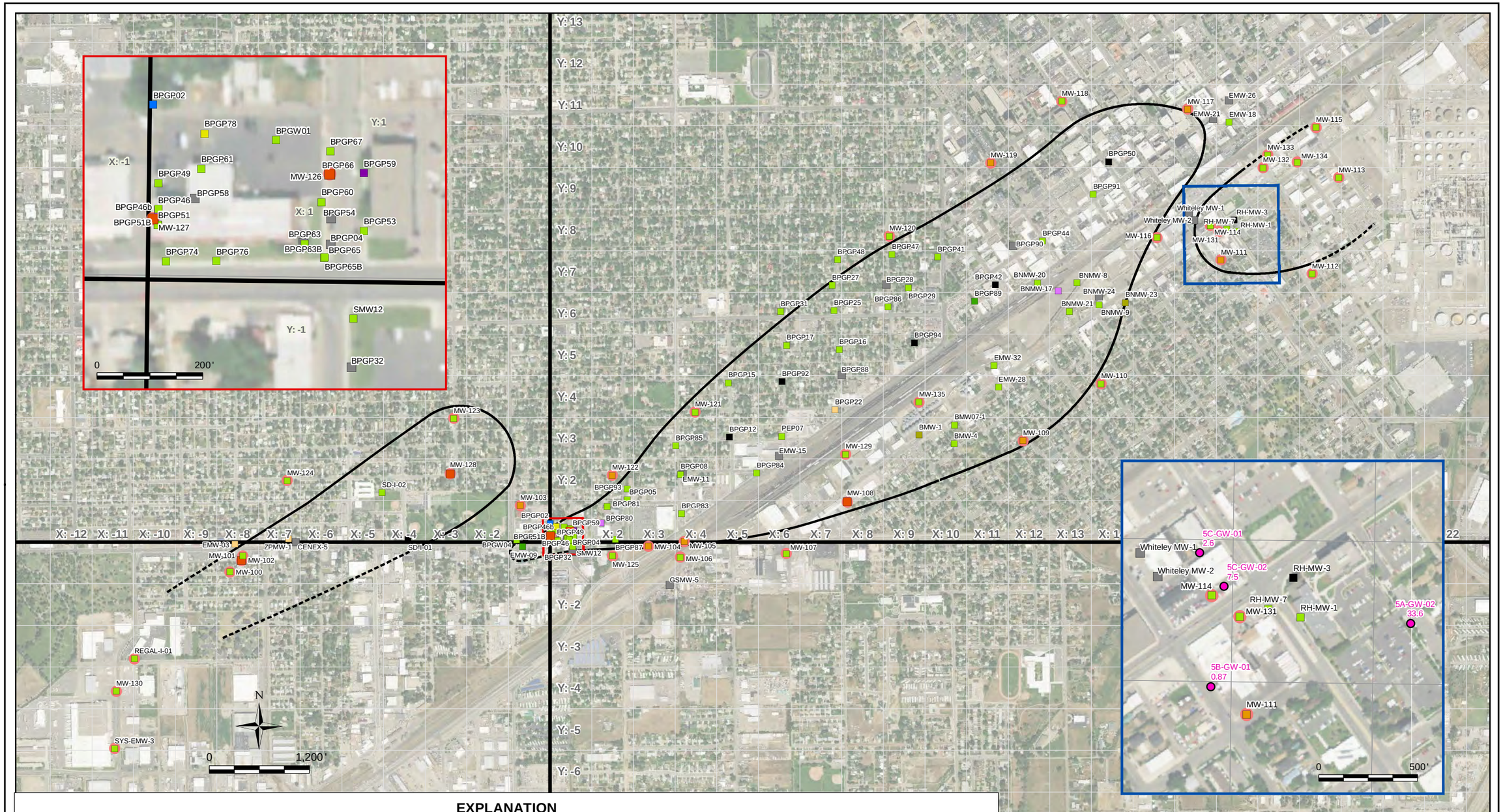
[a] The first number (or number alone) refers to the maximum number of days from sampling to extraction and the second number refers to the maximum number of days from extraction to analysis.

[b] Temperatures are listed in degrees Celsius.

[c] Preservatives will be supplied by the laboratory, but must be added in the field unless noted as pre-preserved.

[e] Metals required are arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, sliver, and zinc

ASA - American Society of Agronomy
EPH - extractable petroleum hydrocarbons
H_2SO_4 - sulfuric acid
HCL - hydrochloric acid
Hg - Mercury
HNO_3 - nitric acid
L - liter
MA - Massachusetts
mL - milliliter
NaOH - sodium hydroxide
oz - ounce
PAH - polynuclear aromatic hydrocarbon
PCB - polychlorinated biphenyl
SPLP - synthetic precipitation leaching procedure
SVOC - semivolatile organic compound
TCLP - toxicity characteristic leaching procedure
VOA - volatile organic analysis
VOC - volatile organic compound
VPH - volatile petroleum hydrocarbons
Zn - zinc



EXPLANATION

- VOCs
- VOCs + EPH + VPH
- VOCs + EPH + VPH + MNA
- VOCs + EPH + VPH + Metals
- VOCs + EPH + VPH + Metals + MNA
- VOCs + MNA
- VOCs + Metals
- VOCs + Metals + MNA
- VOCs + SVOCs + EPH + VPH + MNA
- VOCs + SVOCs + EPH + VPH + Metals
- VOCs + SVOCs + EPH + VPH + Metals + MNA
- NOT PROPOSED FOR SAMPLING
- NEWLY INSTALLED/SAMPLED WELL
- FACILITY GRID (SPACING = 500 FEET)
- FACILITY BOUNDARY, 5 µg/L PCE GROUNDWATER CONTOUR (DASHED WHERE INFERRED)

NOTE: WELLS MW-132 AND MW-133 WILL ALSO INCLUDE PCB ANALYSIS

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FIGURE 1

SECOND QUARTER 2018 GROUNDWATER WELL SAMPLE LOCATIONS DELINEATED BY ANALYTE

BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Drawn By: PH	Checked By: AV	Scale: 1 " = 1,186 '	Date: 5/7/18	File: Billings_MonitoringWellsField.mxd

APPENDIX C-3

THIRD QUARTER 2018 GROUNDWATER SAMPLING SCHEDULE MEMO

memorandum

To:	Mr. Mike Gipson, Montana DEQ
From:	Mr. Andrew Vann, Trihydro Corporation
cc:	Mr. Syris Trahan, Ms. Sarah Seitz, Trihydro Corporation
Date:	September 6, 2018
Re:	Third Quarter 2018 Groundwater Sampling Schedule Billings PCE Groundwater CECRA Facility, Billings, Montana

1.0 INTRODUCTION

Trihydro Corporation (Trihydro) is conducting a Remedial Investigation (RI) on behalf of the Montana Department of Environmental Quality (DEQ) at the Billings PCE Groundwater Comprehensive Environmental Cleanup and Responsibility Act (CECRA) Facility (Facility), in Billings, Montana. The RI's objectives include filling data gaps, identifying potential source areas, evaluating the nature and extent of groundwater contamination, evaluating the potential migration of chlorinated solvents to indoor air, and investigating the potential for harm to human health and the environment. The primary contaminants of potential concern are chlorinated solvents including tetrachloroethene (PCE) and its degradation products (trichloroethene (TCE), cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride); however, other potential contaminants are also being evaluated along with field and monitored natural attenuation (MNA) parameters.

This memo presents the rationale and justification for revisions to the groundwater sampling plan. It contains a brief summary of work conducted pertaining to groundwater investigations to date, summary presentations of recently collected analytical data, as well as proposed groundwater monitoring activities to improve the current understanding of the nature and extent of groundwater contamination at the Facility. This memo is accompanied by May 2018 groundwater analytical report tables (Tables 1 through 6), Q3 2018 groundwater sampling tables (Tables 7 and 8), and a figure of the proposed groundwater sampling locations for Q3 2018 (Figure 1).

2.0 RECENT GROUNDWATER INVESTIGATION ACTIVITIES

From November 2017 through February 2018, Trihydro conducted a direct-push investigation, during which 51 PCE screening groundwater samples were collected from temporary monitoring points. PCE screening samples were analyzed using a modified EPA Method 8260 VOC analysis, which only evaluated the concentration of PCE in the sample. The monitoring points were installed in locations designed to delineate the edge of groundwater contamination exceeding the DEQ-7 standard for PCE (5 µg/L), or to evaluate potential source areas (Section 8.2.1, Figure 8 – 1 of the Remedial Investigation Workplan).

On February 5, 2018, Trihydro submitted the Alluvial and Bedrock Groundwater Monitoring Well Location Rationale memo to DEQ. The memo used groundwater data from the July 2017 groundwater monitoring event, as well as the groundwater PCE screening sampling event, to select locations for additional monitoring wells to further characterize the nature and extent of groundwater contamination at the Facility. Trihydro installed 33 alluvial groundwater monitoring wells and 2 bedrock groundwater monitoring wells in March and April 2018, which were subsequently sampled during the May 2018 groundwater sampling event.

In May 2018, Trihydro conducted groundwater sampling at monitoring wells across the facility. Groundwater samples were analyzed for a variety of constituents, including volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), Resource Conservation and Recovery Act (RCRA) metals, extractable petroleum hydrocarbons (EPH), volatile petroleum hydrocarbons (VPH), polychlorinated biphenyls (PCB), and a range of monitored natural attenuation (MNA) parameters.

3.0 MAY 2018 GROUNDWATER ANALYTICAL RESULTS

Following the preliminary groundwater sampling event in July and August 2017, the groundwater sampling schedule was revised to target contaminants of potential concern (COPCs), including previously unknown or uncharacterized contaminants, as well as further delineation of known contamination at the Facility. The May 2018 groundwater sampling schedule included a revised list of wells and analytes, including sampling at the 35 newly installed wells described in Section 2. The following analyses were conducted at monitoring wells across the Facility:

- **EPH by the Montana-Modified Massachusetts Method**

  Samples from 20 wells were evaluated for EPH during the investigation, 8 of which previously had been identified as having petroleum hydrocarbon impacts, as well as 12 newly installed wells. In the wells sampled, EPH was only detected in 5 samples in excess of the screening level of 1,000 µg/L. After fractionation, none of the wells contained extractable petroleum fractions exceeding RBCA Risk-Based-Screening Levels. Detectable EPH was observed in all but 2 of the wells sampled. EPH results are presented in Table 1.

- **VPH by the Montana-Modified Massachusetts Method**

  Samples from 20 wells were also evaluated for VPH during the investigation. Of those, samples from 5 wells contained contaminants exceeding an applicable screening level. Wells with exceedances of screening levels, and the contaminants observed, were:

  BPGP02 – benzene (X:1,Y:1)

  BPGP78 – benzene, C5-C8 aliphatics (X:1,Y:1)

  BPGP89 – benzene, C5-C8 aliphatics (X:2,Y:1)

EMW-09 – C5-C8 aliphatics, C9-C12 aliphatics (X:-1,Y:-1)

MW-117 – C5-C8 aliphatics, C9-C-10 aromatics, C9-C12 aliphatics (X:16, Y:11)

VPH results are presented in Table 2.

- **VOCs by EPA Method 8260**

  The 105 groundwater monitoring wells sampled during the May 2018 event were evaluated for VOCs. Of the 105 wells sampled, 66 contained PCE exceeding the DEQ-7 human health standard of 5 µg/L. Only 10 of the wells did not contain detectable PCE. PCE daughter products TCE, cis-1,2-DCE, and vinyl chloride were detected at concentrations exceeding screening levels at one or more wells. Other VOCs exceeding screening levels include benzene, ethylbenzene, xylenes, MTBE, naphthalene, 1,2,4-trimethlybenzene, chloroform, 1,1-dichloroethane, and 1,2-dichloroethane,VOC results are presented in Table 3.

- **SVOCs by EPA Method 8270**

  Samples from 13 wells were evaluated for SVOCs during the investigation. Of those wells, SVOCs were detected in only 5 wells, and only two exceedances of a generic screening level were observed. Monitoring well MW-111 contained bis(2-ethylhexyl)phthalate exceeding the EPA Tapwater RSL, and MW-117 contained 1-methylnaphthalene exceeding the RBCA RBSL. SVOC results are presented in Table 4. Additionally, two wells, MW-132 and MW-133 were evaluated for the specific polychlorinated biphenyl SVOCs using EPA Method 8082, due to historical records indicating transformer repair/recycle in proximity to the wells. PCBs were not detected in either sample.

- **Dissolved Metals by EPA Methods 200.8 and 245.1**

  Samples from 21 wells were evaluated for metals, including mercury, during the investigation. No samples contained contaminants in excess of their respective DEQ-7 standard or RBCA RBSL, although manganese was found in excess of the EPA Tapwater RSL in 12 wells at the Facility, and cobalt exceeded the Tapwater RSL in 3 wells. Metals results are presented in Table 5.

MNA Parameters

MNA parameters measured during the May 2018 Groundwater sampling event include carbon, chloride, ethane, ethylene, and methane, nitrogen, nitrate and nitrite, and sulfate. Seventeen monitoring wells were sampled for MNA parameters during the event. Monitoring wells for MNA parameters were selected to provide a holistic overview of site conditions. While these parameters do not generally have human health standards or RBSLs in groundwater, they can provide insight into the presence of breakdown products of solvents (chloride), the presence of carbon sources that are being degraded by naturally occurring bacteria (methane), and the depletion of terminal electron receptors in the subsurface (sulfate). MNA Parameter results are presented in Table 6.

These results will be evaluated and analyzed further in the facility Remedial Investigation Report.

4.0 UPDATES TO THE GROUNDWATER SAMPLING PLAN

The third groundwater sampling event during the RI is scheduled for September 2018. The following section contains proposed updates to the groundwater sampling schedule. The purpose of updating the sampling rationale is to streamline analytical suites in locations where specific contaminants have not been observed. The proposed updated sampling rationale table is presented in Table 7. Trihydro proposes the following revisions to the schedule:

- **EPH/VPH**

  Remove EPH/VPH analysis at the four wells listed below.

  MW-101 (X:-8,Y:-1), MW-103 (X:-2,Y:1), MW-104 (X:3,Y:-1) and MW-111 (X:17,Y:7) – At each of these locations, there were no detections of VPH compounds, and EPH screen results were below the fractionation threshold.

  Although EPH fractions did not exceed screening levels at the previously sampled locations, EPH fractionation will provide a useful metric against which to compare VPH fraction exceedance as well as understanding depressed chlorinated solvent concentrations compared to nearby wells and will therefore be retained for the remaining wells in the sample schedule. Sampling rationale for individual wells is presented in Table 7.

- **VOCs**

  No revisions to the VOC sampling schedule for existing wells

  If available and owners are amenable, sample several additional existing monitoring or irrigation wells in the following locations for VOCs:

  - Downgradient (both north and northeast) of MW-115
    - Ground Water Information Center (GWIC) well ID 11510 at 116 19th St., Billings, MT or GWIC well 267400 at 1901 1st Ave N., Billings, MT.
  - Upgradient (west) of REGAL-I-01
    - No wells identified immediately upgradient at this time with GWIC search, additional calls and field evaluation may find a potential well in this area.
  - Cross/Downgradient (east) of REAGAL-I-01
    - Irrigation well at Ponderosa Acres previously used for PCE screening – P-I-WEST (GWIC ID 93930 or 93931) at 1301 Industrial Ave., Billings, MT or GWIC 203488 at 1216 Juneau Ave., Billings, MT.

- **SVOCs**

  Reduce SVOC sampling in the existing monitoring well network to the five wells where SVOCs have been detected/exceeded applicable screening levels, plus the two bedrock wells:

  BPGP78 (X:1,Y:1),

  MW-108 (X:8,Y:1)

  MW-111 (X:17,Y:7)

  MW-117 (X:16,Y:11)

  MW-126 (bedrock well) (X:1,Y:1)

  MW-127 (bedrock well) (X:1,Y:1)

  Extensive SVOC impacts have not been identified throughout the Facility, and SVOC sampling has been conducted throughout the existing monitoring well network during the July 2017 sampling event, as well as the newly installed monitoring wells during the May 2018 sampling event. Sampling rationale for individual wells is presented in Table 7.

- **PCBs by EPA Method 8082**

  PCBs were not detected in either of the wells sampled at the Facility. PCBs will be removed from the sampling schedule.

- **Dissolved metals**

  No changes to dissolved metals sampling.

- **MNA Parameters**

  Maintain MNA Parameter sampling at the 17 monitoring wells sampled previously to provide a sitewide overview of MNA parameters, including monitoring wells located along the longitudinal axis of the plume, along the upgradient and downgradient plume boundaries, and near potential source areas.

The total quantity of wells sampled at the Facility will remain at approximately 105 wells. BPGP05 was not sampled in May 2018 as it was destroyed during installation of new ADA-compliant sidewalk ramps. MW-131 was not installed at Meadow Gold dairy.

5.0 BEDROCK WELL SAMPLING/SLUG TESTING

Wells MW-126 and MW-127 were completed and screened in the bedrock near the BSL source area to investigate contaminant concentrations in groundwater and competence of the bedrock in this area. MW-126 was installed to a total depth of 36.1 feet below ground surface (ft bgs). Bedrock contact was at 25.5 ft bgs. Bedrock was very hard, unweathered shale, though it showed signs of fracture. The screened interval was set from 30.5-35.5 ft bgs, with silica sand filter pack extending from 28.1 – 36.1 ft bgs, and a

bentonite plug from 1.8 to 28.1 ft bgs. MW-127 was installed to a total depth of 45 ft bgs. Bedrock contact was at 28.3 ft bgs. Bedrock was very hard, highly fractured shale, which appeared competent and dry during well installation. The screened interval was set from 40-45 ft bgs, with silica sand filter pack extending from 34.5 – 45 ft bgs, and a bentonite plug from 1.7 to 34.5 ft bgs.

MW-126 was sampled during the May 2018 sampling event, but MW-127 was not sampled due to issues with development. After initial installation, the well appeared to be dry. During the May 2018 sampling event, water was observed in MW-127. The well water was highly turbid (peak turbidity reading was approximately 5,700 NTU) during attempted sampling and contained less than 2 feet of water in the well casing. Low-flow purging was attempted at 0.1 L/min, however the well purged dry after approximately 15 minutes, and had not begun to stabilize prior to purging dry. The well did not contain adequate water to allow for development via repeated purging prior to the sampling attempt. MW-127 was subsequently developed June 13-14, 2018. The well was purged dry, then surged with approximately 21 gallons of DI water, which was purged from the well over the course of approximately 36 hours. A total of 24.5 gallons of water were removed from the well, which was purged dry after surging, and allowed to re-equilibrate from June 14, 2018, to present.

Water levels in the bedrock wells have been measured using an oil/water interface probe, and have been checked periodically by local staff during the course of the last four months. This method is proposed for continued slug testing in the deep bedrock wells, due to extremely low recovery rates. Water level recovery from sampling and development for both wells has been very slow, but water levels appear to be approaching the water table elevation of nearby shallow monitoring wells. This may indicate that bedrock is connected to the shallow water table, although the slow recovery indicates that the conductivity of the bedrock is very low. Trihydro performed a preliminary slug test analysis using recovery data following well development which indicates that the conductivity for both wells is on the order of 10^{-7}cm/second. Based on this conductivity the 90% recovery timeframe is estimated at 30-45 days. Based on approximate data collected during attempted groundwater monitoring at MW-126, an initial recovery rate of 5 ml/min was observed after purging the well dry. However, this data is not indicative of a controlled slug-out investigation, and should be used as an order-of-magnitude estimate only. More rigorously collected data will be available after conducting a slug-out test. To confirm that the wells have recovered to static water level from the previous sampling and development activities prior to additional disturbance of the water column, Trihydro proposes to perform slug testing following the September sampling event. Based on the previous development and sampling activities, the wells will be purged dry prior to stabilization using a low-flow sampling technique at the lowest bladder pump purge setting. Therefore, Trihydro proposes to use a modified sampling and slug testing procedure to collect representative groundwater data and slug test data in a timely manner.

Trihydro will attempt to conduct low-flow sampling at the well for VOCs only, via method 8260. If groundwater stabilization parameters do not adequately stabilize prior to the well being purged dry, then VOC samples will be collected when sufficient water has recovered in the well to fill sample bottles,

likely the next day. Cascading water/aeration of the sample is of minimal concern due to the low recharge rates for the bedrock wells.

The slug test will be considered to begin when the well is purged dry. The additional purging to collect VOC samples will have minimal effect on the recovery because the volume for VOC samples (approximately 120 mL) is much less than the 90% recovery volume (approximately 17 liters), and the recharge rates are very slow. Water levels will be recorded at approximately 1, 3, and 6 hours after initial slug removal, and thereafter on a daily basis for approximately 4 days following purging, and 1-2 times per week following that until 90% recovery has been reached. More frequent monitoring using an interface probe or pressure transducer is not necessary due to the low rate of recharge.

6.0 SCHEDULE

Trihydro is planning to prepare for sampling, coordinate with the laboratory, coordinate with property owners, and conduct groundwater sampling during September 2018, with a likely field start date of September 10, 2018.

776-036-001

TABLES

TABLE 1. - SECOND QUARTER 2018 EXTRACTABLE PETROLEUM HYDROCARBONS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	C11-C22, Aromatic, Unadjusted (εg/L)	C19-C36, Aliphatic, Unadjusted (εg/L)	C9-C18, Aliphatic, Unadjusted (εg/L)	Total Extractable Hydrocarbon (εg/L)
BNMW-17	05/08/18	121 J	194 JB	684	684 JB
BPGP02	05/11/18	--	--	--	181 J
BPGP46	05/11/18	--	--	--	114 J
BPGP59	05/10/18	--	--	--	110
BPGP78	05/11/18	--	--	--	756
BPGP80	05/10/18	--	--	--	127
BPGP80 Dup	05/10/18	--	--	--	73.5
BPGP89	05/08/18	<209	76.4J/ND(209)U*	<209	<626
EMW-09	05/11/18	286	22.4 J	104 J	286 J
MW-101	05/07/18	--	--	--	231 JB
MW-103	05/11/18	--	--	--	104 J
MW-104	05/10/18	--	--	--	96.2
MW-105	05/08/18	--	--	--	615 JB
MW-108	05/10/18	56.8	39.4	113	<582
MW-109	05/09/18	--	--	--	206/ND(206)U*
MW-111	05/10/18	--	--	--	188
MW-117	05/10/18	177	63.4	330	330
MW-119	05/10/18	--	--	--	115
MW-122	05/11/18	--	--	--	134 J
MW-128	05/09/18	--	--	--	103J/ND(197)U*
MW-128 Dup	05/09/18	--	--	--	161J/ND(206)U*
MW-129	05/23/18	--	--	--	224 JB
RBCA RBSLs Groundwater		1,100	1,000	1,400	NA
DEQ7 Groundwater Standard		NA	NA	NA	NA
EPA RSL Tapwater		NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 2. - SECOND QUARTER 2018 VOLATILE PETROLEUM HYDROCARBONS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Benzene (εg/L)	C5-C8, Aliphatic, Unadjusted (εg/L)	C9-C10, Aromatic, Unadjusted (εg/L)	C9-C12, Aliphatic, Unadjusted (εg/L)	Ethyl-benzene (εg/L)	m,p-Xylene (εg/L)	MTBE (εg/L)	Naphthalene (εg/L)	o-Xylene (εg/L)	Toluene (εg/L)	Total Purgeable Hydrocarbon (εg/L)	Xylenes, Total (εg/L)
BNMW-17	05/08/18	<1	<20	18.2 J	25.8	<1	<2	<1	0.99 J	<1	<1	39	<3
BPGP02	05/11/18	**53.6**	564	240	637	173	153	<2	21.9	4	8.8	1270	157
BPGP46	05/11/18	1.6	402	66	93.3	<2	<4	<2	<8	<2	<2	466	<6
BPGP59	05/10/18	2.9	577	<20	<20	<10	<20	<10	<5	<10	<10	508	<30
BPGP78	05/11/18	**231**	**1250**	336	1020	490	13.4	<1	6.1	0.53	4.4	2540	13.4
BPGP80	05/10/18	0.46	371	<20	<20	<10	<20	<10	<5	<10	<10	327	<30
BPGP80 Dup	05/10/18	0.67	383	<20	<20	<1	<2	<1	<5	<1	<1	337	<3
BPGP89	05/08/18	**380**	**1490 J+**	93.8 J+	309 J+	151 J+	3.8 J	<2	1.9 J+	1.1 J+	5.7 J+	1980 J+	1.1 J+
EMW-09	05/11/18	<2	**1460**	977	**1520**	254	3.4	21.7	7.1	2.6	0.53	3110	2.6
MW-101	05/07/18	<1	<20 R	<20 R	<20 R	<1	<2	<1 R	<5 R	<1	<1	<20 R	<3
MW-103	05/11/18	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
MW-104	05/10/18	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
MW-105	05/08/18	3.7 J+	306 J+	65 J+	99.9 J+	1.3 J+	<2	<1	1.5 J+	<1	<1	390 J+	<3
MW-108	05/10/18	<1	268	99.3	213	<1	<2	<1	5.1	1.7	<1	502	1.7
MW-109	05/09/18	<0.5	28.6	<20	<20	<0.5	<0.5	<1	<9.9	<0.5	<0.5	25.2	<2
	05/22/18	<1	--	--	--	<1	<2	<1	<4	<1	<1	--	<3
MW-111	05/10/18	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
MW-117	05/10/18	4.9	**2420**	**1950**	**2880**	229	182	<1	5.9	14.1	1.6	5610	196
MW-119	05/10/18	<1	<20	9.7	18.8	0.18	<2	<1	<5	<1	0.18	25.3	<3
MW-122	05/11/18	<1	6.2	8.7	20.3	<1	<2	<1	<5	<1	<1	31	<3
MW-126	05/12/18	<1	<20	<20	<20	<1	<2	<1	<5	<1	<1	<20	<3
MW-128	05/09/18	<0.5	<20	<20	<20	<0.5	<0.5	<1	<9.9	<0.5	<0.5	<20	<2
	05/22/18	<1	--	--	--	<1	<2	<1	<4	<1	0.095	--	<3
MW-128 Dup	05/09/18	<0.5	5.1 J	<20	<20	<0.5	<0.5	<1	<5	<0.5	<0.5	<20	<2
RBCA RBSLs Groundwater		5	650	1,100	1,400	700	NA	30	100	NA	1,000	NA	10,000
DEQ7 Groundwater Standard		5	NA	NA	NA	700	10,000	30	100	10,000	1,000	NA	10,000
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte

Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Allyl Chloride (εg/L)	Benzene (εg/L)	Bromo- chloro- methane (εg/L)	Bromoform (εg/L)	2-Butanone (εg/L)	sec-Butylbenzene (εg/L)	Carbon tetrachloride (εg/L)	Chloroethane (εg/L)	Chloromethane (εg/L)	4-Chloro- toluene (εg/L)	Dibromo- chloromethane (εg/L)	Dibromomethane (εg/L)
BMW07-1	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BMW-1	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BMW-4	05/10/18	<4	1.2	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BNMW-17	05/08/18	<4	<1	<1	<4	<5	0.29 J	<1	<1	<4	<1	<1	<4
BNMW-20	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BNMW-21	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BNMW-23	05/08/18	<4	0.53 J	<1	<4	<5	4	<1	<1	<4	<1	<1	<4
BNMW-8	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BNMW-9	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP02	05/11/18	<8	**53.6**	<2	<8	<10	0.95	<2	<2	<8	<2	<2	<8
BPGP08	05/10/18	<8	<2	<2	<8	<10	<2	<2	<2	<8	<2	<2	<8
BPGP12	05/21/18	<8	<2	<2	<8	<10	<2	<2	<2	<8	<2	<2	<8
BPGP15	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP16	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	1.2	<4
BPGP17	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP22	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	0.93 J	<4
BPGP22 Dup	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	0.58 J	<4
BPGP25	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP27	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	0.52 J	<4
BPGP29	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP31	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP41	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP42	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP44	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP46	05/11/18	<8	1.6	<2	<8	<10	4.4	<2	<2	<8	<2	<2	<8
BPGP46b	05/11/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP47	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP48	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP49	05/11/18	<400	<100	<100	<400	<500	<100	<100	<100	<400	<100	<100	<400
BPGP50	05/21/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP50 Dup	05/21/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP51	05/11/18	<200	<50	<50	<200	<250	<50	<50	<50	<200	<50	<50	<200
BPGP51B	05/11/18	<4	0.76	<1	<4	<5	1.5	<1	<1	<4	<1	<1	<4
BPGP53	05/10/18	<20	<5	<5	<20	<25	<5	<5	<5	<20	<5	<5	<20
BPGP59	05/10/18	<40	2.9	<10	<40	<50	<10	<10	<10	<40	<10	<10	<40
BPGP60	05/10/18	<80	<20	<20	<80	<100	<20	<20	<20	<80	<20	<20	<80
BPGP61	05/11/18	<400	<100	<100	<400	<500	<100	<100	<100	<400	<100	<100	<400
BPGP63	05/11/18	<40	<10	<10	<40	<50	<10	<10	<10	<40	<10	<10	<40
BPGP65	05/12/18	<40	<10	<10	<40	<50	<10	<10	<10	<40	<10	<10	<40
RBCA RBSLs Groundwater		NA	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	5	NA	80	NA	NA	3	NA	30	NA	4	NA
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,3-Di- chloro- benzene (εg/L)	Dichloro- difluoro- methane (εg/L)	1,2- Dichloro- ethane (εg/L)	cis-1,2- Dichloro- ethene (εg/L)	Dichlorofluoromet hane (εg/L)	1,3-Dichloro- propane (εg/L)	1,1-Dichloro- propene (εg/L)	trans-1,3- Dichloro- propene (εg/L)	Ethyl- benzene (εg/L)	Isopropyl- benzene (εg/L)	4-Methyl- 2- Pentanone (εg/L)	MTBE (εg/L)
BMW07-1	05/10/18	<1	<1	<1	43.5	<1	<1	<1	<4	<1	<1	<5	<1
BMW-1	05/10/18	<1	<1	<1	19.1	<1	<1	<1	<4	<1	<1	<5	<1
BMW-4	05/10/18	<1	<1	<1	26.7	<1	<1	<1	<4	<1	<1	<5	<1
BNMW-17	05/08/18	<1	<1	<1	0.26 J	<1	<1	<1	<4	<1	<1	<5	<1
BNMW-20	05/08/18	<1	<1	<1	9.5	<1	<1	<1	<4	<1	<1	<5	<1
BNMW-21	05/08/18	<1	<1	<1	13.9	<1	<1	<1	<4	<1	<1	<5	<1
BNMW-23	05/08/18	<1	<1	<1	10	<1	<1	<1	<4	9.8	6.6	<5	<1
BNMW-8	05/08/18	<1	<1	<1	11	<1	<1	<1	<4	<1	<1	<5	<1
BNMW-9	05/08/18	<1	<1	<1	4.4	<1	<1	<1	<4	<1	<1	<5	<1
BPGP02	05/11/18	<2	<2	<2	<2	<2	<2	<2	<8	173	5.5	<10	<2
BPGP08	05/10/18	<2	<2	0.86	24.7	<2	<2	<2	<8	<2	<2	<10	<2
BPGP12	05/21/18	<2	<2	<2	6.1	<2	<2	<2	<8	<2	<2	<10	<2
BPGP15	05/08/18	<1	<1	<1	3.3	<1	<1	<1	<4	<1	<1	<5	<1
BPGP16	05/08/18	<1	<1	<1	0.65 J	<1	<1	<1	<4	<1	<1	<5	<1
BPGP17	05/08/18	<1	<1	<1	40.3	<1	<1	<1	<4	<1	<1	<5	<1
BPGP22	05/08/18	<1	<1	<1	1.9	<1	<1	<1	<4	<1	<1	<5	<1
BPGP22 Dup	05/08/18	<1	<1 UJ	<1	1.4	<1	<1	<1	<4	<1	<1	<5	<1
BPGP25	05/07/18	<1	<1	<1	3	<1	<1	<1	<4	<1	<1	<5	<1
BPGP27	05/07/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
BPGP29	05/07/18	<1	<1	<1	10.4	<1	<1	<1	<4	<1	<1	<5	<1
BPGP31	05/07/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
BPGP41	05/07/18	<1	<1	<1	1.7	<1	<1	<1	<4	<1	<1	<5	<1
BPGP42	05/08/18	<1	<1	<1	23.2	<1	<1	<1	<4	<1	<1	<5	<1
BPGP44	05/08/18	<1	<1	<1	11.9	<1	<1	<1	<4	<1	<1	<5	<1
BPGP46	05/11/18	<2	<2	<2	<2	<2	<2	<2	<8	<2	9.3	<10	<2
BPGP46b	05/11/18	<1	<1	<1	1.4	<1	<1	<1	<4	<1	<1	<5	<1
BPGP47	05/07/18	<1	<1	<1	3	<1	<1	<1	<4	<1	<1	<5	<1
BPGP48	05/07/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
BPGP49	05/11/18	<100	<100	<100	<100	<100	<100	<100	<400	<100	<100	<500	<100
BPGP50	05/21/18	<1	<1	<1	11	<1	<1	<1	<4	<1	<1	<5	<1
BPGP50 Dup	05/21/18	<1	<1	<1	10.8	<1	<1	<1	<4	<1	<1	<5	<1
BPGP51	05/11/18	<50	<50	<50	<50	<50	<50	<50	<200	<50	<50	<250	<50
BPGP51B	05/11/18	<1	<1	<1	<1	<1	<1	<1	<4	0.14	2.6	<5	<1
BPGP53	05/10/18	<5	<5	<5	1	<5	<5	<5	<20	<5	<5	<25	<5
BPGP59	05/10/18	<10	<10	<10	**88.6**	<10	<10	<10	<40	<10	<10	<50	<10
BPGP60	05/10/18	<20	<20	<20	4.6	<20	<20	<20	<80	<20	<20	<100	<20
BPGP61	05/11/18	<100	<100	<100	41.6	<100	<100	<100	<400	<100	33.4	<500	<100
BPGP63	05/11/18	<10	<10	<10	<10	<10	<10	<10	<40	<10	<10	<50	<10
BPGP65	05/12/18	<10	<10	<10	<10	<10	<10	<10	<40	<10	<10	<50	<10
RBCA RBSLs Groundwater		NA	NA	4	NA	NA	NA	NA	NA	700	NA	NA	30
DEQ7 Groundwater Standard		600	1,000	4	70	NA	NA	NA	2	700	NA	NA	30
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
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Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Naphthalene (εg/L)	Styrene (εg/L)	1,1,2,2-Tetrachloro- ethan (εg/L)	Tetrahydrofuran (εg/L)	Toluene (εg/L)	1,2,4- Trichloro-benzene (εg/L)	1,1,2- Trichloro-ethane (εg/L)	Trichloro-fluoromethane (εg/L)	1,1,2- Trichloro-trifluoro- ethane (εg/L)	1,3,5-Trimethyl-benzene (εg/L)	m,p-Xylene (εg/L)	o-Xylene (εg/L)
BMW07-1	05/10/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
BMW-1	05/10/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
BMW-4	05/10/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
BNMW-17	05/08/18	0.99 J	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BNMW-20	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BNMW-21	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BNMW-23	05/08/18	1.2 J	<1	<1	<10	0.22J/ND(1)U*	<1	<1	<1	<1	<1	0.3 J	<1
BNMW-8	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BNMW-9	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP02	05/11/18	21.9	<2	<2	<80	8.8	<2	<2	<2	<2	6.6	153	4
BPGP08	05/10/18	<8	<2	<2	<80	<2	<2	<2	<2	<2	<2	<4	<2
BPGP12	05/21/18	<8	<2	<2	<20	<2	<2	<2	<2	<2	<2	<4	<2
BPGP15	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP16	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP17	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP22	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP22 Dup	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP25	05/07/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP27	05/07/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP29	05/07/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP31	05/07/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP41	05/07/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP42	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP44	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP46	05/11/18	<8	<2	<2	<20	<2	<2	<2	<2	<2	<2	<4	<2
BPGP46b	05/11/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
BPGP47	05/07/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP48	05/07/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP49	05/11/18	<400	<100	<100	<4000	<100	<100	<100	<100	<100	<100	<200	<100
BPGP50	05/21/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP50 Dup	05/21/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP51	05/11/18	<200	<50	<50	<2000	<50	<50	<50	<50	<50	<50	<100	<50
BPGP51B	05/11/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP53	05/10/18	<20	<5	<5	<200	<5	<5	<5	<5	<5	<5	<10	<5
BPGP59	05/10/18	<5	<10	<10	<400	<10	<10	<10	<10	<10	<10	<20	<10
BPGP60	05/10/18	<80	<20	<20	<800	<20	<20	<20	<20	<20	<20	<40	<20
BPGP61	05/11/18	<400	<100	<100	<1000	<100	<100	<100	<100	<100	<100	<200	<100
BPGP63	05/11/18	<40	<10	<10	<100	<10	<10	<10	<10	<10	<10	<20	<10
BPGP65	05/12/18	<40	<10	<10	<400	<10	<10	<10	<10	<10	<10	<20	<10
RBCA RBSLs Groundwater		100	NA	NA	NA	1,000	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		100	100	2	NA	1,000	70	3	10,000	NA	NA	10,000	10,000
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Xylenes, Total (εg/L)	Acetone (εg/L)	Bromo- benzene (εg/L)	Bromo- dichloro- methane (εg/L)	Bromo- methane (εg/L)	n-Butyl- benzene (εg/L)	tert-Butyl- benzene (εg/L)	Chlorobenzene (εg/L)	Chloroform (εg/L)	2-Chloro- toluene (εg/L)	1,2-Dibromo 3- chloro- propane (εg/L)	1,2- Dibromo- ethane (εg/L)
BMW07-1	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
BMW-1	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
BMW-4	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
BNMW-17	05/08/18	<3	<20	<1	<1	<4 UJ	<1	<1	<1	<1	<1	<4	<1
BNMW-20	05/08/18	<3	<20	<1	<1	<4 UJ	<1	<1	<1	<1	<1	<4	<1
BNMW-21	05/08/18	<3	<20	<1	<1	<4 UJ	<1	<1	<1	<1	<1	<4	<1
BNMW-23	05/08/18	<3	<20	<1	<1	<4 UJ	2.5	0.38 J	<1	<1	<1	<4	<1
BNMW-8	05/08/18	<3	<20	<1	<1	<4 UJ	<1	<1	<1	<1	<1	<4	<1
BNMW-9	05/08/18	<3	<20	<1	<1	<4 UJ	<1	<1	<1	<1	<1	<4	<1
BPGP02	05/11/18	157	<40	<2	<2	<8	0.92	<2	<2	<2	<2	<8	<2
BPGP08	05/10/18	<6	<40	<2	<2	<8	<2	<2	<2	3.5	<2	<8	<2
BPGP12	05/21/18	<6	<40	<2	<2	<8	<2	<2	<2	3.4	<2	<20	<2
BPGP15	05/08/18	<3	<20	<1	0.59 J	<4	<1	<1	<1	3.5	<1	<4	<1
BPGP16	05/08/18	<3	<20	<1	6.2	<4 UJ	<1	<1	<1	23.4	<1	<4	<1
BPGP17	05/08/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
BPGP22	05/08/18	<3	<20	<1	4.9	<4	<1	<1	<1	27.7	<1	<4	<1
BPGP22 Dup	05/08/18	<3	<20	<1	4.4	<4	<1	<1	<1	27.4	<1	<4	<1
BPGP25	05/07/18	<3	<20	<1	2	<4	<1	<1	<1	10.9	<1	<4	<1
BPGP27	05/07/18	<3	<20	<1	3.3	<4	<1	<1	<1	19.7	<1	<4	<1
BPGP29	05/07/18	<3	<20	<1	<1	<4	<1	<1	<1	12.5	<1	<4	<1
BPGP31	05/07/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
BPGP41	05/07/18	<3	<20	<1	<1	<4	<1	<1	<1	4.3	<1	<4	<1
BPGP42	05/08/18	<3	<20	<1	<1	<4	<1	<1	<1	0.97 J	<1	<4	<1
BPGP44	05/08/18	<3	<20	<1	<1	<4 UJ	<1	<1	<1	1.3	<1	<4	<1
BPGP46	05/11/18	<6	<40	<2	<2	<8	0.56	<2	<2	<2	<2	<8	<2
BPGP46b	05/11/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
BPGP47	05/07/18	<3	<20	<1	<1	<4	<1	<1	<1	4.2	<1	<4	<1
BPGP48	05/07/18	<3	<20	<1	1.1	<4	<1	<1	<1	10	<1	<4	<1
BPGP49	05/11/18	<300	<2000	<100	<100	<400	<100	<100	<100	<100	<100	<400	<100
BPGP50	05/21/18	<3	<20	<1	<1	<4	<1	<1	<1	0.59	<1	<10	<1
BPGP50 Dup	05/21/18	<3	<20	<1	<1	<4	<1	<1	<1	0.59	<1	<10	<1
BPGP51	05/11/18	<150	<1000	<50	<50	<200	<50	<50	<50	<50	<50	<200	<50
BPGP51B	05/11/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
BPGP53	05/10/18	<15	<100	<5	<5	<20	<5	<5	<5	<5	<5	<20	<5
BPGP59	05/10/18	<30	<200	<10	<10	<40	<10	<10	<10	<10	<10	<40	<10
BPGP60	05/10/18	<60	<400	<20	<20	<80	<20	<20	<20	<20	<20	<80	<20
BPGP61	05/11/18	<300	<2000	<100	<100	<400	<100	<100	<100	<100	<100	<400	<100
BPGP63	05/11/18	<30	<200	<10	<10	<40	<10	<10	<10	<10	<10	<40	<10
BPGP65	05/12/18	<30	<200	<10	<10	<40	<10	<10	<10	8.3	<10	<40	<10
RBCA RBSLs Groundwater		10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.017
DEQ7 Groundwater Standard		10,000	NA	NA	10	10	NA	NA	100	70	NA	0.2	0.004
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,2-Di- chloro-benzene (εg/L)	1,4-Di- chloro-benzene (εg/L)	1,1-Dichloro-ethane (εg/L)	1,1-Dichloro-ethene (εg/L)	trans-1,2-Dichloro- ethene (εg/L)	1,2-Dichloro-propane (εg/L)	2,2-Dichloro-propane (εg/L)	Cis-1,3- dichloro-propene (εg/L)	Diethyl ether (εg/L)	Hexachloro-butadiene (εg/L)	p-Isopropyl-toluene (εg/L)	Methylene Chloride (εg/L)
BMW07-1	05/10/18	<1	<1	<1	<1	0.24	<4	<4	<4	<4	<1	<1	<4
BMW-1	05/10/18	<1	<1	<1	<1	0.27	<4	<4	<4	<4	<1	<1	<4
BMW-4	05/10/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BNMW-17	05/08/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BNMW-20	05/08/18	<1	<1	0.3 J	<1	<1	<4	<4	<4	<4	<1	<1	<4
BNMW-21	05/08/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BNMW-23	05/08/18	<1	<1	<1	<1	0.7 J	<4	<4	<4	<4	<1	0.69 J	<4
BNMW-8	05/08/18	<1	<1	0.35 J	<1	<1	<4	<4	<4	<4	<1	<1	<4
BNMW-9	05/08/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP02	05/11/18	<2	<2	<2	<2	<2	<8	<8	<8	<8	<2	0.43	<8
BPGP08	05/10/18	<2	<2	<2	<2	<2	<8	<8	<8	<8	<2	<2	<8
BPGP12	05/21/18	<2	<2	1	<2	<2	<8	<8	<8	<8	<2	<2	<8
BPGP15	05/08/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP16	05/08/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP17	05/08/18	<1	<1	0.54 J	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP22	05/08/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP22 Dup	05/08/18	<1	<1	<1	<1	<1	<4	<4 UJ	<4	<4	<1	<1	<4
BPGP25	05/07/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP27	05/07/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP29	05/07/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP31	05/07/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP41	05/07/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP42	05/08/18	<1	<1	0.64 J	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP44	05/08/18	<1	<1	0.48 J	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP46	05/11/18	<2	<2	<2	<2	<2	<8	<8	<8	<8	<2	<2	<8
BPGP46b	05/11/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP47	05/07/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP48	05/07/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP49	05/11/18	<100	<100	<100	<100	<100	<400	<400	<400	<400	<100	<100	<400
BPGP50	05/21/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP50 Dup	05/21/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP51	05/11/18	<50	<50	<50	<50	<50	<200	<200	<200	<200	<50	<50	<200
BPGP51B	05/11/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP53	05/10/18	<5	<5	<5	<5	<5	<20	<20	<20	<20	<5	<5	<20
BPGP59	05/10/18	<10	<10	<10	<10	<10	<40	<40	<40	<40	<10	<10	<40
BPGP60	05/10/18	<20	<20	<20	<20	<20	<80	<80	<80	<80	<20	<20	<80
BPGP61	05/11/18	<100	<100	<100	<100	<100	<400	<400	<400	<400	<100	<100	<400
BPGP63	05/11/18	<10	<10	<10	<10	<10	<40	<40	<40	<40	<10	<10	<40
BPGP65	05/12/18	<10	<10	<10	<10	<10	<40	<40	<40	<40	<10	<10	<40
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		600	75	NA	7	100	5	NA	4	NA	5	NA	5
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
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Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	n-Propyl-benzene (εg/L)	1,1,1,2-Tetrachloro- ethan (εg/L)	Tetrachloro-ethene (εg/L)	1,2,3- Trichloro-benzene (εg/L)	1,1,1- Trichloro-ethane (εg/L)	Trichloro- ethene (εg/L)	1,2,3- Trichloro-propane (εg/L)	1,2,4- Trimethyl-benzene (εg/L)	Vinyl Chloride (εg/L)
BMW07-1	05/10/18	<1	<1	**48.1**	<1	<1	**34.8**	<4	<1	<0.2
BMW-1	05/10/18	<1	<1	**131**	<1	<1	**19.5**	<4	<1	<0.2
BMW-4	05/10/18	<1	<1	**54.4**	<1	<1	**15.6**	<4	<1	<0.2
BNMW-17	05/08/18	<1	<1	<1	<1	<1	<0.4	<4	<1	<0.2
BNMW-20	05/08/18	<1	<1	**33.2**	<1	0.16 J	**8.3**	<4	<1	<0.2
BNMW-21	05/08/18	<1	<1	**20.9**	<1	0.18 J	**6.5**	<4	<1	<0.2
BNMW-23	05/08/18	12.9	<1	3.2	<1	<1	**7**	<4	4.5	<0.2
BNMW-8	05/08/18	<1	<1	**14.3**	<1	0.16 J	**6.6**	<4	<1	<0.2
BNMW-9	05/08/18	<1	<1	**6**	<1	<1	3.7	<4	<1	0.17 J
BPGP02	05/11/18	13.2	<2	1.4	<2	<2	0.92	<8	97	<0.4
BPGP08	05/10/18	<2	<2	**361**	<2	0.63	**32.1**	<8	<2	<0.4
BPGP12	05/21/18	<2	<2	**593**	<2	1.8	**24.2**	<8	<2	<0.4
BPGP15	05/08/18	<1	<1	**42.3**	<1	<1	**10.1**	<4	<1	<0.2
BPGP16	05/08/18	<1	<1	**155**	<1	<1	4.9	<4	<1	<0.2
BPGP17	05/08/18	<1	<1	**123**	<1	0.56 J	**41.1**	<4	<1	<0.2
BPGP22	05/08/18	<1	<1	**65**	<1	<1	**7**	<4	<1	<0.2
BPGP22 Dup	05/08/18	<1	<1	**59.1**	<1	<1	**5.7**	<4	<1	<0.2
BPGP25	05/07/18	<1	<1	**172 J-**	<1	0.29 J	**14**	<4	<1	<0.2
BPGP27	05/07/18	<1	<1	**18.3**	<1	<1	1.3	<4	<1	<0.2
BPGP29	05/07/18	<1	<1	**37.2 J-**	<1	<1	**19.8**	<4	<1	**0.46**
BPGP31	05/07/18	<1	<1	0.42 J	<1	<1	<0.4	<4	<1	<0.2
BPGP41	05/07/18	<1	<1	**42.4**	<1	<1	4.6	<4	<1	<0.2
BPGP42	05/08/18	<1	<1	**231**	<1	0.61 J	**42.3**	<4	<1	<0.2
BPGP44	05/08/18	<1	<1	**152**	<1	0.51 J	**25.3**	<4	<1	<0.2
BPGP46	05/11/18	9.1	<2	**368**	<2	<2	2.8	<8	<2	<0.4
BPGP46b	05/11/18	<1	<1	**1980**	<1	<1	**246**	<4	<1	<0.2
BPGP47	05/07/18	<1	<1	**67.5**	<1	<1	**7.6**	<4	<1	<0.2
BPGP48	05/07/18	<1	<1	**23.7 J-**	<1	<1	1.8	<4	<1	<0.2
BPGP49	05/11/18	<100	<100	**21900**	<100	<100	<40	<400	<100	<20
BPGP50	05/21/18	<1	<1	**61.7**	<1	<1	**16.6**	<4	<1	<0.2
BPGP50 Dup	05/21/18	<1	<1	**59.6**	<1	<1	**15.9**	<4	<1	<0.2
BPGP51	05/11/18	<50	<50	**39300**	<50	<50	<20	<200	<50	<10
BPGP51B	05/11/18	0.74	<1	**80.6**	<1	<1	0.99	<4	<1	<0.2
BPGP53	05/10/18	<5	<5	**521**	<5	<5	2.1	<20	<5	<1
BPGP59	05/10/18	<10	<10	**1520**	<10	<10	**431**	<40	<10	<2
BPGP60	05/10/18	<20	<20	**2690**	<20	<20	**66.3**	<80	<20	<4
BPGP61	05/11/18	<100	<100	**15500**	<100	<100	**131**	<400	<100	<20
BPGP63	05/11/18	<10	<10	**991**	<10	<10	**10**	<40	<10	<2
BPGP65	05/12/18	<10	<10	**1690**	<10	<10	**10.1**	<40	<10	<2
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	NA	5	NA	200	5	NA	NA	0.2
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
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RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
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Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Allyl Chloride (εg/L)	Benzene (εg/L)	Bromo- chloro- methane (εg/L)	Bromoform (εg/L)	2-Butanone (εg/L)	sec-Butylbenzene (εg/L)	Carbon tetrachloride (εg/L)	Chloroethane (εg/L)	Chloromethane (εg/L)	4-Chloro- toluene (εg/L)	Dibromo- chloromethane (εg/L)	Dibromomethane (εg/L)
BPGP65B	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP67	05/10/18	<4	0.9	<1	<4	11.1	<1	<1	<1	<4	<1	<1	<4
BPGP74	05/11/18	<400	<100	<100	<400	<500	<100	<100	<100	<400	<100	<100	<400
BPGP76	05/11/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP78	05/11/18	<4	**231**	<1	<4	<5	4.6	<1	<1	<4	<1	<1	<4
BPGP80	05/10/18	<40	0.46	<10	<40	<50	<10	<10	<10	<40	<10	<10	<40
BPGP80 Dup	05/10/18	<4	0.67	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP81	05/21/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP83	05/21/18	<8	<2	<2	<8	<10	<2	<2	<2	<8	<2	<2	<8
BPGP84	05/21/18	<20	<5	<5	<20	<25	<5	<5	<5	<20	<5	<5	<20
BPGP85	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP86	05/07/18	<8	<2	<2	<8	<10	<2	<2	<2	<8	<2	<2	<8
BPGP87	05/10/18	<8	<2	<2	<8	<10	<2	<2	<2	<8	<2	<2	<8
BPGP89	05/08/18	<8	**380**	<2	<8	<10	2.8	<2	<2	<8	<2	<2	<8
BPGP91	05/21/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP92	05/08/18	<8 UJ	<2 UJ	<2 UJ	<8 UJ	<10 UJ	<2 UJ	<2 UJ	<2 UJ	<8 UJ	<2 UJ	<2 UJ	<8 UJ
BPGP93	05/21/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGP94	05/21/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
BPGW01	05/11/18	<4	3.2	<1	<4	<5	1.1	<1	<1	<4	<1	<1	<4
BPGW04	05/11/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
EMW-03	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
EMW-09	05/11/18	<8	<2	<2	<8	<10	30.4	<2	<2	<8	<2	<2	<8
EMW-18	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
EMW-28	05/21/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
EMW-32	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-100	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-101	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-102	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-103	05/11/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-104	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-105	05/08/18	<4	3.7 J+	<1	<4	23.5 J+	1.8	<1	<1	<4	<1	<1	<4
MW-106	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-107	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-108	05/10/18	<4	<1	<1	<4	<5	1.6	<1	<1	<4	<1	<1	<4
MW-109	05/09/18	--	<0.5	--	--	--	--	--	--	--	--	--	--
	05/22/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-110	05/22/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-111	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-112	05/22/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
RBCA RBSLs Groundwater		NA	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	5	NA	80	NA	NA	3	NA	30	NA	4	NA
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,3-Di- chloro- benzene (εg/L)	Dichloro- difluoro- methane (εg/L)	1,2- Dichloro- ethane (εg/L)	cis-1,2- Dichloro- ethene (εg/L)	Dichlorofluoromet hane (εg/L)	1,3-Dichloro- propane (εg/L)	1,1-Dichloro- propene (εg/L)	trans-1,3- Dichloro- propene (εg/L)	Ethyl- benzene (εg/L)	Isopropyl- benzene (εg/L)	4-Methyl- 2- Pentanone (εg/L)	MTBE (εg/L)
BPGP65B	05/10/18	<1	<1	<1	0.65	<1	<1	<1	<4	<1	<1	<5	<1
BPGP67	05/10/18	<1	<1	<1	10.9	<1	<1	<1	<4	0.25	9.2	<5	<1
BPGP74	05/11/18	<100	<100	<100	**196**	<100	<100	<100	<400	<100	<100	<500	<100
BPGP76	05/11/18	<1	<1	<1	62.3	<1	<1	<1	<4	<1	<1	<5	<1
BPGP78	05/11/18	<10.6	<1	0.57	1.8	<1	<1	<1	<4	490	46.6	<5	<1
BPGP80	05/10/18	<10	<10	<10	15.2	<10	<10	<10	<40	<10	<10	<50	<10
BPGP80 Dup	05/10/18	<1	<1	<1	23.2	<1	<1	<1	<4	<1	<1	<5	<1
BPGP81	05/21/18	<1	<1	<1	0.73	<1	<1	<1	<4	<1	<1	<5	<1
BPGP83	05/21/18	<2	<2	<2	6	<2	<2	<2	<8	<2	<2	<10	<2
BPGP84	05/21/18	<5	<5	<5	20.5	<5	<5	<5	<20	<5	<5	<25	<5
BPGP85	05/08/18	<1	<1	<1	0.92 J	<1	<1	<1	<4	<1	<1	<5	<1
BPGP86	05/07/18	<2	<2	<2	5.8	<2	<2	<2	<8	<2	<2	<10	<2
BPGP87	05/10/18	<2	<2	<2	<2	<2	<2	<2	<8	<2	<2	<10	<2
BPGP89	05/08/18	<2	<2	<2	**78.4**	<2	<2	<2	<8	151 J+	10.6	<10	<2
BPGP91	05/21/18	<1	<1	0.48	12.9	<1	<1	<1	<4	<1	<1	<5	<1
BPGP92	05/08/18	<2 UJ	<2 UJ	<2 UJ	9.8 J-	<2 UJ	<2 UJ	<2 UJ	<8 UJ	<2 UJ	<2 UJ	<10 UJ	<2 UJ
BPGP93	05/21/18	<1	<1	1.7	3.3	<1	<1	<1	<4	<1	<1	<5	<1
BPGP94	05/21/18	<1	<1	<1	20.2	<1	<1	<1	<4	<1	<1	<5	<1
BPGW01	05/11/18	<1	<1	<1	3.4	<1	<1	<1	<4	6	3.4	<5	<1
BPGW04	05/11/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
EMW-03	05/07/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
EMW-09	05/11/18	<2	<2	<2	<2	<2	<2	<2	<8	254	107	<10	21.7
EMW-18	05/10/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
EMW-28	05/21/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
EMW-32	05/10/18	<1	<1	<1	0.58	<1	<1	<1	<4	<1	<1	<5	<1
MW-100	05/07/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-101	05/07/18	<10	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1 R
MW-102	05/07/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-103	05/11/18	<10.3	<1	<1	0.22	<1	<1	<1	<4	<1	<1	<5	<1
MW-104	05/10/18	<10	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-105	05/08/18	<9.9	<1	<1	**93**	<1	<1	<1	<4	1.3 J+	2.4	<5	<1
MW-106	05/08/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-107	05/10/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-108	05/10/18	<9.8	<1	<1	48.3	<1	<1	<1	<4	<1	<1	<5	<1
MW-109	05/09/18	<9.9	--	--	--	--	--	--	--	<0.5	--	--	<1
	05/22/18	<1	<1	<1	1.8	<1	<1	<1	<4	<1	<1	<5	<1
MW-110	05/22/18	<1	<1	<1	6.4	<1	<1	<1	<4	<1	<1	<5	<1
MW-111	05/10/18	<10.4	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-112	05/22/18	<1	<1	<1	0.94	<1	<1	<1	<4	<1	<1	<5	<1
RBCA RBSLs Groundwater		NA	NA	4	NA	NA	NA	NA	NA	700	NA	NA	30
DEQ7 Groundwater Standard		600	1,000	4	70	NA	NA	NA	2	700	NA	NA	30
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Naphthalene (εg/L)	Styrene (εg/L)	1,1,2,2-Tetrachloro- ethan (εg/L)	Tetrahydrofuran (εg/L)	Toluene (εg/L)	1,2,4- Trichloro-benzene (εg/L)	1,1,2- Trichloro-ethane (εg/L)	Trichloro-fluoromethane (εg/L)	1,1,2- Trichloro-trifluoro- ethane (εg/L)	1,3,5-Trimethyl-benzene (εg/L)	m,p-Xylene (εg/L)	o-Xylene (εg/L)
BPGP65B	05/10/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
BPGP67	05/10/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	0.36	<2	0.48
BPGP74	05/11/18	<400	<100	<100	<1000	<100	<100	<100	<100	<100	<100	<200	<100
BPGP76	05/11/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP78	05/11/18	6.1	<1	<1	<40	4.4	<10.6	<1	<1	<1	12	13.4	0.53
BPGP80	05/10/18	<5	<10	<10	<400	<10	<10	<10	<10	<10	<10	<20	<10
BPGP80 Dup	05/10/18	<5	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
BPGP81	05/21/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP83	05/21/18	<8	<2	<2	<20	<2	<2	<2	<2	<2	<2	<4	<2
BPGP84	05/21/18	<20	<5	<5	<50	<5	<5	<5	<5	<5	<5	<10	<5
BPGP85	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP86	05/07/18	<8	<2	<2	<20	<2	<2	<2	<2	<2	<2	<4	<2
BPGP87	05/10/18	<8	<2	<2	<80	<2	<2	<2	<2	<2	<2	<4	<2
BPGP89	05/08/18	1.9 J+	<2	<2	<20	5.7 J+	<2	<2	<2	<2	<2	3.8 J	1.1 J+
BPGP91	05/21/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP92	05/08/18	<8 UJ	<2 UJ	<2 UJ	<20 UJ	<2 UJ	<2 UJ	<2 UJ	<2 UJ	<2 UJ	<2 UJ	<4 UJ	<2 UJ
BPGP93	05/21/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGP94	05/21/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
BPGW01	05/11/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	0.3	<1
BPGW04	05/11/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
EMW-03	05/07/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
EMW-09	05/11/18	7.1	<2	<2	<20	0.53	<2	<2	<2	<2	<2	3.4	2.6
EMW-18	05/10/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
EMW-28	05/21/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
EMW-32	05/10/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
MW-100	05/07/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-101	05/07/18	<5 R	<1	<1	<10	<1	<10	<1	<1	<1	<1	<2	<1
MW-102	05/07/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-103	05/11/18	<5	<1	<1	<10	<1	<10.3	<1	<1	<1	<1	<2	<1
MW-104	05/10/18	<5	<1	<1	<40	<1	<10	<1	<1	<1	<1	<2	<1
MW-105	05/08/18	1.5 J+	<1	<1	<10	<1	<9.9	<1	<1	<1	<1	<2	<1
MW-106	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-107	05/10/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
MW-108	05/10/18	5.1	<1	<1	<10	<1	<9.8	<1	<1	<1	<1	<2	1.7
MW-109	05/09/18	<9.9	--	--	--	<0.5	<9.9	--	--	--	--	<0.5	<0.5
	05/22/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-110	05/22/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-111	05/10/18	<5	<1	<1	<40	<1	<10.4	<1	<1	<1	<1	<2	<1
MW-112	05/22/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
RBCA RBSLs Groundwater		100	NA	NA	NA	1,000	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		100	100	2	NA	1,000	70	3	10,000	NA	NA	10,000	10,000
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Xylenes, Total (εg/L)	Acetone (εg/L)	Bromo- benzene (εg/L)	Bromo- dichloro- methane (εg/L)	Bromo- methane (εg/L)	n-Butyl- benzene (εg/L)	tert-Butyl- benzene (εg/L)	Chlorobenzene (εg/L)	Chloroform (εg/L)	2-Chloro- toluene (εg/L)	1,2-Dibromo 3- chloro- propane (εg/L)	1,2- Dibromo- ethane (εg/L)
BPGP65B	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
