

Air Sparge System Installation & Surface/Groundwater Monitoring Work Plan

Town Pump Whitefish 1

6600 Highway 93 South

Whitefish, MT 59937

Facility ID# 15-10105, Release# 192 & 4155

Work Plans 35156/35157

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September 9, 2026

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1.0 Introduction

West Central Environmental Consultants (WCEC) has prepared this Additional Remedial Investigation Work Plan for the Town Pump Whitefish #1 located at 6600 Hwy 93 South in Whitefish, Montana [Figure 1]. The purpose of the scope of work included in this Work Plan is to continue surface and groundwater monitoring, complete a pilot study of air sparge treatment of smear zone north of Town Pump convenience store, and repair and survey all site wells to ensure accurate groundwater flow calculation and viability of site monitoring points. This work plan has been generated in response to the work plan release letter issued by the Montana DEQ on March 6, 2026 and following additional discussions with DEQ and the Montana PTRCB.

1.1 Site Location & Setting

The Site is located in Section 36, T31N, R22W of Flathead County, Montana [Figure 1]. The facility is an active Town Pump gasoline service station, food store, and casino located within the city of Whitefish. Site features are shown on Figure 2. The Town Pump facility maintains a total of five petroleum underground storage tanks (USTs) which consist of three 12,000 gallon gasoline USTs, one 20,000 gallon gasoline UST, and one 12,000 gallon diesel UST. The tank basin is located on the south side of the facility building and the fuel dispensers are located on the east side of the facility building. The Whitefish River is located approximately 200 feet north of the facility and flows in a general southeasterly direction through the city of Whitefish.

Main underground utility corridors in the immediate area are aligned north-south within and adjacent to US Highway 93 South, which borders the east side of the Site, and along West 10th Street, which borders the west side of the Site. The water service connection to the facility building is located on the east side of the Site and a water service connection to the hydrogen peroxide remediation system is located on the west side of the Site. Sewer and natural gas mains are located along West 10th Street. Fiber optic and a storm water drainage system parallels US Highway 93 South on the east side of the Site.

The groundwater monitoring wells installed on the Site property include 25, two-inch diameter wells installed in flush grade monuments cemented in place, and 4 one-inch diameter stick-up wells installed in the seep area adjacent to the river. Some groundwater monitoring wells were abandoned over the course of Site investigation as better understanding of the complex hydrogeology emerged and it was apparent that some wells bridged the perched and regional aquifers. The well locations are shown in Figure 2. The groundwater monitoring wells completed in the seep area are installed to a depth of approximately 5 to 7 feet below ground surface (bgs). The groundwater monitoring wells completed in the perched aquifer are installed to depths that range from 24 feet bgs to 34 feet BGS, and the groundwater monitoring wells completed in the regional aquifer are installed to depths that range from 38 feet to 50 feet bgs.

2.0 Soil Lithology, Hydrogeology & Site History

The following site history, soil lithology, and hydrogeology sections were obtained from various reports prepared and submitted by Olympus Technical Services. WCEC began working on the site in June 2025.

2.1 Soil Lithology

The general soil lithology at the Site consists of a five-foot surface layer of silty sand and gravel that overlies unconsolidated sediments deposited in glacial lake and near-shore glacial lake environments. The uppermost sediments are glacial lake silts and clays with interbedded sand lenses that vary in thickness from less than one inch to up to six inches thick. This unit extends to depths of 25 to at least 40 feet below ground surface and overlies a more permeable sand unit that contains some interbedded silt and clay. The contact between these units dips to the east and may represent a transgressive surface as the glacial lake overrode beach and dune sands. Petroleum hydrocarbon impacts occur in both units.

2.2 Hydrogeology

The uppermost groundwater occurs in water bearing sand stringers interbedded within the glacial lake sediments at about 15 feet to 25 feet bgs in a perched aquifer system that extends approximately 75 feet laterally around the dispenser area. Groundwater mounding has been reported to occur in the perched aquifer near monitoring well MW-4, which is in the dispenser area. The source of the mounding is unknown but could be the result of surface water infiltration through cracks in the pavement or recharge from a storm water drainage system along the east side of the Site. Groundwater in the perched aquifer system has been reported to flow radially away from the dispenser area at a hydraulic gradient of about 0.13 ft/ft. Groundwater levels in the perched aquifer have varied as much as 10 feet in well MW-4, which is located near groundwater mounding source(s), or as little as ½ foot in well MW-1, which is located along the fringe of the perched aquifer.

A “regional aquifer” is present in the underlying sand unit at about 35 feet BGS. Groundwater in this aquifer flows north to the Whitefish River at a relatively flat hydraulic gradient of approximately $7.0E-4$ ft/ft. Both the regional and the perched aquifer systems are impacted with petroleum from historical releases at the Site.

Aquifer tests were performed by Olympus in 2009 at five Site monitoring wells to measure the hydraulic conductivity of both the perched and the regional aquifers at the Site. Monitoring wells MW-4 and MW-29, which were completed in the perched aquifer, and monitoring wells MW-15, MW-19, and MW-27, which were completed in the regional aquifer, were selected for testing based on soil lithologies representing the

range of Site conditions. Slug testing was performed by lowering (slug in or falling head) and raising (slug out or rising head) a weighted cylinder constructed with Schedule 40 PVC piping of known volume, recording water level displacements with a pressure transducer, and saving the water level displacement data with an electronic data-logger. Two to three slug-in and slug-out tests were completed in each well. Hydraulic conductivity (K) values in the perched aquifer wells ranged from 0.1 to 1.3 gpd/ft² and K values in the regional aquifer wells ranged from 4 gpd/ft² to 1,045 gpd/ft². Based on the K values, the seepage velocity in the perched aquifer system is estimated to be in the range of 0.01 to 0.06 ft/day and the seepage velocity in the regional aquifer system is estimated to be in the range of 0.002 to 1 ft/day.

2.3 Site History

Town Pump purchased the Roundup Country Store property in 1989 and discovered petroleum impacted soil (Release 192) in the historical tank basin during upgrades to the fueling structures. Impacted soil removal was conducted during the upgrade and petroleum impacted soil was removed from the tank basin and the dispenser area to up 22 feet bgs (depth limit of the excavator). Petroleum impacted soil was left in place along the floor and walls of the excavation; however, standards for petroleum concentrations in soil had not yet been developed so the release was closed by the DEQ, then the Department of Health and Environmental Science. In January 2003, a second petroleum release (Release 4155) was detected by the facility's tank monitoring system which resulted from a 0.1 gallon per hour gasoline leak from a fuel line in the dispenser area.

Site investigations were conducted by Integrated Geosciences, Inc. and subsequently by Olympus to evaluate the extent and magnitude of impacts in soil and groundwater resulting from historical petroleum releases at the Site. Investigation results indicated that petroleum impacts to soil and groundwater were site wide and that worst case impacts were located near the tank basins (historical and existing) and the fuel dispenser area where petroleum analyte concentrations in soil and groundwater exceeded Human Health Standards (HHS) and Risk Based Screening Levels (RBSLs). Site investigation and corrective action results have been presented in reports submitted to the DEQ.

In 2007, Olympus installed an air sparge (AS) remediation system in a petroleum impacted seep area discovered in 2005 near the Whitefish River [Figure 2]. The AS system consisted of 13 vertical well points installed in bank soil near the river, which are plumbed to an air compressor housed in an equipment shed located at the top of the riverbank. Monitoring wells ASMW-1 through ASMW-4 were installed in the seep area to evaluate the effectiveness of remediation system operations. The results of system operation, maintenance, and monitoring have been presented in reports submitted to the DEQ.

In 2011, Olympus installed Soil Vapor Extraction (SVE) and hydrogen peroxide injection systems at the facility to treat worst case source areas. The purpose of the hydrogen peroxide injection system is to enhance

aerobic biodegradation of petroleum hydrocarbons, and specifically benzene, in the regional and perched aquifers. The SVE system consists of five, 4-inch diameter wells which are plumbed to two blowers housed in an equipment shed located north of the facility. The hydrogen peroxide fluid injection system consists of 17 one-inch diameter wells and 2 two-inch diameter wells which are individually plumbed to injection equipment housed in a shed located north of the facility. A hydrogen peroxide solution at a concentration of 1,000 ppm to 1,250 ppm was injected into the aquifer system at a total flow rate of about 2 gallons per minute. The hydrogen peroxide injection system became operational in April 2011, and by the end of 2016, approximately 7,285 pounds of oxygen had been injected into the aquifers. At DEQ's request, the system operations were discontinued in 2017 while an LNAPL investigation and remedial alternatives analysis was conducted.