BPGP67	05/10/18	<3	21.9	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
BPGP74	05/11/18	<300	<2000	<100	<100	<400	<100	<100	<100	<100	<100	<400	<100
BPGP76	05/11/18	<3	<20	<1	1.3	<4	<1	<1	<1	27.9	<1	<4	<1
BPGP78	05/11/18	13.4	<20	<1	<1	<4	1.5	0.16	<1	<1	<1	<4	<1
BPGP80	05/10/18	<30	<200	<10	<10	<40	<10	<10	<10	<10	<10	<40	<10
BPGP80 Dup	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	1.1	<1	<4	<1
BPGP81	05/21/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
BPGP83	05/21/18	<6	<40	<2	<2	<8	<2	<2	<2	6.7	<2	<20	<2
BPGP84	05/21/18	<15	<100	<5	<5	<20	<5	<5	<5	<5	<5	<50	<5
BPGP85	05/08/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
BPGP86	05/07/18	<6	<40	<2	2.8	<8	<2	<2	<2	13.9	<2	<8	<2
BPGP87	05/10/18	<6	<40	<2	<2	<8	<2	<2	<2	2	<2	<8	<2
BPGP89	05/08/18	1.1 J+	<40	<2	<2	<8	1.1 J	<2	<2	<2	<2	<8	<2
BPGP91	05/21/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
BPGP92	05/08/18	<6 UJ	<40 UJ	<2 UJ	<2 UJ	<8 UJ	<2 UJ	<2 UJ	<2 UJ	1 J-	<2 UJ	<8 UJ	<2 UJ
BPGP93	05/21/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
BPGP94	05/21/18	<3	<20	<1	1.7	<4	<1	<1	<1	9.8	<1	<10	<1
BPGW01	05/11/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
BPGW04	05/11/18	<3	<20	<1	0.55	<4	<1	<1	<1	6.7	<1	<4	<1
EMW-03	05/07/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
EMW-09	05/11/18	2.6	<40	<2	<2	<8	8.1	0.71	<2	<2	<2	<8	<2
EMW-18	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
EMW-28	05/21/18	<3	<20	<1	5.9	<4	<1	<1	<1	57.4	<1	<10	<1
EMW-32	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-100	05/07/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-101	05/07/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-102	05/07/18	<3	<20	<1	<1	<4	<1	<1	<1	0.74 J	<1	<4	<1
MW-103	05/11/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-104	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-105	05/08/18	<3	22.1/ND(22.1)U*	<1	<1	<4 UJ	1.4	0.19 J	<1	<1	<1	<4	<1
MW-106	05/08/18	<3	<20	<1	<1	<4 UJ	<1	<1	<1	1	<1	<4	<1
MW-107	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	3.3	<1	<4	<1
MW-108	05/10/18	1.7	<20	<1	<1	<4	<1	1.6	<1	<1	<1	<4	<1
MW-109	05/09/18	<2	--	--	--	--	--	--	--	--	--	--	--
	05/22/18	<3	<20	<1	<1	<4	<1	<1	<1	3.5	<1	<10	<1
MW-110	05/22/18	<3	<20	<1	<1	<4	<1	<1	<1	1.5	<1	<10	<1
MW-111	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	7.3	<1	<4	<1
MW-112	05/22/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
RBCA RBSLs Groundwater		10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.017
DEQ7 Groundwater Standard		10,000	NA	NA	10	10	NA	NA	100	70	NA	0.2	0.004
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
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NA - No applicable screening levels for this analyte
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Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,2-Di- chloro-benzene (εg/L)	1,4-Di- chloro-benzene (εg/L)	1,1-Dichloro-ethane (εg/L)	1,1-Dichloro-ethene (εg/L)	trans-1,2-Dichloro- ethene (εg/L)	1,2-Dichloro-propane (εg/L)	2,2-Dichloro-propane (εg/L)	Cis-1,3- dichloro-propene (εg/L)	Diethyl ether (εg/L)	Hexachloro-butadiene (εg/L)	p-Isopropyl-toluene (εg/L)	Methylene Chloride (εg/L)
BPGP65B	05/10/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP67	05/10/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP74	05/11/18	<100	<100	<100	<100	<100	<400	<400	<400	<400	<100	<100	<400
BPGP76	05/11/18	<1	<1	<1	<1	0.47	<4	<4	<4	<4	<1	<1	<4
BPGP78	05/11/18	<10.6	<10.6	<1	<1	<1	<4	<4	<4	<4	<10.6	1.4	<4
BPGP80	05/10/18	<10	<10	<10	<10	<10	<40	<40	<40	<40	<10	<10	<40
BPGP80 Dup	05/10/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP81	05/21/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP83	05/21/18	<2	<2	<2	<2	<2	<8	<8	<8	<8	<2	<2	<8
BPGP84	05/21/18	<5	<5	<5	<5	<5	<20	<20	<20	<20	<5	<5	<20
BPGP85	05/08/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP86	05/07/18	<2	<2	<2	<2	<2	<8	<8	<8	<8	<2	<2	<8
BPGP87	05/10/18	<2	<2	<2	<2	<2	<8	<8	<8	<8	<2	<2	<8
BPGP89	05/08/18	<2	<2	0.41 J	<2	<2	<8	<8	<8	<8	<2	<2	<8
BPGP91	05/21/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP92	05/08/18	<2 UJ	<2 UJ	0.9 J-	<2 UJ	<2 UJ	<8 UJ	<8 UJ	<8 UJ	<8 UJ	<2 UJ	<2 UJ	<8 UJ
BPGP93	05/21/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGP94	05/21/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGW01	05/11/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
BPGW04	05/11/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
EMW-03	05/07/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
EMW-09	05/11/18	<2	<2	<2	<2	<2	<8	<8	<8	<8	<2	1.4	<8
EMW-18	05/10/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
EMW-28	05/21/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
EMW-32	05/10/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-100	05/07/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-101	05/07/18	<10	<10	<1	<1	<1	<4	<4	<4	<4	<10	<1	<4
MW-102	05/07/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-103	05/11/18	<10.3	<10.3	<1	<1	<1	<4	<4	<4	<4	<10.3	<1	<4
MW-104	05/10/18	<10	<10	<1	<1	<1	<4	<4	<4	<4	<10	<1	<4
MW-105	05/08/18	<9.9	<9.9	<1	<1	<1	<4	<4	<4	<4	<9.9	<1	<4
MW-106	05/08/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-107	05/10/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-108	05/10/18	<9.8	<9.8	<1	<1	0.4	<4	<4	<4	<4	<9.8	<1	<4
MW-109	05/09/18	<9.9	<9.9	--	--	--	--	--	--	--	<9.9	--	--
	05/22/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-110	05/22/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-111	05/10/18	<10.4	<10.4	<1	<1	<1	<4	<4	<4	<4	<10.4	<1	<4
MW-112	05/22/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		600	75	NA	7	100	5	NA	4	NA	5	NA	5
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	n-Propyl-benzene (εg/L)	1,1,1,2-Tetrachloro- ethan (εg/L)	Tetrachloro-ethene (εg/L)	1,2,3- Trichloro-benzene (εg/L)	1,1,1- Trichloro-ethane (εg/L)	Trichloro- ethene (εg/L)	1,2,3- Trichloro-propane (εg/L)	1,2,4- Trimethyl-benzene (εg/L)	Vinyl Chloride (εg/L)
BPGP65B	05/10/18	<1	<1	4.2	<1	<1	0.24	<4	<1	<0.2
BPGP67	05/10/18	0.64	<1	**118**	<1	<1	**15.6**	<4	0.45	<0.2
BPGP74	05/11/18	<100	<100	**14400**	<100	<100	**186**	<400	<100	<20
BPGP76	05/11/18	<1	<1	**1720**	<1	<1	**67.1**	<4	<1	<0.2
BPGP78	05/11/18	115	<1	1.3	<1	<1	0.7	<4	47.2	<0.2
BPGP80	05/10/18	<10	<10	**1190**	<10	<10	**92.5**	<40	<10	<2
BPGP80 Dup	05/10/18	<1	<1	**1340**	<1	<1	**124**	<4	<1	<0.2
BPGP81	05/21/18	<1	<1	**94.6**	<1	<1	4.7	<4	<1	<0.2
BPGP83	05/21/18	<2	<2	**852**	<2	<2	**26.3**	<8	<2	<0.4
BPGP84	05/21/18	<5	<5	**387**	<5	<5	**19**	<20	<5	**5.5**
BPGP85	05/08/18	<1	<1	**10.2**	<1	<1	2.4	<4	<1	<0.2
BPGP86	05/07/18	<2	<2	**258**	<2	<2	**18.8**	<8	<2	<0.4
BPGP87	05/10/18	<2	<2	**142**	<2	<2	1.8	<8	<2	<0.4
BPGP89	05/08/18	14.8	<2	<2	<2	<2	**78.5**	<8	3	<0.4
BPGP91	05/21/18	<1	<1	1.4	<1	<1	0.27	<4	<1	<0.2
BPGP92	05/08/18	<2 UJ	<2 UJ	**429 J-**	<2 UJ	1.1 J-	**104 J-**	<8 UJ	<2 UJ	<0.4 UJ
BPGP93	05/21/18	<1	<1	**27.6**	<1	<1	4	<4	<1	<0.2
BPGP94	05/21/18	<1	<1	**90.2**	<1	<1	**23.3**	<4	<1	<0.2
BPGW01	05/11/18	2.6	<1	**17**	<1	<1	2.7	<4	<1	<0.2
BPGW04	05/11/18	<1	<1	**5.6**	<1	<1	<0.4	<4	<1	<0.2
EMW-03	05/07/18	<1	<1	<1	<1	<1	<0.4	<4	<1	<0.2
EMW-09	05/11/18	363	<2	0.6	<2	<2	<0.8	<8	3.6	<0.4
EMW-18	05/10/18	<1	<1	0.74	<1	<1	0.36	<4	<1	<0.2
EMW-28	05/21/18	<1	<1	<1	<1	<1	<0.4	<4	<1	<0.2
EMW-32	05/10/18	<1	<1	3.9	<1	<1	0.65	<4	<1	<0.2
MW-100	05/07/18	<1	<1	**8.4**	<1	<1	0.79	<4	<1	<0.2
MW-101	05/07/18	<1	<1	2.7	<1	<1	<0.4	<4	<1	<0.2
MW-102	05/07/18	<1	<1	**185**	<1	<1	3.3	<4	<1	<0.2
MW-103	05/11/18	<1	<1	2.5	<1	<1	0.64	<4	<1	<0.2
MW-104	05/10/18	<1	<1	3	<1	<1	0.2	<4	<1	<0.2
MW-105	05/08/18	5	<1	**164**	<1	<1	**76.8**	<4	<1	**1.1**
MW-106	05/08/18	<1	<1	4.1	<1	<1	<0.4	<4	<1	<0.2
MW-107	05/10/18	<1	<1	<1	<1	<1	<0.4	<4	<1	<0.2
MW-108	05/10/18	<1	<1	<1	<1	<1	<0.4	<4	<1	**0.36**
MW-109	05/09/18	--	--	--	--	--	--	--	--	--
	05/22/18	<1	<1	2.3	<1	<1	0.88	<4	<1	<0.2
MW-110	05/22/18	<1	<1	4.2	<1	<1	2.4	<4	<1	<0.2
MW-111	05/10/18	<1	<1	0.79	<1	<1	0.49	<4	<1	<0.2
MW-112	05/22/18	<1	<1	1.8	<1	<1	0.84	<4	<1	<0.2
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	NA	5	NA	200	5	NA	NA	0.2
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
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Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Allyl Chloride (εg/L)	Benzene (εg/L)	Bromo- chloro- methane (εg/L)	Bromoform (εg/L)	2-Butanone (εg/L)	sec-Butylbenzene (εg/L)	Carbon tetrachloride (εg/L)	Chloroethane (εg/L)	Chloromethane (εg/L)	4-Chloro- toluene (εg/L)	Dibromo- chloromethane (εg/L)	Dibromomethane (εg/L)
MW-113	05/22/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-114	05/22/18	<4	<1	<1	<4	<5	0.45	<1	<1	<4	<1	<1	<4
MW-114 Dup	05/22/18	<4	<1	<1	<4	<5	0.46	<1	<1	<4	<1	<1	<4
MW-115	05/22/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-116	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-117	05/10/18	<4	4.9	<1	<4	<5	9.2	<1	<1	<4	0.21	<1	<4
MW-118	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-119	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-120	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-121	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-121 Dup	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-122	05/11/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-123	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-124	05/07/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-125	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-125 Dup	05/10/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-126	05/12/18	<4	<1	<1	<4	4.3	<1	<1	<1	<4	<1	<1	<4
MW-128	05/09/18	--	<0.5	--	--	--	--	--	--	--	--	--	--
	05/22/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-128 Dup	05/09/18	--	<0.5	--	--	--	--	--	--	--	--	--	--
MW-129	05/23/18	<4	0.4	<1	<4	<5	0.49	<1	<1	<4	<1	<1	<4
MW-130	05/23/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-132	05/23/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-133	05/23/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-134	05/23/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
MW-135	05/23/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
PEP07	05/11/18	<20	<5	<5	<20	<25	<5	<5	<5	<20	<5	<5	<20
PEP07 Dup	05/11/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
REGAL-I-01	05/21/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
RH-MW-1	05/22/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
RH-MW-3	05/22/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
RH-MW-7	05/22/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
SD-I-01	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
SD-I-02	05/08/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
SMW12	05/11/18	<4	<1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
SYS-EMW-03	05/22/18	<4	2.1	<1	<4	<5	1.1	<1	<1	<4	<1	<1	<4
ZPMW-1	05/22/18	<4	1.1	<1	<4	<5	<1	<1	<1	<4	<1	<1	<4
RBCA RBSLs Groundwater		NA	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	5	NA	80	NA	NA	3	NA	30	NA	4	NA
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
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RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
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TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,3-Di- chloro- benzene (εg/L)	Dichloro- difluoro- methane (εg/L)	1,2- Dichloro- ethane (εg/L)	cis-1,2- Dichloro- ethene (εg/L)	Dichlorofluoromethane (εg/L)	1,3-Dichloro- propane (εg/L)	1,1-Dichloro- propene (εg/L)	trans-1,3- Dichloro- propene (εg/L)	Ethyl- benzene (εg/L)	Isopropyl- benzene (εg/L)	4-Methyl- 2- Pentanone (εg/L)	MTBE (εg/L)
MW-113	05/22/18	<1	<1	<1	0.51	<1	<1	<1	<4	<1	<1	<5	<1
MW-114	05/22/18	<1	<1	0.28	**85.1**	<1	<1	<1	<4	<1	<1	<5	<1
MW-114 Dup	05/22/18	<1	<1	0.26	**84.7**	<1	<1	<1	<4	<1	<1	<5	<1
MW-115	05/22/18	<1	<1	<1	7.8	<1	<1	<1	<4	<1	<1	<5	<1
MW-116	05/08/18	<1	<1	<1	2	<1	<1	<1	<4	<1	<1	<5	<1
MW-117	05/10/18	<10	<1	0.93	7.7	<1	<1	<1	<4	229	36.5	<5	<1
MW-118	05/10/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-119	05/10/18	<10	<1	<1	0.43	<1	<1	<1	<4	0.18	<1	<5	<1
MW-120	05/07/18	<1	<1	<1	2	<1	<1	<1	<4	<1	<1	<5	<1
MW-121	05/10/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-121 Dup	05/10/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-122	05/11/18	<10.6	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-123	05/08/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-124	05/07/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-125	05/10/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-125 Dup	05/10/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-126	05/12/18	<11.8	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-128	05/09/18	<9.9	--	--	--	--	--	--	--	<0.5	--	--	<1
	05/22/18	<1	<1	<1	0.5	<1	<1	<1	<4	<1	<1	<5	<1
MW-128 Dup	05/09/18	<10.1	--	--	--	--	--	--	--	<0.5	--	--	<1
MW-129	05/23/18	<1	<1	<1	**92.3**	<1	<1	<1	<4	<1	<1	<5	<1
MW-130	05/23/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-132	05/23/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-133	05/23/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-134	05/23/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
MW-135	05/23/18	<1	<1	0.75	23.6	<1	<1	<1	<4	<1	<1	<5	<1
PEP07	05/11/18	<5	<5	<5	3.9	<5	<5	<5	<20	<5	<5	<25	<5
PEP07 Dup	05/11/18	<1	<1	<1	4.5	<1	<1	<1	<4	0.56	<1	<5	<1
REGAL-I-01	05/21/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
RH-MW-1	05/22/18	<1	<1	<1	3.1	<1	<1	<1	<4	<1	<1	<5	<1
RH-MW-3	05/22/18	<1	<1	<1	19.2	<1	<1	<1	<4	<1	<1	<5	<1
RH-MW-7	05/22/18	<1	<1	<1	31.9	<1	<1	<1	<4	<1	<1	<5	<1
SD-I-01	05/08/18	<1	<1 UJ	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
SD-I-02	05/08/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
SMW12	05/11/18	<1	<1	<1	<1	<1	<1	<1	<4	<1	<1	<5	<1
SYS-EMW-03	05/22/18	<1	<1	<1	<1	<1	<1	<1	<4	1.9	0.2	1.8	<1
ZPMW-1	05/22/18	<1	<1	0.66	0.75	<1	<1	<1	<4	<1	<1	<5	<1
RBCA RBSLs Groundwater		NA	NA	4	NA	NA	NA	NA	NA	700	NA	NA	30
DEQ7 Groundwater Standard		600	1,000	4	70	NA	NA	NA	2	700	NA	NA	30
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Naphthalene (εg/L)	Styrene (εg/L)	1,1,2,2-Tetrachloro- ethan (εg/L)	Tetrahydrofuran (εg/L)	Toluene (εg/L)	1,2,4- Trichloro-benzene (εg/L)	1,1,2- Trichloro-ethane (εg/L)	Trichloro-fluoromethane (εg/L)	1,1,2- Trichloro-trifluoro- ethane (εg/L)	1,3,5-Trimethyl-benzene (εg/L)	m,p-Xylene (εg/L)	o-Xylene (εg/L)
MW-113	05/22/18	<4	<1	<1	<10	0.2	<1	<1	<1	<1	<1	<2	<1
MW-114	05/22/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-114 Dup	05/22/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-115	05/22/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-116	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-117	05/10/18	5.9	<1	<1	<40	1.6	<10	<1	<1	<1	8.2	182	14.1
MW-118	05/10/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
MW-119	05/10/18	<5	<1	<1	<40	0.18	<10	<1	<1	<1	<1	<2	<1
MW-120	05/07/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-121	05/10/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
MW-121 Dup	05/10/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
MW-122	05/11/18	<5	<1	<1	<10	<1	<10.6	<1	<1	<1	<1	<2	<1
MW-123	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-124	05/07/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-125	05/10/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
MW-125 Dup	05/10/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
MW-126	05/12/18	<5	<1	<1	<40	<1	<11.8	<1	<1	<1	<1	<2	<1
MW-128	05/09/18	<9.9	--	--	--	<0.5	<9.9	--	--	--	--	<0.5	<0.5
	05/22/18	<4	<1	<1	<10	0.095	<1	<1	<1	<1	<1	<2	<1
MW-128 Dup	05/09/18	<5	--	--	--	<0.5	<10.1	--	--	--	--	<0.5	<0.5
MW-129	05/23/18	<5	<1	<1	<10	0.23	<1	<1	<1	<1	<1	<2	<1
MW-130	05/23/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-132	05/23/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-133	05/23/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-134	05/23/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
MW-135	05/23/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
PEP07	05/11/18	<20	<5	<5	<50	<5	<5	<5	<5	<5	<5	<10	<5
PEP07 Dup	05/11/18	<4	<1	<1	<40	<1	<1	<1	<1	<1	<1	<2	<1
REGAL-I-01	05/21/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
RH-MW-1	05/22/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
RH-MW-3	05/22/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
RH-MW-7	05/22/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
SD-I-01	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
SD-I-02	05/08/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
SMW12	05/11/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
SYS-EMW-03	05/22/18	4.7	<1	<1	<10	<1	<1	<1	<1	<1	0.33	15.6	4.2
ZPMW-1	05/22/18	<4	<1	<1	<10	<1	<1	<1	<1	<1	<1	<2	<1
RBCA RBSLs Groundwater		100	NA	NA	NA	1,000	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		100	100	2	NA	1,000	70	3	10,000	NA	NA	10,000	10,000
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Xylenes, Total (εg/L)	Acetone (εg/L)	Bromo- benzene (εg/L)	Bromo- dichloro- methane (εg/L)	Bromo- methane (εg/L)	n-Butyl- benzene (εg/L)	tert-Butyl- benzene (εg/L)	Chlorobenzene (εg/L)	Chloroform (εg/L)	2-Chloro- toluene (εg/L)	1,2-Dibromo 3- chloro- propane (εg/L)	1,2- Dibromo- ethane (εg/L)
MW-113	05/22/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
MW-114	05/22/18	<3	<20	<1	<1	<4	<1	0.25	<1	<1	<1	<10	<1
MW-114 Dup	05/22/18	<3	<20	<1	<1	<4	<1	0.28	<1	<1	<1	<10	<1
MW-115	05/22/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
MW-116	05/08/18	<3	<20	<1	<1	<4 UJ	<1	<1	<1	<1	<1	<4	<1
MW-117	05/10/18	196	11.1	<1	<1	<4	13.6	0.55	<1	<1	<1	<4	<1
MW-118	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-119	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-120	05/07/18	<3	<20	<1	<1	<4	<1	<1	<1	5.2	<1	<4	<1
MW-121	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-121 Dup	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-122	05/11/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-123	05/08/18	<3	<20	<1	<1	<4 UJ	<1	<1	<1	0.62 J	<1	<4	<1
MW-124	05/07/18	<3	<20	<1	<1	<4 UJ	<1	<1	<1	<1	<1	<4	<1
MW-125	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-125 Dup	05/10/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-126	05/12/18	<3	11.3	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
MW-128	05/09/18	<2	--	--	--	--	--	--	--	--	--	--	--
	05/22/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
MW-128 Dup	05/09/18	<2	--	--	--	--	--	--	--	--	--	--	--
MW-129	05/23/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
MW-130	05/23/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
MW-132	05/23/18	<3	<20	<1	<1	<4	<1	<1	<1	0.78	<1	<10	<1
MW-133	05/23/18	<3	<20	<1	<1	<4	<1	<1	<1	0.63	<1	<10	<1
MW-134	05/23/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
MW-135	05/23/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
PEP07	05/11/18	<15	<100	<5	<5	<20	<5	<5	<5	<5	<5	<20	<5
PEP07 Dup	05/11/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
REGAL-I-01	05/21/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
RH-MW-1	05/22/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
RH-MW-3	05/22/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
RH-MW-7	05/22/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
SD-I-01	05/08/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<4	<1
SD-I-02	05/08/18	<3	<20	<1	<1	<4 UJ	<1	<1	<1	<1	<1	<4	<1
SMW12	05/11/18	<3	<20	<1	<1	<4	<1	<1	<1	0.86	<1	<4	<1
SYS-EMW-03	05/22/18	19.8	17.7	<1	<1	<4	0.6	<1	<1	<1	<1	<10	<1
ZPMW-1	05/22/18	<3	<20	<1	<1	<4	<1	<1	<1	<1	<1	<10	<1
RBCA RBSLs Groundwater		10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.017
DEQ7 Groundwater Standard		10,000	NA	NA	10	10	NA	NA	100	70	NA	0.2	0.004
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
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RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,2-Di- chloro-benzene (εg/L)	1,4-Di- chloro-benzene (εg/L)	1,1-Dichloro-ethane (εg/L)	1,1-Dichloro-ethene (εg/L)	trans-1,2-Dichloro- ethene (εg/L)	1,2-Dichloro-propane (εg/L)	2,2-Dichloro-propane (εg/L)	Cis-1,3- dichloro-propene (εg/L)	Diethyl ether (εg/L)	Hexachloro-butadiene (εg/L)	p-Isopropyl-toluene (εg/L)	Methylene Chloride (εg/L)
MW-113	05/22/18	<1	<1	4.9	<1	<1	<4	<4	<4	<4	<4	<1	<4
MW-114	05/22/18	<1	<1	<1	<1	1.8	<4	<4	<4	<4	<4	<1	<4
MW-114 Dup	05/22/18	<1	<1	<1	<1	1.7	<4	<4	<4	<4	<4	<1	<4
MW-115	05/22/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<4	<1	<4
MW-116	05/08/18	<1	<1	0.44 J	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-117	05/10/18	<10	<10	<1	<1	1.4	<4	<4	<4	<4	<10	10.4	<4
MW-118	05/10/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-119	05/10/18	<10	<10	<1	<1	<1	<4	<4	<4	<4	<10	<1	<4
MW-120	05/07/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-121	05/10/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-121 Dup	05/10/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-122	05/11/18	<10.6	<10.6	<1	<1	<1	<4	<4	<4	<4	<10.6	<1	<4
MW-123	05/08/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-124	05/07/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-125	05/10/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-125 Dup	05/10/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
MW-126	05/12/18	<11.8	<11.8	<1	<1	<1	<4	<4	<4	<4	<11.8	<1	<4
MW-128	05/09/18	<9.9	<9.9	--	--	--	--	--	--	--	<9.9	--	--
	05/22/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<4	<1	<4
MW-128 Dup	05/09/18	<10.1	<10.1	--	--	--	--	--	--	--	<10.1	--	--
MW-129	05/23/18	<1	<1	<1	<1	0.24	<4	<4	<4	<4	<4	<1	<4
MW-130	05/23/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<4	<1	<4
MW-132	05/23/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<4	<1	<4
MW-133	05/23/18	<1	<1	0.43	<1	<1	<4	<4	<4	<4	<4	<1	<4
MW-134	05/23/18	<1	<1	0.51	<1	<1	<4	<4	<4	<4	<4	<1	<4
MW-135	05/23/18	<1	<1	<1	<1	0.13	<4	<4	<4	<4	<4	<1	<4
PEP07	05/11/18	<5	<5	<5	<5	<5	<20	<20	<20	<20	<5	<5	<20
PEP07 Dup	05/11/18	<1	<1	0.47	<1	<1	<4	<4	<4	<4	<1	<1	<4
REGAL-I-01	05/21/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
RH-MW-1	05/22/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
RH-MW-3	05/22/18	<1	<1	<1	<1	0.79	<4	<4	<4	<4	<1	<1	<4
RH-MW-7	05/22/18	<1	<1	<1	<1	0.79	<4	<4	<4	<4	<4	<1	<4
SD-I-01	05/08/18	<1	<1	<1	<1	<1	<4	<4 UJ	<4	<4	<1	<1	<4
SD-I-02	05/08/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
SMW12	05/11/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<1	<1	<4
SYS-EMW-03	05/22/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<4	1.1	<4
ZPMW-1	05/22/18	<1	<1	<1	<1	<1	<4	<4	<4	<4	<4	<1	<4
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		600	75	NA	7	100	5	NA	4	NA	5	NA	5
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 3. - SECOND QUARTER 2018 VOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	n-Propyl-benzene (εg/L)	1,1,1,2-Tetrachloro- ethan (εg/L)	Tetrachloro-ethene (εg/L)	1,2,3- Trichloro-benzene (εg/L)	1,1,1- Trichloro-ethane (εg/L)	Trichloro- ethene (εg/L)	1,2,3- Trichloro-propane (εg/L)	1,2,4- Trimethyl-benzene (εg/L)	Vinyl Chloride (εg/L)
MW-113	05/22/18	<1	<1	<1	<1	1.6	<0.4	<4	<1	<0.2
MW-114	05/22/18	<1	<1	**24.9**	<1	<1	**13.3**	<4	<1	**0.48**
MW-114 Dup	05/22/18	<1	<1	**25.6**	<1	<1	**13.7**	<4	<1	**0.47**
MW-115	05/22/18	<1	<1	**956**	<1	<1	**57.7**	<4	<1	<0.2
MW-116	05/08/18	<1	<1	0.91 J	<1	<1	1.8	<4	<1	<0.2
MW-117	05/10/18	93.7	<1	0.25	<1	<1	1.7	<4	1010	<0.2
MW-118	05/10/18	<1	<1	<1	<1	<1	<0.4	<4	<1	<0.2
MW-119	05/10/18	<1	<1	1.7	<1	<1	1.7	<4	<1	<0.2
MW-120	05/07/18	0.25 J	<1	**42.9**	<1	<1	**5.3**	<4	2.7	<0.2
MW-121	05/10/18	<1	<1	1.4	<1	<1	0.21	<4	<1	<0.2
MW-121 Dup	05/10/18	<1	<1	1.4	<1	<1	<0.4	<4	<1	<0.2
MW-122	05/11/18	<1	<1	0.69	<1	<1	<0.4	<4	<1	<0.2
MW-123	05/08/18	<1	<1	**7.8**	<1	<1	0.35 J	<4	<1	<0.2
MW-124	05/07/18	<1	<1	1	<1	<1	<0.4	<4	<1	<0.2
MW-125	05/10/18	<1	<1	0.58	<1	<1	<0.4	<4	<1	<0.2
MW-125 Dup	05/10/18	<1	<1	0.62	<1	<1	<0.4	<4	<1	<0.2
MW-126	05/12/18	<1	<1	1	<1	<1	<0.4	<4	<1	<0.2
MW-128	05/09/18	--	--	--	--	--	--	--	--	--
	05/22/18	<1	<1	**13**	<1	<1	1.2	<4	<1	<0.2
MW-128 Dup	05/09/18	--	--	--	--	--	--	--	--	--
MW-129	05/23/18	<1	<1	**80.2**	<1	<1	**28.3**	<4	<1	**1.1**
MW-130	05/23/18	<1	<1	<1	<1	<1	<0.4	<4	<1	<0.2
MW-132	05/23/18	<1	<1	1.1	<1	<1	<0.4	<4	<1	<0.2
MW-133	05/23/18	<1	<1	1.2	<1	0.59	0.35	<4	<1	<0.2
MW-134	05/23/18	<1	<1	<1	<1	<1	<0.4	<4	<1	<0.2
MW-135	05/23/18	<1	<1	**71.6**	<1	<1	**9**	<4	<1	<0.2
PEP07	05/11/18	<5	<5	**520**	<5	<5	**10.9**	<20	<5	<1
PEP07 Dup	05/11/18	0.22	<1	**596**	<1	0.9	**18.1**	<4	<1	<0.2
REGAL-I-01	05/21/18	<1	<1	**6.1**	<1	<1	0.61	<4	<1	<0.2
RH-MW-1	05/22/18	<1	<1	**29.5**	<1	<1	3.7	<4	<1	<0.2
RH-MW-3	05/22/18	<1	<1	**13.8**	<1	<1	**6.6**	<4	<1	<0.2
RH-MW-7	05/22/18	<1	<1	**126**	<1	<1	**20.6**	<4	<1	<0.2
SD-I-01	05/08/18	<1	<1	**5.9**	<1	<1	0.82	<4	<1	<0.2
SD-I-02	05/08/18	<1	<1	**7**	<1	<1	<0.4	<4	<1	<0.2
SMW12	05/11/18	<1	<1	4.5	<1	<1	<0.4	<4	<1	<0.2
SYS-EMW-03	05/22/18	0.45	<1	<1	<1	<1	<0.4	<4	42.5	<0.2
ZPMW-1	05/22/18	<1	<1	**44.4**	<1	<1	3.3	<4	<1	<0.2
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	NA	5	NA	200	5	NA	NA	0.2
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 4. - SECOND QUARTER 2018 SEMIVOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Naphthalene (εg/L)	Acenaph-thene (εg/L)	Acenaph-thylene (εg/L)	Anthracene (εg/L)	Benzo(a)-anthracene (εg/L)	Benzo(a)-pyrene (εg/L)	Benzo(b)-fluor-anthene (εg/L)	Benzo(ghi)-perylene (εg/L)	Benzo(k) fluor-anthene (εg/L)	Bis(2chloro ethoxy)-methane (εg/L)	Bis(2-chloro ethyl)ether (εg/L)	Bis(2-ethyl hexyl)-phthalate (εg/L)
BPGP78	05/11/18	6.1	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6
MW-101	05/07/18	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MW-103	05/11/18	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3
MW-104	05/10/18	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MW-105	05/08/18	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
MW-108	05/10/18	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8
MW-109	05/09/18	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
MW-111	05/10/18	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	16.2
MW-117	05/10/18	5.9	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MW-119	05/10/18	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MW-122	05/11/18	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6
MW-126	05/12/18	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8
MW-128	05/09/18	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
MW-128 Dup	05/09/18	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1
MW-132	05/23/18	--	--	--	--	--	--	--	--	--	--	--	--
MW-133	05/23/18	--	--	--	--	--	--	--	--	--	--	--	--
RBCA RBSLs Groundwater		100	70	NA	NA	0.5	0.05	0.5	NA	5	NA	NA	NA
DEQ7 Groundwater Standard		100	670	NA	2,100	0.5	0.05	0.5	NA	0.5	NA	NA	NA
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte

Data Not Validated

TABLE 4. - SECOND QUARTER 2018 SEMIVOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	4-Bromo-phenyl-phenylether (εg/L)	Benzyl Butyl Phthalate (εg/L)	Car-bazole (εg/L)	4-Chloro-3-Methyl phenol (εg/L)	4-Chloro-aniline (εg/L)	2-Chloro-naphthalene (εg/L)	2-Chloro-phenol (εg/L)	4-Chloro-phenyl-phenylether (εg/L)	Chrysene (εg/L)	Dibenz (a,h) anthracene (εg/L)	Dibenzo-furan (εg/L)	1,2-Di-chloro-benzene (εg/L)
BPGP78	05/11/18	<10.6	<10.6	<10.6	<10.6	<53.2	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6
MW-101	05/07/18	<10	<10	<10	<10	<50	<10	<10	<10	<10	<10	<10	<10
MW-103	05/11/18	<10.3	<10.3	<10.3	<10.3	<51.5	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3
MW-104	05/10/18	<10	<10	<10	<10	<50	<10	<10	<10	<10	<10	<10	<10
MW-105	05/08/18	<9.9	<9.9	<9.9	<9.9	<49.5	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
MW-108	05/10/18	<9.8	<9.8	<9.8	<9.8	<49	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8
MW-109	05/09/18	<9.9	<9.9	<9.9	<9.9	<49.5	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
MW-111	05/10/18	<10.4	<10.4	<10.4	<10.4	<52.1	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4
MW-117	05/10/18	<10	<10	<10	<10	<50	<10	<10	<10	<10	<10	<10	<10
MW-119	05/10/18	<10	<10	<10	<10	<50	<10	<10	<10	<10	<10	<10	<10
MW-122	05/11/18	<10.6	<10.6	<10.6	<10.6	<53.2	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6
MW-126	05/12/18	<11.8	<11.8	<11.8	<11.8	<58.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8
MW-128	05/09/18	<9.9	<9.9	<9.9	<9.9	<49.5	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
MW-128 Dup	05/09/18	<10.1	<10.1	<10.1	<10.1	<50.5	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1
MW-132	05/23/18	--	--	--	--	--	--	--	--	--	--	--	--
MW-133	05/23/18	--	--	--	--	--	--	--	--	--	--	--	--
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	50	0.05	NA	NA
DEQ7 Groundwater Standard		NA	NA	NA	NA	NA	NA	NA	NA	50	0.05	NA	600
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte

Data Not Validated

TABLE 4. - SECOND QUARTER 2018 SEMIVOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	1,3-Di-chloro-benzene (εg/L)	1,4-Di-chloro-benzene (εg/L)	3,3'-Di-chloro-benzidine (εg/L)	2,4-Dichloro-phenol (εg/L)	Diethyl-phthalate (εg/L)	2,4-Dimethyl-phenol (εg/L)	Dimethyl Phthalate (εg/L)	Di-n-butyl-phthalate (εg/L)	2-Methyl-4,6-dinitro phenol (εg/L)	2,4-Dinitro-phenol (εg/L)	2,4-Dinitro Toluene (εg/L)	2,6-Dinitro Toluene (εg/L)
BPGP78	05/11/18	<10.6	<10.6	<53.2	<10.6	<10.6	<53.2	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6
MW-101	05/07/18	<10	<10	<50	<10	<10	<50	<10	<10	<10	<10 UJ	<10	<10
MW-103	05/11/18	<10.3	<10.3	<51.5	<10.3	<10.3	<51.5	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3
MW-104	05/10/18	<10	<10	<50	<10	<10	<50	<10	<10	<10	<10	<10	<10
MW-105	05/08/18	<9.9	<9.9	<49.5	<9.9	<9.9	<49.5	<9.9	<9.9	<9.9	<9.9 UJ	<9.9	<9.9
MW-108	05/10/18	<9.8	<9.8	<49	<9.8	<9.8	<49	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8
MW-109	05/09/18	<9.9	<9.9	<49.5	<9.9	<9.9	<49.5	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
MW-111	05/10/18	<10.4	<10.4	<52.1	<10.4	<10.4	<52.1	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4
MW-117	05/10/18	<10	<10	<50	<10	<10	<50	<10	<10	<10	<10	<10	<10
MW-119	05/10/18	<10	<10	<50	<10	<10	<50	<10	<10	<10	<10	<10	<10
MW-122	05/11/18	<10.6	<10.6	<53.2	<10.6	<10.6	<53.2	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6
MW-126	05/12/18	<11.8	<11.8	<58.8	<11.8	<11.8	<58.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8
MW-128	05/09/18	<9.9	<9.9	<49.5	<9.9	<9.9	<49.5	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
MW-128 Dup	05/09/18	<10.1	<10.1	<50.5	<10.1	<10.1	<50.5	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1
MW-132	05/23/18	--	--	--	--	--	--	--	--	--	--	--	--
MW-133	05/23/18	--	--	--	--	--	--	--	--	--	--	--	--
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		600	75	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte

Data Not Validated

TABLE 4. - SECOND QUARTER 2018 SEMIVOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Di-n-octyl-phthalate (εg/L)	1,2-Diphenyl hydrazine (εg/L)	Fluor-anthene (εg/L)	Fluorene (εg/L)	Hexachloro Benzene (εg/L)	Hexachloro-butadiene (εg/L)	Hexachloro-ethane (εg/L)	Indeno-(1,2,3-cd) pyrene (εg/L)	Isophorone (εg/L)	1-Methyl-naphthalene (εg/L)	2-Methyl-naphthalene (εg/L)	2-Methyl phenol (εg/L)
BPGP78	05/11/18	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	4.6	<10.6	<10.6
MW-101	05/07/18	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MW-103	05/11/18	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3
MW-104	05/10/18	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MW-105	05/08/18	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
MW-108	05/10/18	<9.8	<9.8	<9.8	3.1	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8
MW-109	05/09/18	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
MW-111	05/10/18	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4
MW-117	05/10/18	<10	<10	<10	<10	<10	<10	<10	<10	<10	**22.6**	<10	<10
MW-119	05/10/18	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MW-122	05/11/18	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6
MW-126	05/12/18	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8
MW-128	05/09/18	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
MW-128 Dup	05/09/18	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1
MW-132	05/23/18	--	--	--	--	--	--	--	--	--	--	--	--
MW-133	05/23/18	--	--	--	--	--	--	--	--	--	--	--	--
RBCA RBSLs Groundwater		NA	NA	20	50	NA	NA	NA	0.5	NA	11	36	NA
DEQ7 Groundwater Standard		NA	NA	130	1,100	NA	5	NA	0.5	NA	NA	NA	NA
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte

Data Not Validated

TABLE 4. - SECOND QUARTER 2018 SEMIVOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	3,4-Methyl phenol (εg/L)	2-Nitro-aniline (εg/L)	3-Nitro-aniline (εg/L)	4-Nitro-aniline (εg/L)	Nitro-benzene (εg/L)	2-Nitro-phenol (εg/L)	4-Nitro-phenol (εg/L)	N-Nitroso-dimethyl-amine (εg/L)	N-Nitrosodi-n-propyl-amine (εg/L)	N-Nitroso-diphenyl-amine (εg/L)	2,2'-oxybis(1-Chloropropane) (εg/L)	Penta-chloro-phenol (εg/L)
BPGP78	05/11/18	<21.3	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<21.3
MW-101	05/07/18	<20	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<20 UJ
MW-103	05/11/18	<20.6	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	<20.6
MW-104	05/10/18	<20	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<20
MW-105	05/08/18	<19.8	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<19.8 UJ
MW-108	05/10/18	<19.6	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<19.6
MW-109	05/09/18	<19.8	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<19.8
MW-111	05/10/18	<20.8	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<20.8
MW-117	05/10/18	<20	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<20
MW-119	05/10/18	<20	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<20
MW-122	05/11/18	<21.3	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	<21.3
MW-126	05/12/18	<23.5	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<11.8	<23.5
MW-128	05/09/18	<19.8	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<19.8
MW-128 Dup	05/09/18	<20.2	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	<20.2
MW-132	05/23/18	--	--	--	--	--	--	--	--	--	--	--	--
MW-133	05/23/18	--	--	--	--	--	--	--	--	--	--	--	--
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	NA	NA	NA	NA	NA	60	NA	NA	NA	NA	1
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte

Data Not Validated

TABLE 4. - SECOND QUARTER 2018 SEMIVOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Phen-anthrene (εg/L)	Phenol (εg/L)	Pyrene (εg/L)	1,2,4-Trichloro-benzene (εg/L)	2,4,5-Tri-chloro-phenol (εg/L)	2,4,6-Tri-chloro-phenol (εg/L)	Aroclor-1016 (εg/L)	Aroclor-1221 (εg/L)	Aroclor-1232 (εg/L)	Aroclor-1242 (εg/L)	Aroclor-1248 (εg/L)	Aroclor-1254 (εg/L)
BPGP78	05/11/18	<10.6	11.3	<10.6	<10.6	<10.6	<10.6	--	--	--	--	--	--
MW-101	05/07/18	<10	<10	<10	<10	<10	<10	--	--	--	--	--	--
MW-103	05/11/18	<10.3	<10.3	<10.3	<10.3	<10.3	<10.3	--	--	--	--	--	--
MW-104	05/10/18	<10	<10	<10	<10	<10	<10	--	--	--	--	--	--
MW-105	05/08/18	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	--	--	--	--	--	--
MW-108	05/10/18	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	--	--	--	--	--	--
MW-109	05/09/18	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	--	--	--	--	--	--
MW-111	05/10/18	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	--	--	--	--	--	--
MW-117	05/10/18	<10	<10	<10	<10	<10	<10	--	--	--	--	--	--
MW-119	05/10/18	<10	<10	<10	<10	<10	<10	--	--	--	--	--	--
MW-122	05/11/18	<10.6	<10.6	<10.6	<10.6	<10.6	<10.6	--	--	--	--	--	--
MW-126	05/12/18	<11.8	2.1	<11.8	<11.8	<11.8	<11.8	--	--	--	--	--	--
MW-128	05/09/18	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	--	--	--	--	--	--
MW-128 Dup	05/09/18	<10.1	<10.1	<10.1	<10.1	<10.1	<10.1	--	--	--	--	--	--
MW-132	05/23/18	--	--	--	--	--	--	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
MW-133	05/23/18	--	--	--	--	--	--	<0.095	<0.095	<0.095	<0.095	<0.095	<0.095
RBCA RBSLs Groundwater		NA	NA	20	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	NA	830	70	NA	NA	0.5	0.5	0.5	0.5	0.5	0.5
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte

Data Not Validated

TABLE 4. - SECOND QUARTER 2018 SEMIVOLATILE ORGANIC COMPOUNDS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Aroclor-1260 (εg/L)	Aroclor-1262 (εg/L)	Aroclor-1268 (εg/L)
BPGP78	05/11/18	--	--	--
MW-101	05/07/18	--	--	--
MW-103	05/11/18	--	--	--
MW-104	05/10/18	--	--	--
MW-105	05/08/18	--	--	--
MW-108	05/10/18	--	--	--
MW-109	05/09/18	--	--	--
MW-111	05/10/18	--	--	--
MW-117	05/10/18	--	--	--
MW-119	05/10/18	--	--	--
MW-122	05/11/18	--	--	--
MW-126	05/12/18	--	--	--
MW-128	05/09/18	--	--	--
MW-128 Dup	05/09/18	--	--	--
MW-132	05/23/18	<0.11	<0.11	<0.11
MW-133	05/23/18	<0.095	<0.095	<0.095
RBCA RBSLs Groundwater		NA	NA	NA
DEQ7 Groundwater Standard		0.5	0.5	0.5
EPA RSL Tapwater		NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte

Data Not Validated

TABLE 5. - SECOND QUARTER 2018 METALS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Antimony, Dissolved (εg/L)	Barium, Dissolved (εg/L)	Cadmium, Dissolved (εg/L)	Cobalt, Dissolved (εg/L)	Iron, Dissolved (εg/L)	Manganese, Dissolved (εg/L)	Nickel, Dissolved (εg/L)	Silver, Dissolved (εg/L)	Vanadium, Dissolved (εg/L)	Aluminum, Dissolved (εg/L)	Arsenic, Dissolved (εg/L)	Beryllium, Dissolved (εg/L)
BMW-1	05/10/18	0.16 J	8.9	0.076J/ND(0.08) U*	0.8	21.4J/ND(50)U*	**390**	6.7	<0.5	2.1	17.4 JB	**2.4**	<0.2
BNMW-17	05/08/18	<0.5	219	<0.08	0.46 J	**5350**	**1340**	2.3	<0.5	3.9	13 JB	**6.9**	<0.2
BNMW-23	05/08/18	<0.5	43.8	<0.08	0.91	251	**1250**	3.4	<0.5	1.3	4J/ND(10)U*	**2.1**	<0.2
BPGP22	05/08/18	<0.5	13.8	<0.08	<0.5	<50	19.1	2.2	<0.5	1	3.9J/ND(10)U*	**2**	<0.2
BPGP22 Dup	05/08/18	<0.5	13	<0.08	<0.5	<50	18.4	2.2	<0.5	1 J	3.4J/ND(10)U*	**1.9**	<0.2
BPGP46	05/11/18	<0.5	5 JB	<0.08	0.15 J	<50 UJ	**203**	0.56	<0.5	<1	<10	**0.82**	<0.2
BPGP59	05/10/18	0.16 J	26.5	0.034J/ND(0.08) U*	1.7	8.4J/ND(50)U*	**558**	5.2	<0.5	2.1	4.9J/ND(10)U*	**2.1**	<0.2
BPGP78	05/11/18	<0.5	21.2	<0.08	0.15 J	96.5 J-	**117**	0.76	<0.5	0.47 J	2.7 J	**1.1**	<0.2
BPGP80	05/10/18	0.12 J	16.7	0.068J/ND(0.08) U*	2.2	<50	**430**	4.2	<0.5	2.3	5J/ND(10)U*	**2.2**	<0.2
BPGP80 Dup	05/10/18	<0.5	17.3	0.029J/ND(0.08) U*	2.2	<50	**446**	4.2	<0.5	2.3	3.4J/ND(10)U*	**2.3**	<0.2
EMW-03	05/07/18	0.4 J	146	0.061 J	**7.6**	**6310**	**2050**	14.4	<0.5	16	**6420**	**5.4**	0.21
MW-101	05/07/18	0.16 J	32.6	0.049 J	0.39 J	261	**271**	4.5	<0.5	1.9	**249**	**0.97**	<0.2
MW-103	05/11/18	0.13J/ND(0.5)U*	17.6	0.079 J	1.3	21.1 J-	**177**	9.4	<0.5	1.3	12	**1.2**	<0.2
MW-104	05/10/18	<0.5	30.9	0.037J/ND(0.08) U*	0.42 J	133	**164**	4.6	<0.5	1.7	**90.4**	**1.8**	<0.2
MW-105	05/08/18	0.68	44.8	0.033 J	1.2	19 J	**1630**	9.7	<0.5	2.3	5.7J/ND(10)U*	**3.6**	<0.2
MW-108	05/10/18	<0.5	20.5	<0.08	<0.5	**3440**	**1270**	2.3	<0.5	0.91 J	**82.8**	**0.83**	<0.2
MW-109	05/09/18	0.28 J	21.2	0.034 J	**10.3**	24.4 J	**2460**	20.5	<0.5	0.69 J	5.2 J	**0.75**	<0.2
MW-111	05/10/18	0.28 J	16.9	0.052J/ND(0.08) U*	1.6	52.8 JB	**888**	6.4	<0.5	0.86 J	35.4	**0.94**	<0.2
MW-117	05/10/18	0.12 J	45.2	<0.08	0.17 J	**1650**	**812**	2.3	<0.5	0.67 J	**124**	**2.5**	<1
MW-119	05/10/18	0.19 J	19.9	0.081/ND(0.081) U*	4.8	138	**68.3**	12.5	<0.5	1.8	**114**	**1.1**	<0.2
MW-122	05/11/18	0.12J/ND(0.5)U*	14.2	0.029 J	1.8	7.2 J-	**714**	12.9	<0.5	1	3.6 J	**1**	<0.2
MW-128	05/09/18	0.19 J	18.4	0.052 J	**8.7**	26.3 J	**1650**	10.4	<0.5	1.1	11	**0.91**	<0.2
MW-128 Dup	05/09/18	0.19 J	17.8	0.066 J	**8.6**	26 J	**1570**	10.2	<0.5	1.1	9.8 J	**0.91**	<0.2
ZPMW-1	05/09/18	0.14 J	21.3	<0.08	0.61	<50	**172**	3	<0.5	1.8	5.1 J	**1.2**	<0.2
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		6	1,000	5	NA	NA	NA	100	100	NA	NA	10	4
EPA TAPWATER RSLs MAY 2018		7.8	3,800	9.2	6	14,000	430	390	94	86	20,000	0.052	25
EPA Secondary MCLs		NA	NA	NA	NA	300	50	NA	100	NA	50	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 5. - SECOND QUARTER 2018 METALS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Chromium, Dissolved (εg/L)	Copper, Dissolved (εg/L)	Lead, Dissolved (εg/L)	Mercury, Dissolved (εg/L)	Selenium, Dissolved (εg/L)	Thallium, Dissolved (εg/L)	Zinc, Dissolved (εg/L)
BMW-1	05/10/18	0.15J/ND(0.5)U*	2.4 JB	0.05J/ND(0.1)U*	<0.01	7.8	<0.1	8.1 JB
BNMW-17	05/08/18	0.77 JB	0.31 J	0.055 J	<0.01	0.43 J	<0.1	3.1J/ND(5)U*
BNMW-23	05/08/18	0.3J/ND(0.5)U*	0.7 J	0.076 J	<0.01	0.2 J	<0.1	1J/ND(5)U*
BPGP22	05/08/18	0.53 JB	1.5	<0.1	<0.01	9.7	<0.1	<5
BPGP22 Dup	05/08/18	0.47J/ND(0.5)U*	1.4	<0.1	<0.01	12.4	<0.1	1.3J/ND(5)U*
BPGP46	05/11/18	<0.5	<1	<0.1	<0.01	<0.5	<0.1	1.1 J
BPGP59	05/10/18	0.6 JB	1.6 JB	0.036J/ND(0.1)U*	<0.01	5.2	<0.1	1.4J/ND(5)U*
BPGP78	05/11/18	<0.5	<1	<0.1	<0.01	0.58	<0.1	3.4 J
BPGP80	05/10/18	0.7 JB	2.3 JB	0.029J/ND(0.1)U*	<0.01	9	0.029 J	1.8J/ND(5)U*
BPGP80 Dup	05/10/18	0.71 JB	1.4 JB	<0.1	0.004 J	9.1	<0.1	1.3J/ND(5)U*
EMW-03	05/07/18	8.4	7	3.8	0.011	7.5	0.08 J	17.7/ND(17.7)U*
MW-101	05/07/18	0.48 J	1.6	0.22	<0.01	15.9	<0.1	2.6J/ND(5)U*
MW-103	05/11/18	1.4	2.5	<0.1	<0.01	11.5	<0.1	1.3 J
MW-104	05/10/18	0.29J/ND(0.5)U*	1.7 JB	0.1 JB	<0.01	8	<0.1	1.9J/ND(5)U*
MW-105	05/08/18	<0.5	1.1	1.6	<0.01	1.1	<0.1	3.2J/ND(5)U*
MW-108	05/10/18	0.41J/ND(0.5)U*	0.41J/ND(1)U*	0.095J/ND(0.1)U*	<0.01	0.19 J	<0.1	1.2J/ND(5)U*
MW-109	05/09/18	<0.5	0.99 J	<0.1	<0.01	3.8	<0.1	1.9 J
MW-111	05/10/18	0.29J/ND(0.5)U*	3.3	0.063J/ND(0.1)U*	<0.01	7.7	0.03 J	5.8 JB
MW-117	05/10/18	0.35J/ND(0.5)U*	1.1 JB	1.5	<0.01	<2.5	<0.1	5.4 JB
MW-119	05/10/18	0.34J/ND(0.5)U*	2.6 JB	0.15 JB	<0.01	10.5	<0.1	2.8J/ND(5)U*
MW-122	05/11/18	0.18 J	2.2	<0.1	<0.01	9.2	<0.1	1.9 J
MW-128	05/09/18	0.19J/ND(0.5)U*	2.5	0.032 J	<0.01	19.1	<0.1	2 J
MW-128 Dup	05/09/18	0.25J/ND(0.5)U*	2.4	<0.1	<0.01	18.8	<0.1	1.3 J
ZPMW-1	05/09/18	<0.5	1.3	<0.1	<0.01	14	<0.1	7.2
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		100	1,300	15	2	50	2	2,000
EPA TAPWATER RSLs MAY 2018		22,000	800	15	0.63	100	0.2	6,000
EPA Secondary MCLs		NA	1,000	NA	NA	NA	NA	500

Notes:
µg/L - micrograms per liter
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RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
J+ - Estimated concentration, possibly biased high
J- - Estimated concentration, possibly biased low
J - Estimated concentration
UJ - Estimated reporting limit
U - Evaluated to be undetected at the reported concent
JB - Estimated concentration due to blank contamination
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 6. - SECOND QUARTER 2018 MONITORED NATURAL ATTENUATION PARAMETERS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Location ID	Date Sampled	Chloride (mg/L)	Ethylene (εg/L)	Nitrogen, Nitrate & Nitrite (mg/L)	Ethane (εg/L)	Methane (εg/L)	Sulfate (mg/L)	Total Organic Carbon (mg/L)
BMW-1	05/10/18	73.7	<10	9.7	<10	1.4	834	1.2
BNMW-23	05/08/18	61.6	<10	<0.01	<10	8.4J/ND(10)U*	653	1.9
BPGP02	05/11/18	171	<10	0.13	<10	64.8	551	1.8
BPGP12	05/09/18	83.4	<10 UJ	2.6 J+	<10 UJ	1.4J/ND(10)U*	1130	1.8
BPGP42	05/08/18	71.9	<10	2.8 J+	<10	<10	1030	1.2
BPGP50	05/09/18	567	<10 UJ	2.8 J+	<10 UJ	3.1J/ND(10)U*	1160	0.39 J
BPGP59	05/10/18	62.6	<10	0.46	<10	98.3	561	1.3
BPGP78	05/11/18	100	<10	0.11	11	484	787	2.5
BPGP92	05/08/18	--	<10	1.7 J+	<10	1.9J/ND(10)U*	1240	1.4
BPGP94	05/09/18	50.3	<10 UJ	4.2 J+	<10 UJ	<10 UJ	828	1.2
MW-101	05/07/18	95.3	1.9 J	13.3	<10	9.6J/ND(10)U*	907	1.2
MW-108	05/10/18	90.3	<10	0.005	<10	6.4	1150	3.3
MW-128	05/09/18	90.5	4.1 J-	7.7 J+	5.8 J-	17 J-	1250	2.4
MW-128 Dup	05/09/18	90.6	3.9 J-	7.3 J+	5.4 J-	15.6 J-	1230	3
RH-MW-3	05/09/18	110	<10 UJ	0.89 J+	<10 UJ	2.1J/ND(10)U*	434	1.1
SD-I-01	05/08/18	118	<10	7 J+	<10	<10	1000	1.2
RBCA RBSLs Groundwater		NA	NA	NA	NA	NA	NA	NA
DEQ7 Groundwater Standard		NA	NA	NA	NA	NA	NA	NA
EPA RSL Tapwater		NA	NA	NA	NA	NA	NA	NA

Notes:
µg/L - micrograms per liter
< - target analyte was not detected above the listed concentration
RBCA - Risk-Based Corrective Action
RBSL - Risk-Based Screening Level
RSL - Regional Screening Level
-- - Analyte not evaluated for this sample
NA - No applicable screening levels for this analyte
* - The first result represents the laboratory reported concentration. The second result was evaluated to be undetected at the reported concentration by the data validator. The result was determined to be a false positive.

Data Not Validated

TABLE 7. THIRD QUARTER 2018 GROUNDWATER SAMPLING DETAILS AND RATIONALE
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

									Investigation Type				Proposed Analyses						
Location Number	**General Location**	**X EASTING**	**Y NORTHING**	**Sample September 2018**	**Grid Area**	**Location Type (s)**	**Sample Method**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Sampling Suite**	**Rationale / Comments**
BMW07-1	Southern Plume Edge	2219785.56	557091.206	Y	X:10,Y:3	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BMW-1	Southern Plume Edge	2219358.105	556967.07	Y	X:9,Y:3	MW	Low-flow pump	2	X	X	-	-	X	-	X	-	X	VOCs + Metals + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BMW-4	Southern Plume Edge	2219779.586	556863.733	Y	X:10,Y:3	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BNMW-17	Plume Body - BNSF Property	2221310.462	558399.895	Y	X:13,Y:7	MW	Low-flow pump	2	X				X	-	X	X	-	VOCs + EPH + VPH + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BNMW-20	Plume Body - BNSF Property	2220782.759	558794.391	Y	X:12,Y:7	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BNMW-21	Plume Body - BNSF Property	2221164.974	558455.441	Y	X:13,Y:6	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BNMW-23	Plume Body - BNSF Property	2221835.533	558561.035	Y	X:14,Y:6	MW	Peristaltic	1	X	X	-	-	X	-	X	-	X	VOCs + Metals + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sampled KJ/BN in 2014 for PCE
BNMW-8	Plume Body - BNSF Property	2221254.884	558796.87	Y	X:13,Y:7	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BNMW-9	Plume Body - BNSF Property	2221518.1	558533.803	Y	X:14,Y:6	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Retained for sampling in 2018 to delineate vinyl chloride plume.
BPGP02	BSL Source Area	2214931.705	555908.324	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	X	X	VOCs + EPH + VPH + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Q3 Exceedance of VPH Fractions.
BPGP08	Plume Body	2216494.508	556497.214	Y	X:4,Y:2	MW	Peristaltic	0.5	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Comparison of 4" well to 1/2" well at BPGP08.
BPGP12	Plume Body	2217082.512	556943.688	Y	X:5,Y:3	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	X	VOCs + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP15	Northern Plume Edge	2217068.461	557594.852	Y	X:5,Y:4	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP16	Plume Body	2218399.879	557995.922	Y	X:7,Y:5	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP17	Plume Body	2217767.809	558045.463	Y	X:6,Y:5	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP22	Plume Body	2218348.447	557272.636	Y	X:7,Y:4	MW	Peristaltic	0.75	X	X	-	-	X	-	X	-	-	VOCs + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP25	Plume Body	2218339.431	558464.97	Y	X:7,Y:6	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP27	Northern Plume Edge	2218315.593	558765.571	Y	X:7,Y:7	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sample located in northern edge of plume.
BPGP29	Plume Body	2219230.314	558739.677	Y	X:10,Y:7	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of vinyl chloride in GW plume.
BPGP31	Northern Plume Edge	2217695.901	558452.807	Y	X:6,Y:6	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Previously observed PCE concentrations below DEQ-7 standard.
BPGP41	Plume Body	2219582.521	559105.98	Y	X:10,Y:7	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP42	Plume Body	2220274.833	558774.764	Y	X:11,Y:7	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	X	VOCs + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP44	Plume Body	2220838.629	559296.446	Y	X:12,Y:8	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP46	BSL Source Area	2214939.733	555769.453	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	X	X	-	VOCs + EPH + VPH + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Q3 Exceedance of VPH Fractions.
BPGP47	Northern Plume Edge	2219033.088	559139.757	Y	X:9,Y:7	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sample located in northern edge of plume.
BPGP48	Northern Plume Edge	2218382.123	559073.972	Y	X:7,Y:7	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Sample located in northern edge of plume. Previously observed PCE concentrations below DEQ-7 standard.
BPGP49	BSL Source Area	2214940.1	555804.912	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP50	Distal End of Plume	2221635.863	560252.685	Y	X:14,Y:10	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	X	VOCs + MNA	Characterize distal edge of groundwater contamination. Sample located within known extent of plume impacts.
BPGP51	BSL Source Area	2214940.247	555750.213	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP51B	BSL Source Area	2214939.746	555750.078	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Deeper well comparison to shallower screen
BPGP53	BSL Source Area	2215212.544	555745.05	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP59	BSL Source Area	2215211.732	555821.489	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	X	X	X	VOCs + EPH + VPH + Metals + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Q3 Exceedance of VPH Fractions.
BPGP60	BSL Source Area	2215155.656	555782.837	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP61	BSL Source Area	2214996.488	555824.443	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP63	BSL Source Area	2215134.076	555727.052	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. East/northeast of sheet pile area.

TABLE 7. THIRD QUARTER 2018 GROUNDWATER SAMPLING DETAILS AND RATIONALE
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

									Investigation Type				Proposed Analyses						
Location Number	**General Location**	**X EASTING**	**Y NORTHING**	**Sample September 2018**	**Grid Area**	**Location Type (s)**	**Sample Method**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Sampling Suite**	**Rationale / Comments**
BPGP65	BSL Source Area	2215160.057	555709.046	Y	X:1,Y:1	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP65B	BSL Source Area	2215160.865	555710.243	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP67	BSL Source Area	2215166.644	555849.803	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Approximately 10+ feet from BPGP66, but order of magnitude lower in concentration in 2015.
BPGP74	BSL Source Area	2214951.281	555702.122	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Historically highest concentration well just north of sheetpile.
BPGP76	BSL Source Area	2215017.85	555703.108	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP78	BSL Source Area	2214999.996	555871.206	Y	X:1,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	X	X	X	X	VOCs + SVOCs + EPH + VPH + Metals + MNA	Characterize nature and extent of groundwater contamination. Only exceedance of SVOCs in Q3 2017 at this location. Q3 Exceedance of VPH Fractions.
BPGP80	Plume Body	2215537.28	555917.425	Y	X:2,Y:1	MW	Peristaltic	0.75	X	X	-	-	X	-	X	X	-	VOCs + EPH + VPH + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Q3 2017 Exceedance of VPH Fractions.
BPGP81	Plume Body	2215612.693	556115.497	Y	X:2,Y:1	MW	Peristaltic	1	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP83	Plume Body	2216506.117	556028.633	Y	X:4,Y:1	MW	Peristaltic	1	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP84	Plume Body	2217409.223	556514.026	Y	X:5,Y:2	MW	Peristaltic	1	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP85	Plume Body	2216437.299	556842.584	Y	X:4,Y:3	MW	Peristaltic	1	X	X	-	-	X	-	-	-	--	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Standing water, well irrigated location possibly.
BPGP86	Plume Body	2218984.831	558510.347	Y	X:9,Y:6	MW	Peristaltic	0.75	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP87	Plume Body	2215712.214	555716.625	Y	X:2,Y:1	MW	Peristaltic	1	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP89	Plume Body	2220024.366	558577.052	Y	X:11,Y:6	MW	Peristaltic	1	X	X	-	-	X	-	-	X	-	VOCs + EPH + VPH	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Q3 2017 Exceedance of VPH Fractions.
BPGP91	Distal End of Plume	2221448.65	559860.92	Y	X:14,Y:9	MW	Peristaltic	1	X	X	-	-	X	-	-	-	-	VOCs	Characterize distal edge of groundwater contamination. Sample located within known extent of plume impacts.
BPGP92	Plume Body	2217713.727	557612.76	Y	X:6,Y:4	MW	Peristaltic	1	X	X	-	-	X	-	-	-	X	VOCs + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGP93	Plume Body	2215853.781	556318.553	Y	X:2,Y:2	MW	Peristaltic	1	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. Not found during groundwater inventory, but recent EPA replacement
BPGP94	Plume Body	2219301.548	558075.396	Y	X:9,Y:5	MW	Peristaltic	1	X	X	-	-	X	-	-	-	X	VOCs + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGW01	BSL Source Area	2215094.91	555863.476	Y	X:1,Y:1	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
BPGW04	Western Edge BSL	2214528.017	555711.461	Y	X:-1,Y:1	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Former Tom's Conoco - known area of >9 ug/L PCE
EMW-03	Western Edge - North CAL	2211143.436	555663.962	Y	X:-8,Y:-1	MW	Low-flow pump	2	X	X	-	-	X	-	X	-	-	VOCs + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of petroleum or former petroleum sites.
EMW-09	Western Edge - Southwest BSL	2214596.994	555627.756	Y	X:-1,Y:-1	MW	Low-flow pump	2	X	X	-	-	X	-	-	X	-	VOCs + EPH + VPH	Characterize nature and extent of groundwater contamination. Sample immediately south/southwest of BSL and along the southern edge of Central Ave., which is a utility corridor. Q3 Exceedance of VPH Fractions.
EMW-18	Distal End of Plume	2223083.25	560728.269	Y	X:17,Y:11	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	No solvents or other exceedances detected during Q3 2017, removed from sample 2018.
EMW-28	Southern Plume Edge	2220315.124	557543.594	Y	X:11,Y:4	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	--	VOCs	Characterize nature and extent of groundwater contamination. Sample located along southern edge of plume.
EMW-32	Plume Body - BNSF Property	2220257.433	557806.984	Y	X:11,Y:5	MW	Low-flow pump	2	X	X			X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located along southern edge of plume.
PEP07	Plume Body	2217709.097	556954.261	Y	X:6,Y:3	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
RH-MW-1	Distal End of Plume	2223169.276	559414.006	Y	X:17,Y:8	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts. RH-MW-1 may be destroyed, and RH-MW-2 or similar may be used as an alternate
RH-MW-3	Distal End of Plume	2223141.414	559553.432	Y	X:17,Y:8	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	X	VOCs + MNA	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
RH-MW-7	Distal End of Plume	2223054.698	559440.641	Y	X:17,Y:8	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts.
SD-I-01	Western Edge - Irrigation	2213222.764	555717.337	Y	X:-4,Y:1	IW	Peristaltic	8	X	X	X	-	X	-	-	-	X	VOCs + MNA	Characterize nature and extent of groundwater contamination. Upgradient of BSL used for irrigation at Central Park, but technically Billings School District property with softball field. Concern for risk. Discuss well depth and details with School District #2 of Billings.
SD-I-02	Western Edge - Irrigation	2212910.913	556275.306	Y	X:-4,Y:1	IW	Peristaltic	6	X	X	X	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Upgradient of BSL used for irrigation at Washington Elementary School. Concern for risk. Discuss well depth and details with School District #2 for Billings
SMW12	Southern Plume Edge	2215199.94	555629.383	Y	X:1,Y:-1	MW	Low-flow pump	2	X	X	-	-	X	-	-	-	-	VOCs	Characterize nature and extent of groundwater contamination. Sample located within known extent of plume impacts, well concentrations may be influenced by watering/irrigation of lawn. Well monuments for SMW12 and BPGP32 were filled with surface irrigation water at GW

TABLE 7. THIRD QUARTER 2018 GROUNDWATER SAMPLING DETAILS AND RATIONALE
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