Since 2011, remediation system operations have been reducing petroleum analyte concentrations in source areas at the Site; however, remediation efforts have been hampered by NAPL present in the aquifer systems and the limited area of influence of the existing injection wells. Remediation in the down-gradient portion of the dissolved phase plume is slow, and benzene remains a COC in the seep area near the river. In 2015, a Remedial Alternatives Analyses (RAA) report prepared by Olympus was submitted to the DEQ which presents options to accelerate remediation at the Site. The RAA included technologies to treat the downgradient plume area, and technologies to treat source areas, which could significantly shorten remediation time frames and reduce costs associated with long term remediation operations. In response, the DEQ requested the collection of site-wide dissolved oxygen (DO) concentration data for two consecutive months and intrinsic biodegradation indicator (IBI) data in select areas of the Site to evaluate the effectiveness of current remediation efforts, and to assess the viability of recommended technologies in the RAA. Groundwater monitoring was conducted at the Site in May 2016 and June 2016 to measure DO concentrations and collect IBI data and the results were presented in a report submitted to the DEQ in 2017.

The IBI data indicated that both aerobic and anaerobic biodegradation processes were actively degrading petroleum hydrocarbons at the Site. DO concentrations measured in groundwater wells in 2016 ranged from super saturated concentrations to less than 1.0 mg/L and varied in different plume and remediation affected areas of the Site. DO concentrations have generally increased in source areas since the commencement of remediation operations and fluctuate in response to injection activities and biodegradation processes that consume oxygen. DO concentrations are low in some Site areas and may remain low in areas that are not directly affected by remediation system operations.

Olympus directed an Ultra-Violet Optical Screening Tool (UVOST) investigation at the site in October 2018 with data and a remedial alternatives analysis (RAA) presented in the subsequent *LIF Geoprobe Investigation, Groundwater Monitoring, and Remedial Alternatives Analysis Report* dated May 23, 2019 [Olympus, 2019].

Based on the various investigations completed to date and the RAA evaluation, Olympus presented the following conclusions and recommendations in 2019:

1. Conclusions

- The general soil lithology at the Site consists of an up to five-foot surface layer of silty sand and gravel that overlies unconsolidated sediments deposited in glacial lake and near-shore glacial lake environments. The uppermost sediments are glacial lake silts and clays with interbedded sand lenses that vary in thickness from less than one inch to up to six inches thick. This unit extends to depths of 25 to at least 40 feet below ground surface and overlies a more permeable sand unit that contains some interbedded silt and clay. The contact between these units dips to the east and may represent a transgressive surface as the glacial lake overrode beach and dune sands.
- The uppermost groundwater occurs in water bearing sand stringers interbedded within the glacial lake sediments at about 15 feet to 25 feet BGS in a perched aquifer system that extends approximately 75 feet laterally around the dispenser area. Groundwater mounding occurs in the perched aquifer. A regional aquifer is present in the underlying sand unit at about 35 to 40 feet BGS. Groundwater in this aquifer flows north-northwest to the Whitefish River at a relatively flat hydraulic gradient of approximately $7.0\text{E-}4$ ft/ft.
- NAPL, including mobile and residual phases, is present in the sediments beneath the Site at depths of 17 to 37 feet BGS. NAPL occurs primarily in the area beneath the store and between the store and the pump island canopy to the east of the store. Mobile NAPL, as measured in Site wells, occurs over an area of at least 1,500 square feet and residual NAPL occurs over an area of approximately 20,000 square feet. Mobile NAPL is expressed as accumulating NAPL in several wells; however, it does not appear to be migrating.
- Petroleum hydrocarbons are present in groundwater in both the perched and regional aquifers at concentrations above RBSLs over an area of approximately 70,000 square feet.
- Impacted groundwater is discharging from the regional aquifer into a seep located on the south bank of the Whitefish River. An air sparging system located in the seep is reducing hydrocarbon concentrations, although the benzene HHS is typically exceeded in samples collected from one of the seep monitoring wells.

2. Recommendations:

- Continue operating the air sparging system in the seep until petroleum hydrocarbon concentrations in groundwater at the seep are below RBSLs and HHS.

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- Utilize HVDPE technology in the area of the NAPL plume for source reduction.
- Evaluate the effectiveness of HVDPE in reducing petroleum hydrocarbon concentrations in groundwater and evaluate further remedial action based on those results.
- Maintain the water service supply connection to the injection system at the Site should in situ enhanced bioremediation be utilized following HVDPE.

In 2022, MTDEQ contracted an independent 3rd Party, North Wind Portage, Inc, to perform a data summary and analysis which also included updating the Release Closure Plan (RCP). Recommendations in the 2022 RCP were generally aligned with the recommendations presented by Olympus in the 2019 report. The recommended actions include implementation of HVDPE to reduce source mass and concentrations followed by additional remedial actions to address discharge of constituents at the seep location.

WCEC Completed surface and groundwater monitoring in 2025 and assessed all of the site wells and environmental infrastructure at the facility. Additional sampling of the Whitefish River, surface water seeps, and groundwater sampling of locations near the bank was completed in May 2026.

3.0 Scope of Work

3.1 Scope of Work Overview

The scope of work proposed by WCEC includes the following:

- Conduct monitoring well repair and redevelopment
- Installation of air sparge wells and monitoring wells
- Complete groundwater, seep, and surface water monitoring (detailed in Section 3.2).
- Conduct air sparge pilot study (Section 3.5 & 3.6)
- Prepare Remedial Investigation Report following completion of the AS pilot study that follows the MTDEQ PTCS guidance and includes:
 - Presentation and discussion of all data collected during completion of the AS Pilot study pilot study.
 - Detailed discussion and evaluation of the pilot study with details of on ROI that will be used in implementation of AS system at the facility.
 - Presentation of 2-dimensional and 3-dimensional conceptual site models that depict LNAPL and petroleum constituent distribution within various environmental media, lithologic conditions, hydrologic conditions, site features, and receptors.
 - Details on monitoring well repair and redevelopment
 - Presentation and discussion of groundwater and surface water impacts identified in initial groundwater monitoring event.
- Prepare Groundwater Monitoring Report with RCP following completion of the final groundwater and surface water sampling event. This report will include all MTDEQ PTCS groundwater reporting guidance sections:
 - Site location, geology/lithology, and historical remediation conducted at the facility.
 - Detailed discussion of groundwater and surface water impacts at the facility.
 - Presentation of potentiometric and constituent isoconcentration maps relative to sampling locations and facility infrastructure.
 - Tabulated cumulative analytical and field data related to the releases.
 - Recommendations for additional investigation and remedial actions necessary to mitigate impacts on receptors and progress the releases towards closure.

- Preparation of a Release Closure Plan for the facility.

3.2 Groundwater & Surface Water Sampling

The semiannual groundwater monitoring events will include collection of surface water samples from three locations on the Whitefish River and two seep locations. Groundwater monitoring samples will be collected from select wells located in both the perched and deep aquifers to delineate groundwater impacts. Depth to water measurements will be recorded from all viable site monitoring wells to generate a potentiometric surface plot, groundwater flow direction, and gradient for each hydrologic unit. If present, any accumulations of light nonaqueous phase liquid (LNAPL) in the monitoring wells will be noted and its thickness documented. Groundwater samples will not be collected from any wells that contain a measurable thickness of LNAPL.

Monitoring well sampling will be conducted according to WCEC Standard Operating Procedures (SOPs) and MTDEQ Guidance for low-flow sampling using a peristaltic pump or bladder pump for purging and sample collection. Groundwater quality parameter data (conductivity, pH, salinity, dissolved oxygen, temperature, turbidity, and ORP) will be acquired from all site wells during each event during well purging using an inline flowthrough cell. Purge water will be managed according to the MTDEQ Guidance for Disposal of Untreated Purge Water from Monitoring Wells flow chart.