									Investigation Type				Proposed Analyses						
Location Number	**General Location**	**X EASTING**	**Y NORTHING**	**Sample September 2018**	**Grid Area**	**Location Type (s)**	**Sample Method**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Sampling Suite**	**Rationale / Comments**
ZPMW-1	Western Edge - East CAL	2211785.03	555722.62	Y	X:-7,Y:1	MW	Low-flow pump	2	X	X	-	-	X	-	X	-	-	VOCs + Metals	Characterize nature and extent of groundwater contamination. Sample located within known extent of petroleum or former petroleum sites.
MW-100	Upgradient of CAL	2211115.419	555323.415	Y	X:-8,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Monitor upgradient source(s) southwest of CAL
MW-101	Near potential source area at CAL	2211210.492	555467.407	Y	X:-8,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	-	X	-	X	VOCs + Metals + MNA	Delineate source area groundwater contamination. Evaluate potential for hydrocarbon impacts, metals mobilization, etc.
MW-102	Near potential source area at CAL	2211241.062	555529.267	Y	X:-8,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate source area groundwater contamination.
MW-103	Southern edge of western plume	2214604.744	556143.757	Y	X:-2,Y:1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs + Metals	Delineate southern plume boundary at CAL
MW-104	Southern edge of main plume body	2215952.923	555612.961	Y	X:3,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs + Metals	Southern plume boundary monitoring well. Evaluate potential for hydrocarbon impacts, metals mobilization, etc.
MW-105	Southern edge of main plume body	2216794.615	555936.192	Y	X:4,Y:1	MW	Low-flow pump	2	X	-	-	-	X	-	-	X	-	VOCs + EPH + VPH + Metals	Southern plume boundary monitoring well. Well had an odor and sheen when developed in April 2018.
MW-106	Southern edge of main plume body	2216540.274	555517.908	Y	X:4,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Southern plume boundary monitoring well. Potential delineate sources located south of the railroad.
MW-107	Southern edge of main plume body	2217779.973	555559.713	Y	X:6,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate southern plume boundary.
MW-108	Southern edge of main plume body	2218503.612	556171.171	Y	X:8,Y:1	MW	Low-flow pump	2	X	-	-	-	X	X	-	X	X	VOCs + SVOCs + EPH + VPH + Metals + MNA	Delineate southern plume boundary, Evaluate potential hydrocarbon impacts
MW-109	Southern edge of main plume body	2220625.561	556878.916	Y	X:12,Y:3	MW	Low-flow pump	2	X	-	-	-	X	-	-	X	-	VOCs + EPH + VPH + Metals	Delineate southern plume boundary. Downgradient of former LUST facilities
MW-110	Southern edge of main plume body	2221539.373	557570.999	Y	X:14,Y:4	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate southern boundary of plume.
MW-111	Southern edge of main plume body	2222996.48	559071.346	Y	X:17,Y:7	MW	Low-flow pump	2	X	-	-	-	X	X	-	-	-	VOCs + SVOCs + Metals	Attempt to establish southern bound to PCE plume at former REX Cleaners. Evaluate potential for hydrocarbon impacts.
MW-112	Southern edge of main plume body	2224065.138	558897.663	Y	X:19,Y:7	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Establish distal plume boundary
MW-113	Downgradient of potential source at REX	2224439.134	560051.008	Y	X:20,Y:9	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Establish distal plume boundary
MW-114	Near potential source area at REX	2222899.472	559514.227	Y	X:17,Y:8	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Establish GW concentrations at REX cleaners.
MW-115	Downgradient of potential source at REX	2224114.28	560669.045	Y	X:20,Y:11	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs + SVOCs	Evaluate potential additional source downgradient of REX cleaners.
MW-116	Upgradient of potential source at REX	2222230.39	559315.379	Y	X:15,Y:8	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate distal plume edge from potential additional source area(s).
MW-117	Distal End of Plume	2222581.316	560862.542	Y	X:15,Y:10	MW	Low-flow pump	2	X	-	-	-	X	X	-	X	-	VOCs + SVOCs + EPH + VPH + Metals	Delineate distal plume edge. Evaluate potential for hydrocarbon impacts, metals mobilization, etc. Well had hydrocarbon odor and sheen during development.
MW-118	Northern Plume Edge	2221051.264	560985.496	Y	X:13,Y:11	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Establish northern/distal plume boundary.
MW-119	Northern Plume Edge	2220253.384	560206.104	Y	X:11,Y:10	MW	Low-flow pump	2	X	-	-	-	X	-	-	X	-	VOCs + EPH + VPH + Metals	Establish northern plume boundary. Evaluate potential for hydrocarbon impacts, metals mobilization, etc.
MW-120	Northern Plume Edge	2219221.31	559469.583	Y	X:9,Y:8	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Establish southern plume boundary
MW-121	Northern Plume Edge	2216697.878	557252.822	Y	X:4,Y:4	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate northern plume boundary
MW-122	Northern Plume Edge	2215748.532	556502.112	Y	X:2,Y:2	MW	Low-flow pump	2	X	-	-	-	X	-	-	X	-	VOCs + EPH + VPH + Metals	Delineate northern plume boundary. Evaluate potential for hydrocarbon impacts, metals mobilization, etc.
MW-123	Northern Edge of Western Plume	2213784.146	557184.022	Y	X:-3,Y:3	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate northern plume boundary at former Central Avenue Laundry
MW-124	Northern Edge of Western Plume	2211787.49	556452.139	Y	X:-5,Y:2	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate northern plume boundary at former Central Avenue Laundry
MW-125	Southern Plume Edge	2215712.46	555587.395	Y	X:2,Y:-1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate southern plume boundary.
MW-126	Bedrock well at BSL	2215174.324	555832.637	Y	X:1,Y:1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Evaluate depth to bedrock, potential for DNAPL, bedrock transmissivity and structure.
MW-127	Bedrock well at BSL	2214930.961	555774.467	Y	X:1,Y:1	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Evaluate depth to bedrock, potential for DNAPL, bedrock transmissivity and structure.
MW-128	Central portion of western lobe of plume NW of CAL	2213754.64	556493.498	Y	X:-3,Y:2	MW	Low-flow pump	2	X	-	-	-	X	-	-	X	X	VOCs + EPH + VPH + Metals + MNA	Evaluate potential upgradient impacts near 202 9th St. West. Evaluate potential for hydrocarbon impacts, metals mobilization, etc.
MW-129	Along northern/northeastern edge of fence line in the back of the lot at 4017 1/2 1st Ave S. Mark entire lot.	2218435.026	556739.729	Y	X:8,Y:3	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Well along the back fence line nearest rail property to delineate PCE concentrations in central area of plume without many nearby monitoring wells.

TABLE 7. THIRD QUARTER 2018 GROUNDWATER SAMPLING DETAILS AND RATIONALE
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

									Investigation Type				Proposed Analyses						
Location Number	**General Location**	**X EASTING**	**Y NORTHING**	**Sample September 2018**	**Grid Area**	**Location Type (s)**	**Sample Method**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Sampling Suite**	**Rationale / Comments**
MW-130	In City of Billings right-of-way approximately 300 feet south of the intersection of Industrial Ave and Daniel St. - on west side of Daniel Street just south of the first driveway into the older Sysco building.	2209703.023	553914.862	Y	X:-11,Y:-4	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Up gradient understanding of PCE in area southwest of former Central Avenue Laundry
MW-132	West of 2424 Minnesota Ave on west side of S 25th St. near power substation	2223475.615	560191.731	Y	X:18, Y:9	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Well to delineate PCE concentrations north of 1st Ave S.
MW-133	North of 2424 Minnesota Ave on south side of Minnesota Ave.	2223528.886	560327.969	Y	X:18, Y:10	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Well to delineate contaminant concentrations north of 1st Ave S. and down gradient of Former Pacific Hide & Steel area
MW-134	East of 26 S 24th St. in the ROW of the road on at 24th St.	2223896.168	560326.011	Y	X:18, Y:10	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Well to delineate PCE concentrations north of 1st Ave S
MW-135	Along northeastern edge of fence line in the back of the lot at 4017 1/2 1st Ave S. Mark entire lot.	2219381.672	557415.343	Y	X:9,Y:4	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Well along the back fence line nearest rail property to delineate PCE concentrations in central area of plume without many nearby monitoring wells.
SYS-EMW-3	Existing monitoring well on SYSCO property, upgradient of CAL	2209683.136	553198.566	Y	X:-11,Y:-5	MW	Low-flow pump	2	X	-	-	-	X	-	-	-	-	VOCs	Delineate contaminant concentrations upgradient of CAL
REGAL-I-01	Irrigation Well upgradient of CAL, located at 145 Regal Street. Well location on SE corner of building along Industrial Ave.	2209940.542	554275.76	Y	X:-10,Y:-3	IW	Peristaltic	6	X	-	-	-	X	-	-	-	-	VOCs	Delineate contaminant concentrations upgradient of CAL
GWIC 11510/267400	Irrigation/Existing wells cross or upgradient of MW-115 GWIC 11510 at 116 19th St. or GWIC 267400 at 1901 1st Ave. N	2224678.722	562299.463	Y	X:20, Y14	IW	Peristaltic	Unknown	X				X					VOCs	Delineate contaminate areas near/northeast of MW-115
PAI-WEST	Irrigation/Existing well at Ponderosa Acres, east of REGAL-I-01	2210782.811	554635.077	Y	X:-9,Y-3	IW	Peristaltic	4 inch	X				X					VOCs	Delineate contaminate areas near/northeast of MW-115

TABLE 7. THIRD QUARTER 2018 GROUNDWATER SAMPLING DETAILS AND RATIONALE
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

									Investigation Type				Proposed Analyses						
Location Number	**General Location**	**X EASTING**	**Y NORTHING**	**Sample September 2018**	**Grid Area**	**Location Type (s)**	**Sample Method**	**Well Diameter (inches)**	**Nature and Extent**	**Fate and Transport**	**Risk**	**Ecological Assessment**	**VOCs 8260 (Low Level/Long List) [1]**	**SVOCs 8270 (PAHs) [2]**	**Metals [3]**	**EPH/VPH [4]**	**MNA [5]**	**Sampling Suite**	**Rationale / Comments**
Potential well upgradient (west) of REGAL-I-01	Potential well identified in field upgradient of REGAL-I-01, no immediate upgradient wells identified with GWIC search	NA	NA	Y	West of X:-11, Y-3	IW	Peristaltic	Unknown	X	-	-	-	X	-	-	-	-	VOCs	Delineate contaminant concentrations upgradient of CAL

GROUNDWATER RATIONALE NOTES AND SUMMARY TOTALS

Wells to be sampled	108
Wells for bladder pumps	59
Wells for peristaltic pumps	49

	VOCs 8260 (Low Level/Long List) [1]	SVOCs 8270 (PAHs) [2]	Metals [3]	EPH/VPH [4]	MNA [5]
Environmental Samples	108	4	11	15	15
Field Duplicates	6	1	1	1	-
Equipment Blanks	9	9	0	9	-
Field Blank	9	9	0	9	-
MS/MSD	6	1	1	1	-
Total	138	24	13	35	15

Notes:

VOCs 8260 (Low Level/Long List)[1]	Groundwater analysis method for VOCs by EPA 8260B, Low-level MDLs, long list VOCs - collect with bottles/preservatives according to Table 2
SVOCs 8270 (PAHs) [2]	Groundwater analysis method for SVOCs including PAHs by EPA 8270 - collect with bottles/preservatives according to Table 2
Metals [3]	Groundwater analysis method for 19 dissolved metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, thallium, vanadium, and zinc by EPA Method 200.7 and mercury by CVAA Mercury/EPA Method 245.1 - collect with bottles/preservatives according to Table 2
EPH/VPH [4]	Groundwater analysis method for EPH by SW8015M and MA-EPH fractionization; VPH by MA-VPH - collect with bottles/preservatives according to Table 2
MNA [5]	MNA analyses to include sulfate/sulfite by E300.0, nitrate/nitrite by E353.2, dissolved organic carbon by SW9060, chloride by E300, and methane/ethene/ethane by SW3810/RSK175 - collect with bottles/preservatives according to Table 2
Fluid Levels[6]	Fluid levels collected according to Groundwater Sampling Work Plan July 2017 Memo
Field Parameters[7]	Field parameter analyses will be collected though a groundwater multi-meter according to Groundwater Sampling Work Plan July 2017 Memo
TCLP [8]	Waste analyses will be determined in conjunction with DEQ according to the anticipated characterization of the waste.
Sample Method Comparison[9]	Sample method comparison will involve collecting two VOCs samples with different sample methods (low-flow peristaltic pump and low-flow down-well pump)

TABLE 8. GROUNDWATER SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS
BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Analysis	Method	Sample Container Type and Volume	Holding Time[a]	Preservation Type[b, c]
Water				
VOC	SW8260B	3-40 mL VOA vial with HCL	14 days	HCl
				Store at or below 6 Degrees
EPH Screen	MA-EPH	2-1000 mL amber glass bottles with HCl	14/40 days	Store at or below 6 Degrees
				HCl to pH <2
VPH	MA-VPH	3-40 mL VOA vials with HCl	14 days	Store at or below 6 Degrees
				HCl
SVOC	EPA 8270 by SW3520	2-1000 mL amber glass/teflon bottles	7/40 days	Add 80 mg sodium thiosulfate to chlorinated samples.
				Unpreserved, Store at or below 6 Degrees
Low Level PAH	EPA 8270 PAH SIM	2-1000 mL amber glass/teflon bottles	7/40 days	Add 80 mg sodium thiosulfate to chlorinated samples.
Metals	E245.1/E200.7_8	250-mL plastic	6 months/28 days Hg	Add HNO_3 to pH <2
Dissolved Metals	EPA 6020	250-mL plastic, filtered, with HNO3	15 minutes to filter/preserve (6 months analysis)	Filter, then place in preserved containers; HNO3 to pH <2
Dissolved CVAA Mercury	EPA 245.1	250-mL plastic, filtered, with HNO3	15 minutes to filter/preserve (28 days analysis)	Filter, then place in preserved containers; HNO3 to pH <2
MNA: Sulfate	E300.0	250 mL plastic	28 days	Unpreserved, Store at or below 6 Degrees
MNA: Nitrate+Nitrite	E353.2	250mL plastic, H2SO4 preserved	28 days	Store at or below 6 Degrees; H_2SO_4 to pH <2
Organic Carbon	SW9060	250mL amber glass, H2SO4 preserved	28 days	Store at or below 6 Degrees; H2SO4 to pH <2
Chloride	E300.0	250ml plastic	28 days	Unpreserved, Store at or below 6 Degrees
Methane, ethane, ethene	SW3810/RSK175	3-40ml clear with TSP	14 days	TSP cool to above freezing but not less then 6 deg
INVESTIGATION DERIVED WASTE CHARACTERIZATION - LIQUID				
VOC	SW8260B	250 mL amber glass	14 days to leach and 14 days to	Unpreserved, Store at or below 6 Degrees
TPH	MA-EPH Screen	2-1000 mL amber glass bottles with HCl	14/40 days	Store at or below 6 Degrees
				HCl to pH <2
	MA-VPH	3-40 mL VOA vials with HCl	14 days	Store at or below 6 Degrees
				HCl
TCLP Metals[e]	SW 6010B(RCRA Metals)/SW 7470A (Mercury-Hg)	250-mL amber glass	6 months/28 days Hg	Unpreserved, Store at or below 6 Degrees
Hexavalent Chromium (Cr VI)	3500 CR-B for Hexavalent Chromium	250-mL plastic, unpreserved	24 hour analytical	Unpreserved, Store at or below 6 Degrees
Cyanide (total)	SM 4500-CN-E	250-mL plastic with NaOH	14 days	Place in preserved containers; NaOH
Sulfide (total)	SM 4500S2D	250-mL plastic with NaOH and zinc acetate	15 minutes to filter/preserve (28 days analysis)	Place in preserved containers; NaOH + Zn acetate
Flash Point	Flash Point	250-mL amber glass, unpreserved	14 days	Unpreserved, Store at or below 6 Degrees

Notes:

[a] The first number (or number alone) refers to the maximum number of days from sampling to extraction and the second number refers to the maximum number of days from extraction to analysis.

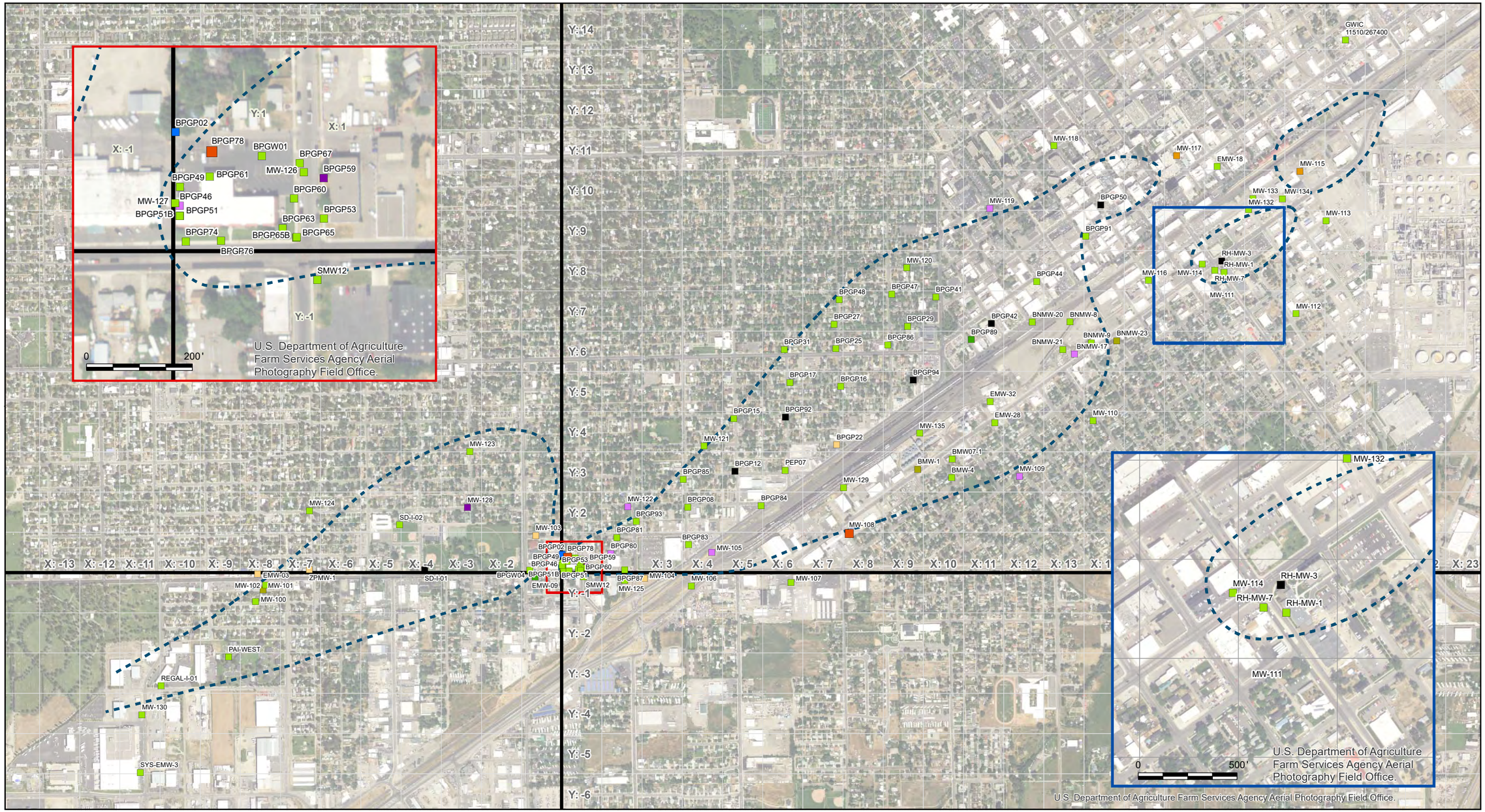
[b] Temperatures are listed in degrees Celsius.

[c] Preservatives will be supplied by the laboratory, but must be added in the field unless noted as pre-preserved.

[e] Metals required are arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, sliver, and zinc

ASA - American Society of Agronomy
EPH - extractable petroleum hydrocarbons
H_2SO_4 - sulfuric acid
HCL - hydrochloric acid
Hg - Mercury
HNO_3 - nitric acid
L - liter
MA - Massachusetts
mL - milliliter
NaOH - sodium hydroxide
oz - ounce
PAH - polynuclear aromatic hydrocarbon
PCB - polychlorinated biphenyl
SPLP - synthetic precipitation leaching procedure
SVOC - semivolatile organic compound
TCLP - toxicity characteristic leaching procedure
VOA - volatile organic analysis
VOC - volatile organic compound
VPH - volatile petroleum hydrocarbons
Zn - zinc

FIGURE



EXPLANATION

- VOCs
- VOCs + EPH + VPH
- VOCs + EPH + VPH + MNA
- VOCs + EPH + VPH + Metals
- VOCs + EPH + VPH + Metals + MNA
- VOCs + MNA
- VOCs + Metals
- VOCs + Metals + MNA
- VOCs + SVOCs + EPH + VPH
- VOCs + SVOCs
- FACILITY GRID (SPACING = 500 FEET)
- FACILITY BOUNDARY, 5 µg/L PCE GROUNDWATER CONTOUR

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FIGURE 1

THIRD QUARTER 2018 GROUNDWATER WELL SAMPLE LOCATIONS DELINEATED BY ANALYTE

BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Drawn By: PH	Checked By: AV	Scale: 1 " = 1,230 '	Date: 9/6/18	File: Billings_MWSampling3Q18_Fig1.mxd

APPENDIX C-4

ALLUVIAL AND BEDROCK GROUNDWATER MONITORING WELL LOCATION RATIONALE MEMO

memorandum

To: Mr. Mike Gipson, Montana DEQ
From: Mr. Andrew Vann
Date: February 5, 2018
Re: Alluvial and Bedrock Groundwater Monitoring Well Location Rationale, Billings PCE Groundwater Facility, Billings Montana

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Trihydro Corporation (Trihydro) has been contracted by the Montana Department of Environmental Quality (DEQ) to conduct a remedial investigation at the Billings PCE Groundwater CECRA Facility (Facility), as described in the Remedial Investigation Work Plan (Work Plan) (Trihydro 2017). One objective described in the Work Plan is to evaluate the nature and extent of contamination at the Facility. Historical groundwater data at the Facility indicate that the dissolved phase chlorinated solvent groundwater plume boundary has not been adequately determined. As part of the investigation, Trihydro has collected analytical groundwater data from existing monitoring wells, as well as direct-push groundwater screening samples from temporary sampling points, to attempt to better delineate the edge of the groundwater plume exceeding DEQ-7 or other applicable groundwater standards or screening levels.

In July and August 2017, Trihydro collected groundwater samples from 88 existing wells at the Facility. Analytical results were presented in the November 10, 2017 Third Quarter 2017 Groundwater Analytical Data – Preliminary Evaluation memo. Groundwater was evaluated for a range of possible contaminants, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), volatile petroleum hydrocarbons (VPH), extractable petroleum hydrocarbons (EPH), metals, monitored natural attenuation (MNA) parameters, and field geochemistry parameters. The most prevalent and consistent contaminant observed at the Facility was tetrachloroethene (PCE) and less frequently, its breakdown products: trichloroethene (TCE), *cis*-1,2-dichloroethene, *trans*-1,2-dichloroethene, and vinyl chloride (VC).

Evaluation of the analytical data resulted in the identification of six regions of the groundwater plume where contaminant concentrations were not adequately delineated. Within these six regions, a total of 23 sub-areas were selected for direct-push groundwater screening, and potential placement of permanent groundwater monitoring wells. At 19 of these locations, the PCE groundwater concentration in the nearest adjacent or upgradient monitoring well exceeded the DEQ-7 groundwater standard of 5 µg/L. Four additional locations at potential source areas were also identified (the former Rex's Cleaners, ALSCO Cleaners, Hospital Laundry Services, and Wetzel's Cleaners). These locations were described in Section 8 of the Work Plan, and were shown on Figures 7-1 through 7-7 and Figure 8-1 of the Work Plan. Figure 8-1 also shows the Third Quarter 2017 PCE groundwater concentrations, as well as the inferred plume boundary, and is attached to this memo.

Direct-push groundwater screening was conducted from November 28 through December 21, 2017. Direct-push samples were collected by driving a well screen down to groundwater using a direct-push

sampling rig, to create a temporary monitoring well at each sub-area. Disposable ¼" LDPE tubing was then connected to a peristaltic pump, and lowered down to the well screen. The screened interval was typically from 19 to 23 feet below ground surface (bgs), and the pump inlet was usually set approximately 1 foot above the bottom of the screen. Due to the screening nature of the sample, water quality parameters were not recorded, however, low-flow sampling protocols were followed to the extent practicable (i.e. groundwater pumping rates were kept below 300 ml/min, and at least three well volumes of groundwater were purged prior to sampling, typically around 1 gallon of purge water per well).

Groundwater screening samples were collected and hand-delivered to Pace Analytical Laboratory in Billings, Montana for analysis. Samples were collected from each area along the inferred plume boundary, as well as from potential source areas, and evaluated for PCE using a modified EPA method 8260, which reported only the PCE concentration, with limited field or laboratory QA/QC protocols, to minimize turnaround time and sample cost. These "rush" screening sample results were typically available within 24-36 hours. The intent of the screening samples was to provide a rapid-turnaround reading of PCE concentrations in the field, to allow step-out or step-in sampling as necessary while drilling subcontractors were on-site. In areas where groundwater screening samples contained PCE at concentrations greater than 10 µg/L, a step-out location was identified (to the extent practicable), utility locates were coordinated, and an additional sample was collected. In locations where screening samples did not contain detectable PCE (i.e. PCE concentrations less than the 1 µg/L reporting limit), a step-in location was identified (to the extent practicable), utility locates were coordinated, and an additional sample was collected.

44 screening groundwater samples were collected over the course of the direct-push investigation. In some identified locations, Trihydro was unable to access the property to collect samples, or met equipment refusal before reaching groundwater. Table 1 presents a list of screening results, screening locations and property (or nearby property) addresses. Screen results are presented, along with Third Quarter 2017 PCE concentrations, on Figure 1. A revised plume boundary is also shown on Figure 1. Approximately 18 additional screening groundwater samples are proposed for the initial phase of the February drilling event, mainly focused on delineation of the groundwater plume in the former Rex's Cleaners area and upgradient (southwest) of the former Central Avenue Laundry. These additional screening samples will help identify or refine alluvial well locations to delineate these plumes, as well as identify potential sources.