Groundwater sample collection from each well will be completed following stabilization of water quality parameters. Water quality parameters, purge volume, and stabilization data for each well will be recorded on WCEC's Well Sampling Form. A duplicate sample will be collected from the monitoring well MW4 for data validation purposes in compliance with DEQ Guidance. This sample will be labeled MWD.

All surface water and groundwater samples will be collected in the appropriate method-specific containers, placed on ice, and shipped to Energy Laboratories (Energy) in Helena, Montana for analysis of VPH.

WCEC will complete semiannual groundwater monitoring events for a period of one year. It is anticipated that the initial monitoring event will be conducted in October or November 2026 during low groundwater conditions at the facility, with the second semiannual event being conducted Spring 2027 during highwater conditions in May. Well sampling will be conducted using low flow sampling methodologies in accordance with MTDEQ requirements and WCEC SOPs. WCEC will use a peristaltic pump to purge and sample each of the shallow monitoring wells. Deep monitoring wells will be sampled using a bladder pump. Groundwater quality parameter data (conductivity, pH, salinity, dissolved oxygen, temperature, ORP, and turbidity) will be acquired from all site wells sampled during each event using a flow through cell. Groundwater sample collection from each well will be completed following stabilization of groundwater quality parameters. Static water levels, groundwater quality parameters, and purge rate for each well will be recorded in the field using WCEC's Well Sampling Form. Depth to water measurements will be used to calculate the potentiometric groundwater surface, flow direction, and gradient for each event. The Fall 2026 sampling and analytical

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analysis plan is outlined in the table below. If monitoring points discussed in section 3.3 cannot be redeveloped or repaired, then samples from these locations will not be collected.

Analytical Analysis Chart - Fall 2026						
Well Sample Location	VPH	EPH	EPH for PAHs	Lead Scavengers	IBI or Injection parameters	Depth to Water only
ASMW1	x					
ASMW2	x					
ASMW3	x					
ASMW4	x					
MW1						
MW4	x					
MW10						x
MW12	x					
MW13	x					
MW14						x
MW15	x					
MW18	x					
MW19						
MW21	x					
MW22	x					
MW24	x					
MW25	x					
MW26						x
MW27	x					
MW29	x					
MW31	x					
MWD	x					
Upstream	x					
Midstream	x					
Downstream	x					
Seep East	x					
Seep West	x					
Analysis Spring Event	22	0	0	0	0	3

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The 2027 Spring semiannual sampling event will be conducted as outlined in the table below. Monitoring points discussed in section 3.3 cannot be redeveloped or repaired will not be sampled.

Analytical Analysis Chart - Spring 2027						
Well Sample Location	VPH	EPH	EPH for PAHs	Lead Scavengers	IBI or Injection parameters	Depth to Water only
ASMW1	x					
ASMW2	x					
ASMW3	x					
ASMW4	x					
MW1						
MW4	x					
MW10						x
MW12	x					
MW13	x					
MW14						x
MW15	x					
MW18	x					
MW19						
MW21	x					
MW22	x					
MW24	x					
MW25	x					
MW26						x
MW27	x					
MW29	x					
MW31	x					
New shallow MW	x					
New deep well	x					
MWD	x					
Surface Water Locations						
Upstream	x					
Midstream	x					
Downstream	x					
Seep East	x					
Seep West	x					
Analysis Fall Event	24	0	0	0	0	3

3.3 Well Rehabilitation, Redevelopment, & Repair

Based on the findings of the initial inspection and events, WCEC recommends well repair and redevelopment be completed as outlined below:

- Redevelop MW4, MW12, MW13, MW14, MW24, I-3, I-8, I-12, I-17, and AS/SVE.
- Repair MW4, MW10, MW13, MW19, MW21, MW22, MW24, MW27, MW31, I-1, I-3, I-4, I-7, I-8, I-9, I-10, I-11, I-14, I-16, ASMW2, ASMW3, and SVE1.

Repairs to monitoring wells will include cutting down well casings that have heaved into the lids on the manholes. Well casings will be extended in areas that have been re-graded and are now completed substantially below grade. This will minimize water collection in manholes and better protect the wells from surface water intrusion. Additional manholes will need to be replaced due to natural deterioration caused by rusting. Multiple wells have rusted or had the bolt tabs broken off and can no longer be properly secured. Since it will be necessary to cut down or extend the casings on many of the wells listed above WCEC will coordinate and oversee elevation and geospatial surveys of all existing and additional monitoring wells by a licensed professional surveyor. This will be conducted following the installation of all new monitoring and system wells at the facility so that they can be included in this survey. WCEC will overlay the data obtained in the survey on the existing georeferenced orthophoto-based figures.