Using the analytical and screening data, Trihydro identified locations where additional permanent groundwater monitoring wells will be installed, to establish the approximate location of the < 5 µg/L groundwater dissolved-phase PCE plume boundary, and/or to provide better delineation of potential source-area groundwater concentrations. Proposed monitoring well IDs, installation locations, nearby screening values, and location rationale are presented in Table 2. There are 26 alluvial wells proposed, with anticipated completion depths of approximately 20-25 feet. Approximately five additional alluvial wells may be installed in the former Rex or former Central Avenue Laundry areas to delineate these

plumes, based on groundwater screening results. Groundwater screening results and additional proposed well locations will be discussed with DEQ prior to well installation.

Trihydro intends these alluvial wells according to the general design noted in Figure 2. These alluvial wells, in combination with the existing monitoring wells at the Facility, will more adequately delineate the dissolved-phase PCE plume boundary, and aid in evaluating the longitudinal and transverse axes of the PCE plumes. Evaluation of completeness of these objectives will be performed following groundwater sampling, as there are considerable unknowns remaining regarding groundwater concentrations in the former Rex and Central Avenue Laundry areas.

Bedrock groundwater monitoring wells, as described in the Work Plan, are also shown on Figure 1 and in Table 2, with a well detail shown on Figure 3. Bedrock wells are anticipated to be completed from approximately 40-50 feet. Both bedrock and alluvial monitoring well construction and sampling will be conducted in accordance with Section 8 of the Work Plan and 4 of the Sampling and Analysis Plan (SAP).

776-036-001

TABLES

TABLE 1. PCE SCREENING RESULTS
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS MONTANA

Location ID	Date Sampled	Address/Location	Tetrachloroethene (ug/L)
1A-GW-01	12/02/17	In Cook Avenue right of way North of 110 12th Street West	1.5
1A-GW-02	12/04/17	In right of way in north of 1142 Howard Ave.	0.25
1B-GW-01	12/02/17	In right of way along 9th Street West, due east of 902 Miles Avenue	8.9
1B-GW-02	12/04/17	In right of way along 9th Street West, south east of 418 9th St. West	<0.055
2A-GW-01	12/02/17	In right of way in easterly lane of Plainview Street, due west of 1216 Central Avenue Property, approximately 50 feet south of Central Avenue	4.3
2A-GW-02	12/03/17	In parking lot ofRituals salon, SE corner by alley behind CAL strip mall, where it intersects plainview.	7
2A-GW-03	12/05/17	In right of way on S Plainview St. - east of 1228 Concord Dr. residence in ROW on Plainview	8.8
2A-GW-04	12/18/17	In north side of Concord Drive, in front of residence at 1311 Concord Drive	8.8
2A-GW-05	12/18/17	In north side of Eldorado Drive, in front of residence at 1235 Eldorado Drive.	13.1
2B-GW-02	12/05/17	In northeast area of Central Park, approximately 15 west of 8th St. W in the small practice field to the north of the park. Almost directly across from the intersection of St. Johns Ave and 8th St. W in Central Park.	3.2
3A-GW-01	12/02/17	In boulevard along Cook Avenue right of way, North of 610 Cook Avenue.	0.83
3B-GW-01	12/02/17	In Miles Avenue right of way, in parking lane in front of 430 Miles Avenue.	0.72
3B-GW-02	12/05/17	Next to north side of Terry Park (City of Billings in ROW) south of 517 Terry Ave. Residence.	<0.055
3C-GW-01	12/04/17	In 1st Street West right of way, due west of 43 Clark Avenue property	<0.055
3C-GW-02	12/18/17	In west side of Moss Lane right of way, approximately 100 feet south of the intersection at Clark Avenue, next to 32 Clark Avenue	<0.055
3D-GW-01	12/05/17	In right of way at 2nd ave N and N 33rd St. (closest address is 3311 2nd Ave. North/Western Inn Motel) - plan to drill in grass boulevard.	67.7
3D-GW-02	12/07/17	In the east side of North 32nd Street, south of 4th Avenue North. In the no-parking area between the entrance and exit to the private parking lots on the east side of the street. East of KTVQ at 3203 3rd Avenue North	<0.055
3E-GW-01	12/02/17	In most westerly angled parking lane at 2929 3rd Avenue North, or in hatched area just beyond that, if necessary.	51.9
3E-GW-02	12/07/17	In the hatched area at the north end of the angled parking on the west side of North 29th Street, West of the building at 2900 4th Avenue North	<0.055

TABLE 1. PCE SCREENING RESULTS
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS MONTANA

Location ID	Date Sampled	Address/Location	Tetrachloroethene (ug/L)
4B-GW-01	12/04/17	South of Keller Supply on BNSF property or in parking lot of Keller Supply Company, west of main building	18.5
4B-GW-02	12/04/17	In parking lot of Keller Supply Company, south of main building near State/1st Ave South ROW and rail spur.	39.3
4C-GW-01	11/30/17	Southeast of car wash awnings, in right of way on S 41st Street	<0.055
4C-GW-03	12/06/17	East of residence in ROW at 4003 2nd Ave. South	0.36
4D-GW-01	11/30/17	In right of way on 2nd Avenue South, NW of 204 S 36th Street property.	15.4
4D-GW-02	12/06/17	In 3rd Avenue South right of way north of residence at 302 S 36th St. Well located in boulevard if possible.	1.1
4E-GW-01	12/06/17	In right of way on 2nd Avenue South, south of corner property located at 199 S 33rd Street	22
4E-GW-02	12/06/17	In right of way of 3rd Ave S. - south of residence with address 224 S 33rd St.	4
5A-GW-01	12/01/17	In right of way of 25th Street South, SW of wholesale remarketing, Inc	1.2
5A-GW-02	12/18/17	In right of way of South 26th St near the parking lot for Riverstone Health Clinic and west of residence at 201 S 26th St.	33.6
5B-GW-01	12/01/17	In City of Billings right of way on north side of 2nd Avenue South.	0.87
5C-GW-02	12/20/17	Near alley of Rex Cleaners nearer to 1st. Ave S. and in or near the adjoining lot of the property to the east - 18 S 27th St. (Erving Properties)	7.5
6A-GW-01	12/01/17	In right of way, in front of 6 29th Street S.	0.69
6B-GW-01	12/20/17	In parking lot SOUTH of Burger Dive	13.7
6B-GW-02	12/06/17	Northwest corner of 3rd Ave N and N 25th St. in ROW of either 3rd Ave. N or N 25th St. - near southeast corner of 300 N 25th St (apartments/offices/condos)	1.5
6C-GW-01	12/07/17	In the southwest corner of the ROW of the deadend of N 24th St. near Rex Restaurant - Southwest corner of intersection at 1st Ave N and N 24th St.	<0.055
6C-GW-02	12/06/17	22nd and 1st - ROW on west side of 22nd St, west of 15 N 22nd St	<0.055
ALSCO-GW-01	11/29/17	348 Calhoun Lane	<0.055
ALSCO-GW-02	11/29/17	348 Calhoun Lane	<0.055
ALSCO-GW-03	11/30/17	NE corner Corner of Calhoun Ln. and Vaughn	<0.055

TABLE 1. PCE SCREENING RESULTS
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS MONTANA

Location ID	Date Sampled	Address/Location	Tetrachloroethene (ug/L)
ALSCO-GW-04	11/29/17	348 Calhoun Lane	<0.055
ALSCO-GW-05	11/29/17	348 Calhoun Lane	<0.055
HLS-GW-03	12/01/17	Approximately 150 feet east of HLS, and 70 feet south of Scentry Biologicals building	0.39
HLS-GW-04	12/01/17	In MDT right of way SE of intersection at 6th Street West and Central Avenue, due east of Scentry Biologicals, Inc.	0.28
HLS-GW-05	12/02/17	Approximately 50 feet east of the north end of Scentry biologicals building	0.29

TABLE 2. PROPOSED MONITORING WELL LOCATIONS AND INSTALLATION RATIONALE
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS MONTANA

Well ID	Nearest Screening Sample ID	PCE Concentration, ug/L	Well Located at Screen or Sample Location?	Well located on City of Billings property?	Well Location	Address	Well Installation Rationale
Alluvial Wells							
MW-100	2A-GW-04	8.8	Y	Y	In north side of Concord Drive, in front of residence at 1311 Concord Drive	1311 Concord Drive	Monitor upgradient source(s) southwest of CAL
MW-101	CAL-MIP-04	--	Y	Y	In alley behind former Central Avenue Laundery.	1246 Central Avenue	Delineate source area groundwater contamination.
MW-102	CAL-MIP-09	--	Y	N	North of CAL, in parking lot NE of Smoker Friendly	1246 Central Avenue	Delineate source area groundwater contamination.
MW-103	2B-GW-02	3.2	Y	N	In northeast area of Central Park, approximately 15 west of 8th St. W in the small practice field to the north of the park. Almost directly across from the intersection of St. Johns Ave and 8th St. W in Central Park.	Central Park	Delineate southern plume boundary at CAL
MW-104	4A-GW-01	--	Y	N	In northeast corner of the triangle of property between Montana Ave., Central Ave, and the Underpass to State. Ave. Close to where Central Ave. takes off to the west from Montana Ave. (south of Albertsons)	MDT Right-of-Way	Southern plume boundary monitoring well.
MW-105	4A-GW-03	--	N	N	Located on BNSF property, directly north of the rail line, south of Montana Avenue.	BNSF property	Southern plume boundary monitoring well.
MW-106	4A-GW-02	--	Y	N	In Northwest corner of JH Motors parking lot.	4540 State Ave.	Southern plume boundary monitoring well. Potential delineate sources located south of the railroad.
MW-107	4B-GW-03	--	Y	N	In parking lot of ABC supply Company, as close to State Avenue as possible	4300 State avenue	Delineate southern plume boundary.
MW-108	4C-GW-01	<0.055	Y	Y	Southeast of car wash awnings, in right of way on S 41st Street	4024 1st Avenue South	Delineate southern plume boundary, evaluate potential hydrocarbon impacts
MW-109	4D-GW-02	1.1	N	Y	In 3rd Avenue South right of way north of residence at 302 S 36th St. Well located in boulevard if possible.	302 S. 36th St.	Delineate southern plume boundary.
MW-110	4E-GW-02	4	Y	Y	In right of way of 3rd Ave S. - south of residence with address 224 S 33rd St.	224 S. 33rd St.	Delineate southern boundary of plume.
MW-111	5B-GW-01	0.87	N	Y	In City of Billings right of way on north side of 2nd Avenue South.	109 S. 28th Street	Attempt to establish southern bound to PCE plume at former REX Cleaners.
MW-112	5D-GW-01	--	Y	Y	In right of way of 4th Avenue South, southeast of commercial building at 311 S 26th Street.	311 S 26th Street	Pending collection of GW screening sample at this location, place monitoring well to establish plume boundary.
MW-113	5D-GW-02	--	Y	Y	On north side of 3rd Avenue S and S 24th St intersection. In ROW of S 24th St. - west of 209 S 24th St and east of 216 S 24th St. Locate on either side of the road to accommodate placement around potential utilities	ROW west of 209 S. 24th St and east of 216 S. 24th St.	Pending collection of GW screening sample at this location, place monitoring well to establish plume boundary.
MW-114	5C-GW-02	7.5	Y	N	Near alley of Rex Cleaners nearer to 1st. Ave S. and in or near the adjoining lot of the property to the east - 18 S 27th St. (Erving Properties)	Alley east of 18 S Broadway	Establish GW concentrations at REX cleaners.
MW-115	5D-GW-04	--	Y	Y	On NE side of S 22nd Street right of way, in front of property at 2121 1st Avenue South.	2121 1st Avenue South	Pending collection of GW screening sample at this location, place monitoring well to establish plume boundary.
MW-116	6A-GW-01	0.69	Y	Y	In right of way, in front of 6 29th Street S.	6 29th Street South	Delineate distal plume edge from potential additional source area(s).
MW-117	6B-GW-01	13.7	Y	N	In parking lot SOUTH of Burger Dive	114 N 27th Street	Delineate distal plume edge.
MW-118	3E-GW-02	<0.055	N	Y	In the hatched area at the north end of the angled parking on the west side of North 29th Street, West of the building at 2900 4th Avenue North	2900 4th Avenue North	Establish northern/distal plume boundary.

TABLE 2. PROPOSED MONITORING WELL LOCATIONS AND INSTALLATION RATIONALE
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS MONTANA

Well ID	Nearest Screening Sample ID	PCE Concentration, ug/L	Well Located at Screen or Sample Location?	Well located on City of Billings property?	Well Location	Address	Well Installation Rationale
MW-119	3D-GW-02	<0.055	N	Y	In the east side of North 32nd Street, south of 4th Avenue North. In the no-parking area between the entrance and exit to the private parking lots on the east side of the street. East of KTVQ at 3203 3rd Avenue North	3203 3rd Avenue North	Establish northern plume boundary.
MW-120	3C-GW-02	<0.055	N	Y	In west side of Moss Lane right of way, approximately 100 feet south of the intersection at Clark Avenue, next to 32 Clark Avenue	32 Clark Avenue	Establish southern plume boundary
MW-121	3B-GW-01	0.72	N	Y	In Miles Avenue right of way, in parking lane in front of 430 Miles Avenue.	430 Miles Avenue	Delineate northern plume boundary
MW-122	3A-GW-01	0.83	N	Y	In boulevard along Cook Avenue right of way, North of 610 Cook Avenue.	610 Cook Avenue	Delineate northern plume boundary
MW-123	1B-GW-01	8.9	Y	Y	In right of way along 9th Street West, due east of 902 Miles Avenue	902 Miles Avenue	Delineate northern plume boundary at former Central Avenue Laundry
MW-124	1A-GW-01	1.5	N	Y	In Cook Avenue right of way North of 110 12th Street West	110 12th Street West	Delineate northern plume boundary at former Central Avenue Laundry
MW-125	HLS-GW-04	0.28	N	N	In MDT right of way SE of intersection at 6th Street West and Central Avenue, due east of Scentry Biologicals, Inc.	612 Central Avenue	Delineate southern plume boundry.
Bedrock Wells							
MW-126	BSL-MIP-11	--	N	Y	In City of Billings right of way on west side 7th Street West, between easements onto 711 Central Avenue property.	711 Central Avenue	Evaluate depth to bedrock, potential for DNAPL, bedrock transmissivity and structure.
MW-127	BSL-MIP-04	--	N	N	On BSL property, in Alley between 711 Central Avenue and BSL.	715 Central Avenue	Evaluate depth to bedrock, potential for DNAPL, bedrock transmissivity and structure.

FIGURES

EXPLANATION

- PROPOSED ALLUVIAL MONITORING WELL LOCATIONS
- PROPOSED BEDROCK MONITORING WELL LOCATIONS
- JULY 2017 PCE GROUNDWATER CONCENTRATIONS, µg/L
- PCE GROUNDWATER SCREENING RESULTS, µg/L
- FACILITY BOUNDARY, 5 µg/L PCE GROUNDWATER CONTOUR (DASHED WHERE INFERRED)

N

0 1,000'

Trihydro CORPORATION
1252 Commerce Drive
Laramie, WY 82070
www.trihydro.com
(P) 307/745.7474 (F) 307/745.7729

FIGURE 1

PROPOSED MONITORING WELL LOCATIONS

BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Drawn By: PH	Checked By: AV	Scale: 1 " = 1,000 '	Date: 1/15/18	File: Fig1-1_Billings_AWM.mxd

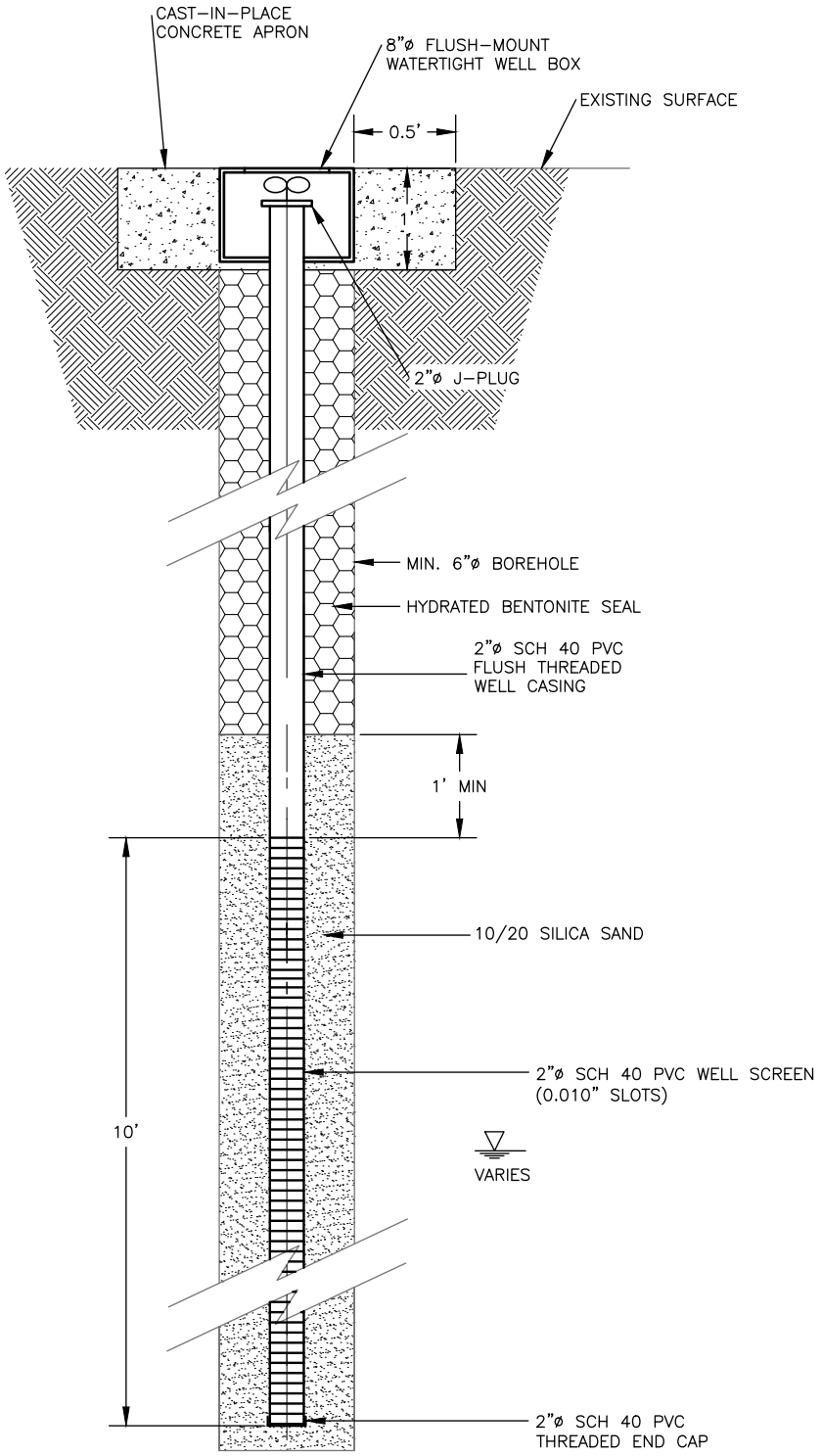


FIGURE 2

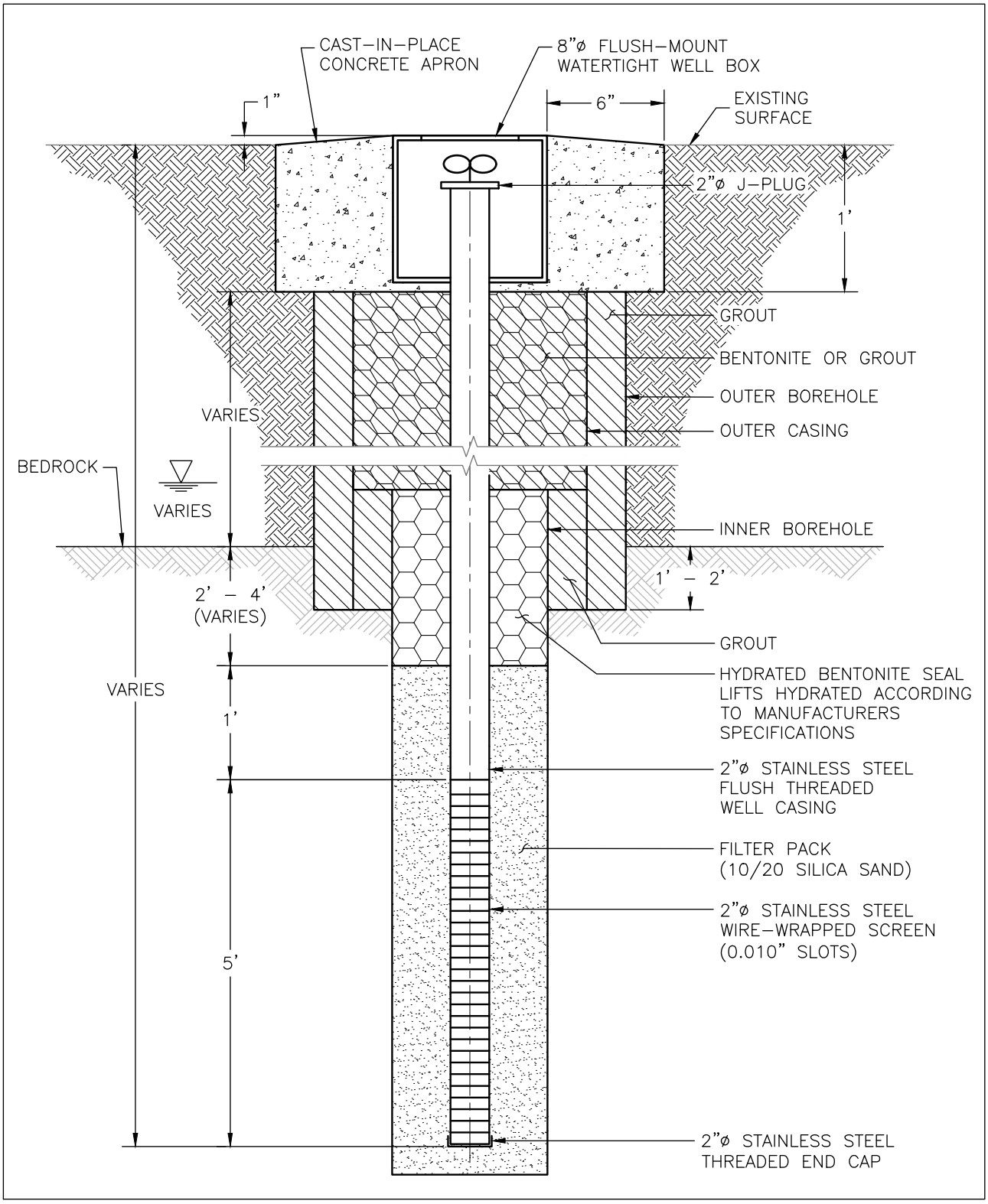
MONITORING WELL DETAIL

BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

Trihydro CORPORATION
1252 Commerce Drive
Laramie, Wyoming 82070
www.trihydro.com
(P) 307/745.7474 (F) 307/745.7729

Drawn By: PC	Checked By: ST	Scale: NONE	Date: 1/9/2018	File: 776-DETMONWELL-201801

\\TRIHYDRO.COM\CLIENTS\GOVSTATE\MDEQSRS\BILLINGSPCE\CADD\BNSF_INFORI\776-DETMONWELL-201801



Trihydro CORPORATION
1252 Commerce Drive
Laramie, Wyoming 82070
www.trihydro.com
(P) 307/745.7474 (F) 307/745.7729

FIGURE 3

TYPICAL FLUSH-MOUNT BEDROCK MONITORING WELL COMPLETION

BILLINGS PCE GROUNDWATER FACILITY
BILLINGS, MONTANA

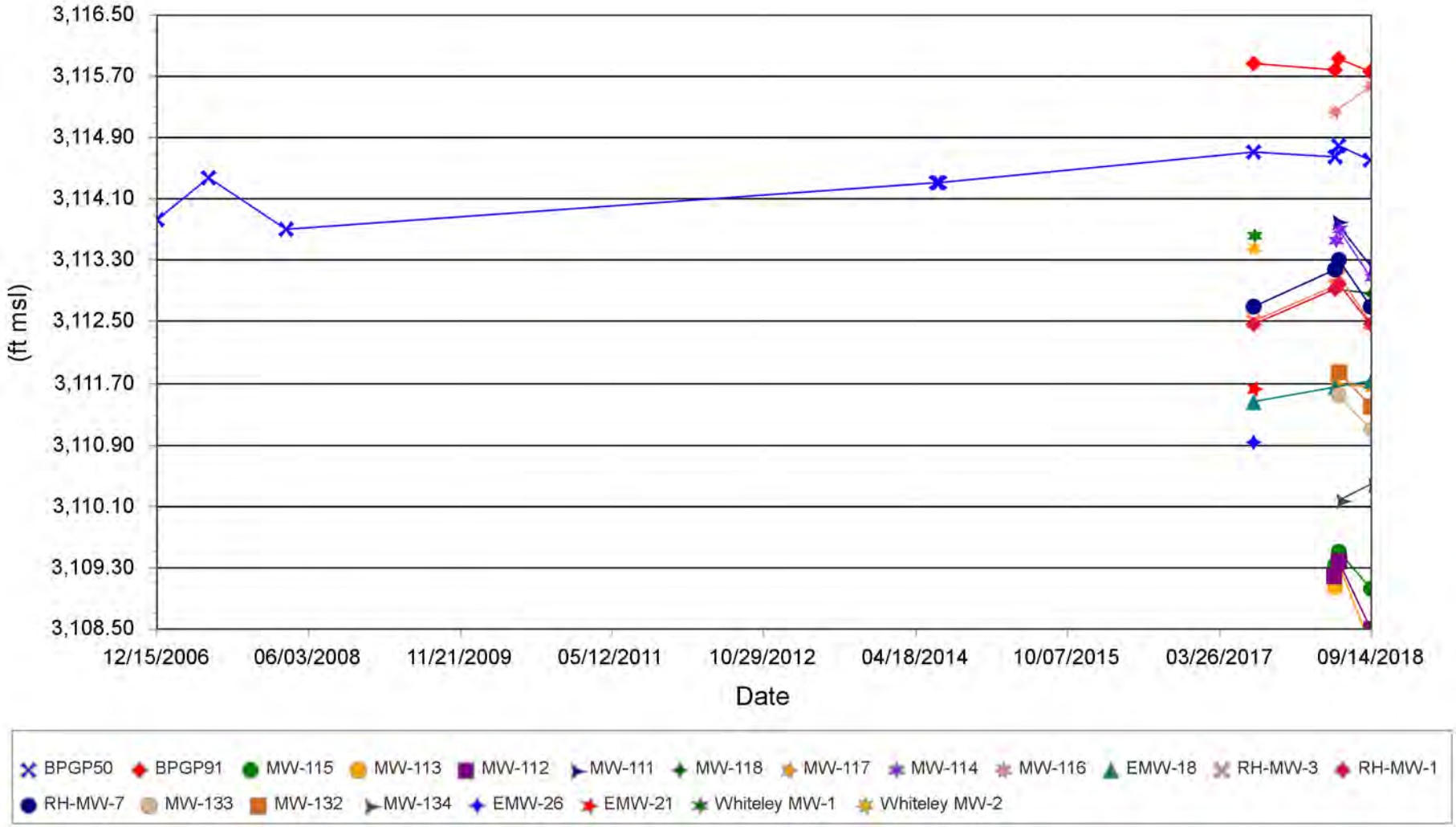
Drawn By: PC	Checked By: AV	Scale: NONE	Date: 11/6/17	File: 776-WELLCOMPLETION201711

\\TRIHYDRO.COM\CLIENTS\GOVSTATE\MDEQSRS\BILLINGSPCE\CADD\VENDORS_SUB\DRILLING\776-WELLCOMPLETION201711

APPENDIX C-5

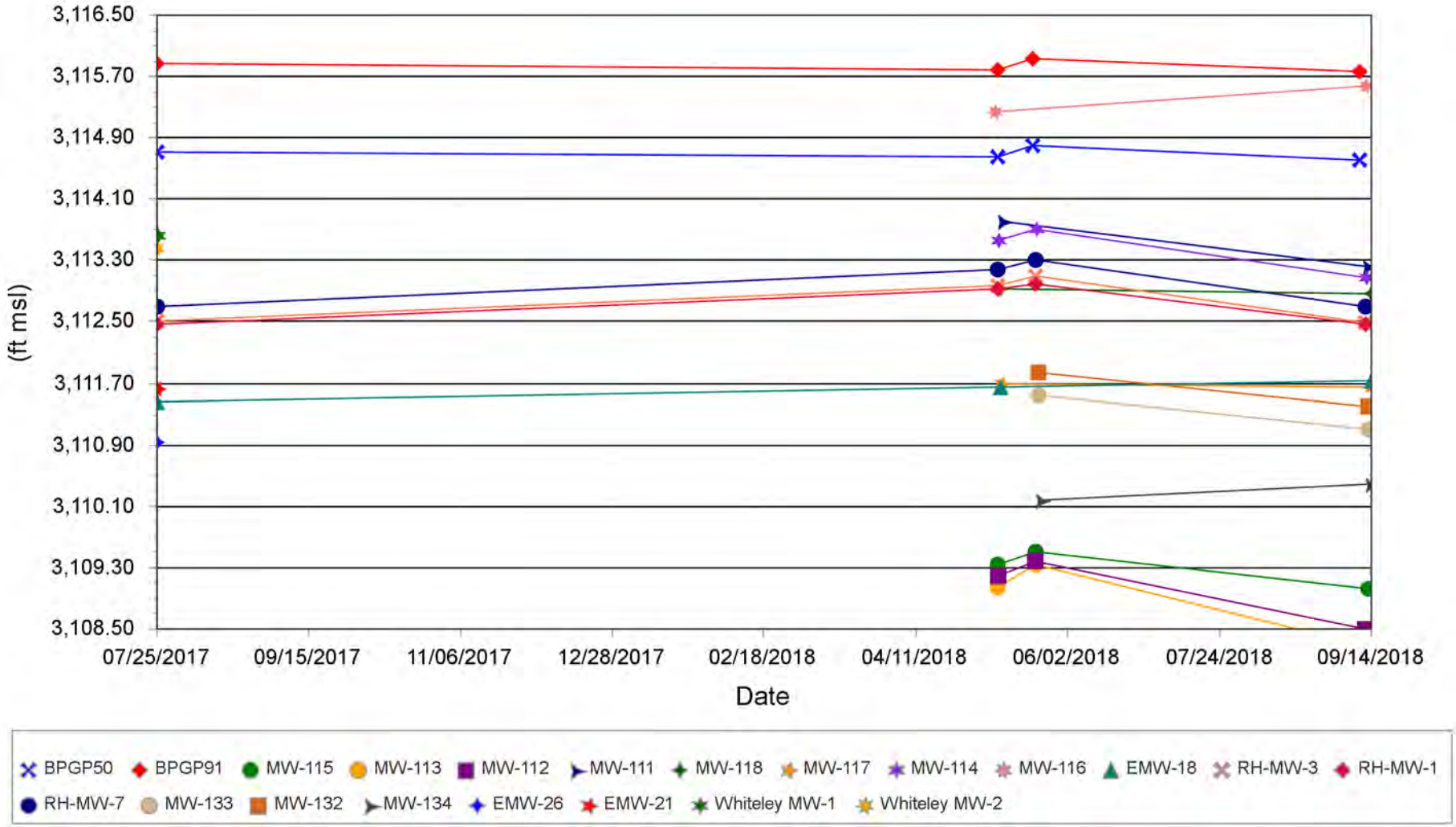
HYDROGRAPHS FOR SELECT BILLINGS PCE GROUNDWATER AREAS/WELLS

APPENDIX C – HISTORICAL HYDROGRAPHS FOR WELLS FOR THE DISTAL NORTHEAST PLUME AREA
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS MT



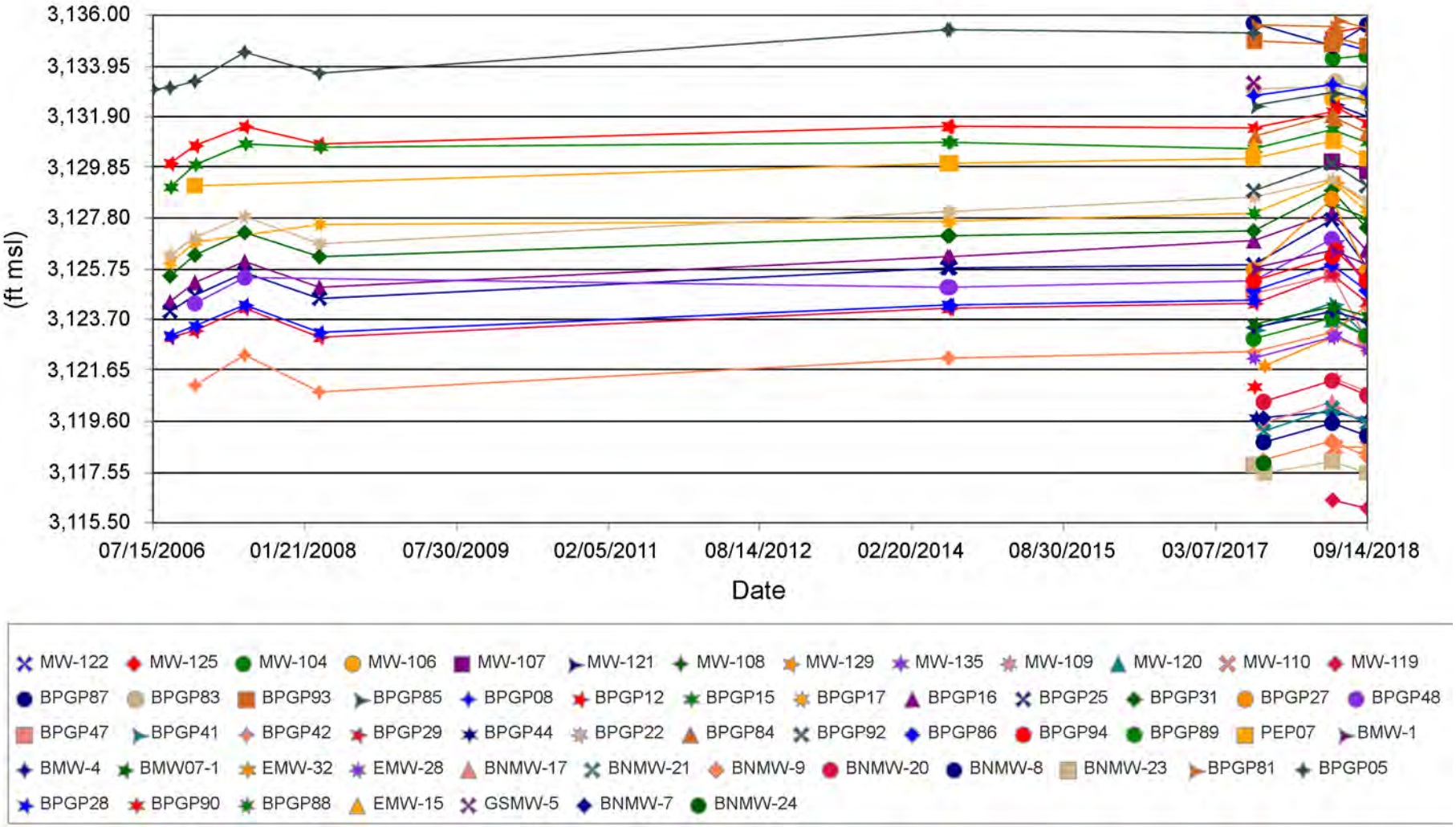
Notes: ft msl - Feet below mean sea level

APPENDIX C – 2017 TO 2018 HYDROGRAPHS FOR WELLS FOR THE DISTAL NORTHEAST PLUME AREA
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS MT



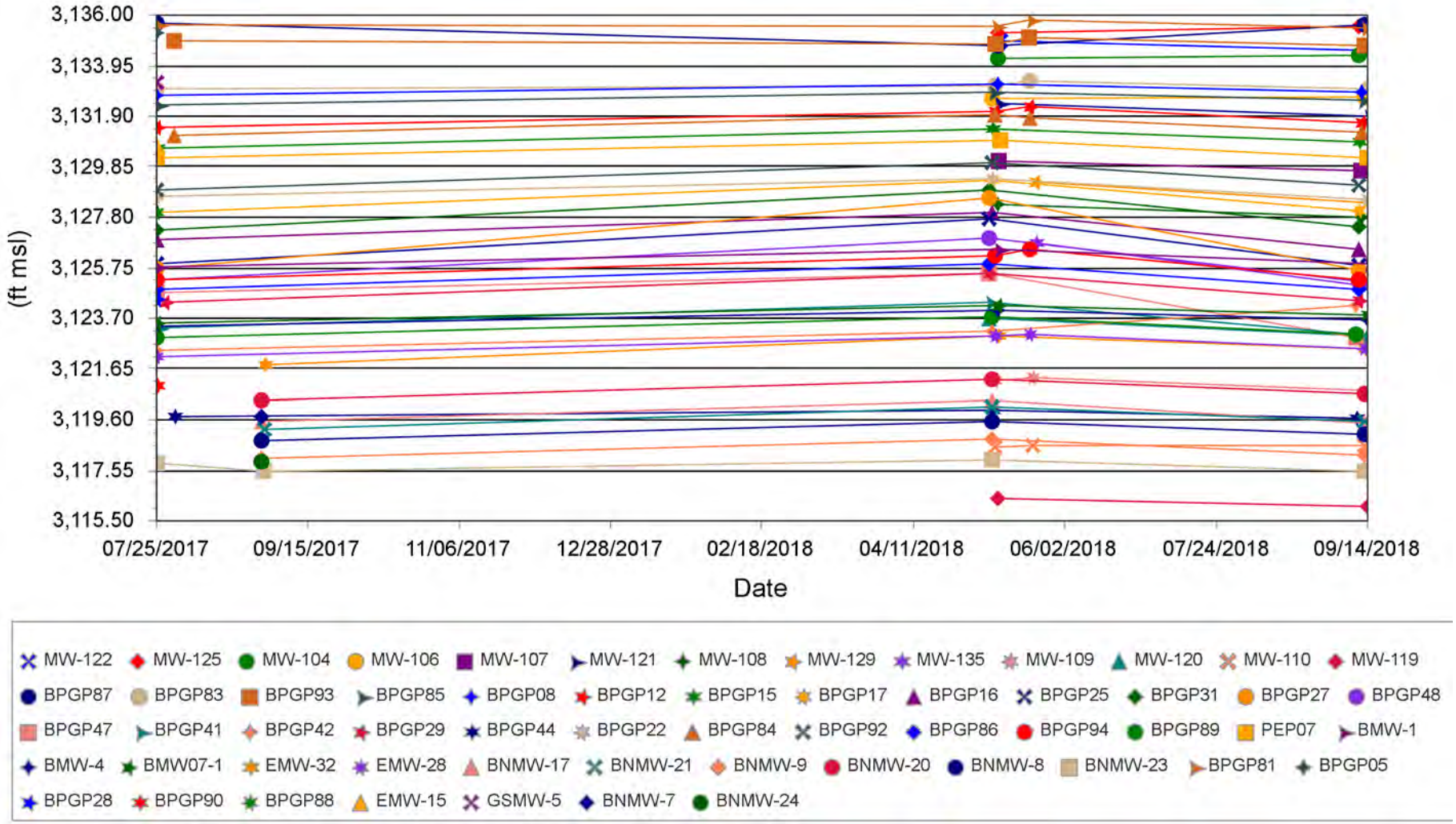
Notes: ft msl - Feet below mean sea level

APPENDIX C – HISTORICAL HYDROGRAPHS FOR BIG SKY LINEN PLUME AREA WELLS
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS MT



Notes: ft msl - Feet below mean sea level

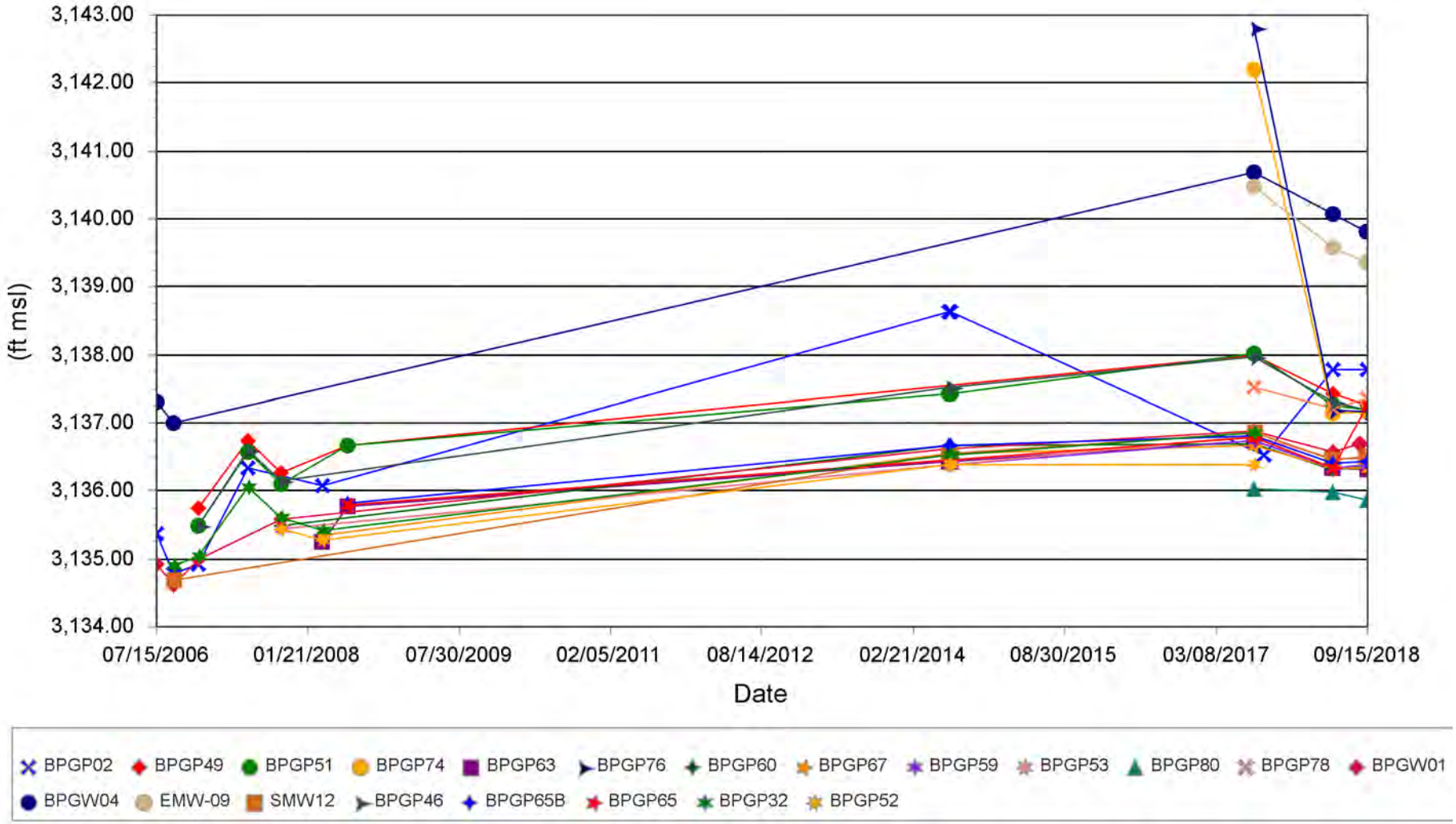
APPENDIX C – 2017 TO 2018 HYDROGRAPHS FOR BIG SKY LINEN PLUME AREA WELLS
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS MT



Notes: ft msl - Feet below mean sea level

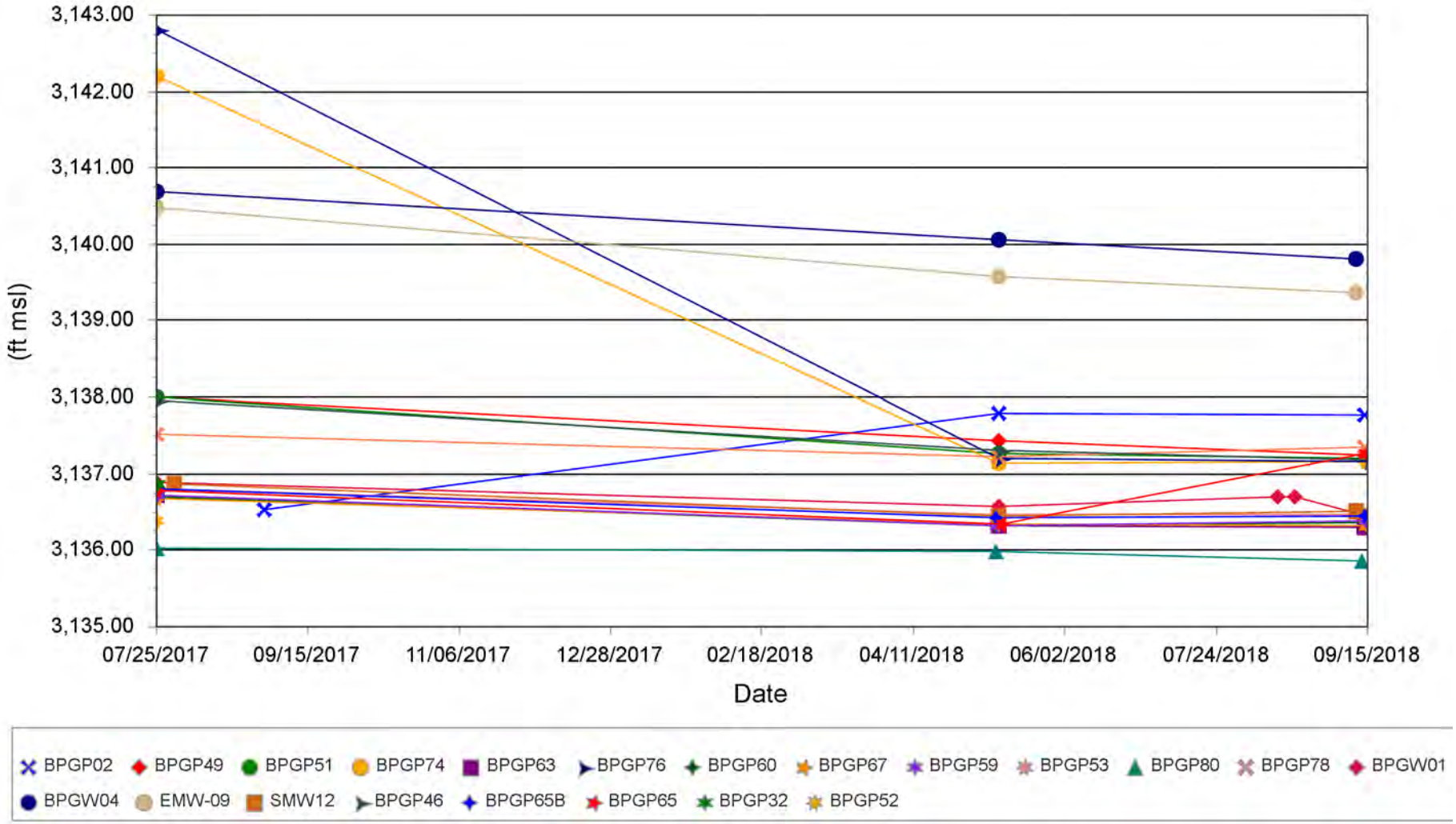
ProjectDirect: Group Three: Main Plume Recent PK:2677 RK:77819

APPENDIX C – HISTORICAL HYDROGRAPHS FOR WELLS NEAR BIG SKY LINEN
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS MT



Notes: ft msl - Feet below mean sea level

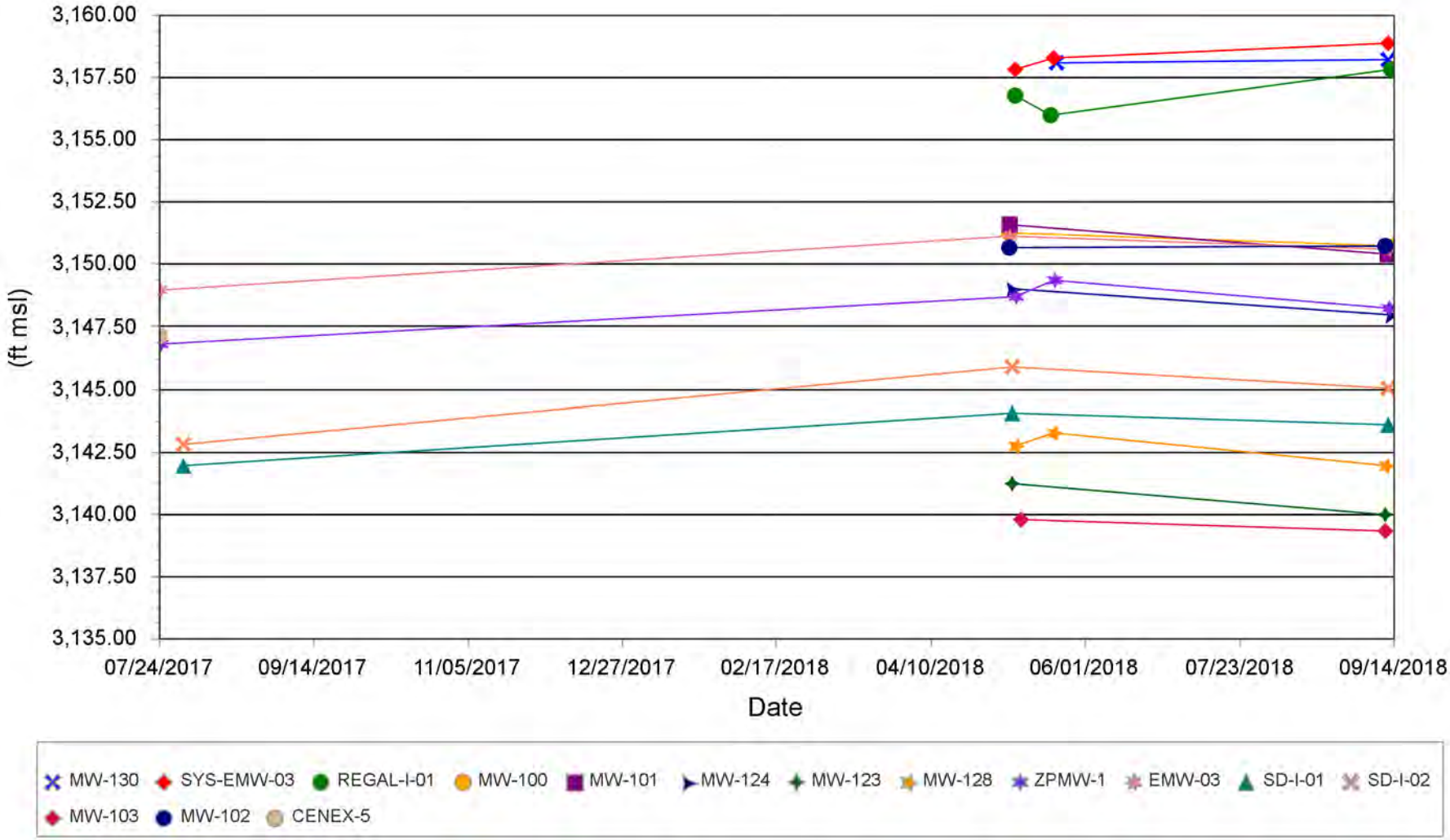
APPENDIX C – 2017 TO 2018 HYDROGRAPHS FOR WELLS NEAR BIG SKY LINEN
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS MT



Notes: ft msl - Feet below mean sea level

ProjectDirect: Group Two: Near BSL Recent PK:2677 RK:77821

APPENDIX C – 2017 TO 2018 HYDROGRAPHS FOR WELLS UPGRADIENT OF BIG SKY LINEN
BILLINGS PCE GROUNDWATER FACILITY, BILLINGS MT



Notes: ft msl - Feet below mean sea level

ProjectDirect: Group One: Upgradient Recent PK:2677 RK:77818