3.4 Monitoring Well, Air Sparge Well Installation, and Vapor Point Installation

The site hydrology consists of two distinct aquifers that are both impacted. The shallow aquifer at the current time does not have enough functional wells to calculate groundwater flow directions or gradient of this perched aquifer. This information is needed to effectively assess groundwater impacts and remedial options moving forward. No wells are currently installed in the deep aquifer near the north side of the fueling islands. It is unknown at the current time what groundwater impacts exist in this area of the facility in the deep aquifer. The level of impacts in this zone of the deep aquifer is needed to guide future remediation decisions at the facility. The recommended locations for the installation of these two wells (one in the shallow aquifer and one in the deep aquifer) are depicted in Figure 4.

The AS well, vapor points, and the new monitoring wells at the facility will all be installed during a single event. Soils from the AS and monitoring well borings will be field screened using a Rae Systems MiniRae™ 3000 photoionization detector (PID), as well as visual and olfactory evidence to determine which horizons may be impacted. The PID will be calibrated using fresh air and span gas calibration points. Isobutylene span gas at a concentration of 100 parts per million (ppm) will be used in the calibration procedure. Soil samples for on-site screening will be placed in plastic zip lock bags. Each bag will be one third filled with soil and sealed trapping volatile organic compounds in the headspace. Headspace development will be allowed to proceed for a minimum of 2 minutes; each bag will be shaken for 15 seconds before and after this period.

The PID probe will then be inserted into the head space of the bag to measure the hydrocarbon compounds that have volatilized into the contained head space. The maximum PID response over a 5 second period will be considered the result of this field screening technique. Soil boring will be completed at the approximate locations depicted on Figure 4. Boring locations will be adjusted to avoid utilities and facility infrastructure if required.

Each individual soil boring will be logged in the field using the Unified Soil Classification System (USCS). Field logs will include details of depth, soil recovery, USCS code, sample depth, and PID reading.

Soil sampling will be based on field screening results. If field screening exhibits hydrocarbon impacts in the perched aquifer zone (15-25 ft bgs) a sample will be collected from the soil horizon exhibiting the greatest PID reading. This protocol will also be applied to the deep aquifer zone (32-40 ft bgs). It is anticipated that 2 soil samples will be collected from each boring under this sampling protocol. If no hydrocarbon impacts are identified in the field screening process, one soil sample will be collected from the groundwater interface of the aquifer that the well is screened across for groundwater monitoring purposes.

Soil samples will be collected using WCEC Standard Operating Procedures (SOPs), and in accordance with MTDEQ requirements. Soil samples will be collected in pre-preserved vials with pre-weighed and measured volumes of methanol noted on the sample vials. A laboratory provided volumetric soil sampling syringe will be used to collect the soil from the soil boring core. If any methanol is lost during sampling from a spill, splash, etc. it will be discarded, and replacement sample will be collected. Following sample collection, samples will be packed on ice and shipped under chain of custody to Energy Laboratory, Inc. (Energy) in Helena, Montana. All soil samples will be analyzed for volatile petroleum hydrocarbons (VPH).

The monitoring wells will be installed using 4.25 inch I.D. hollow stem auger tooling. Monitoring wells installed in the shallow aquifer will be screened from 25 to 10 feet below ground surface (bgs) with solid riser extending from 10 feet bgs to near ground surface. The groundwater monitoring wells will be constructed using a 2-inch schedule 40 PVC riser and 0.010 slot PVC screen. The well annulus will be filled with 10/20 silica sand pack from the bottom of the boring to 6 inches above the screened interval, with the remainder of the boring annulus consisting of a bentonite seal. Monitoring wells installed in the deep aquifer will be screened from 50 to 35 feet below ground surface (bgs) with solid riser extending from 35 feet bgs to near ground surface. All new monitoring wells will be completed using 8-inch flush mount monuments set in concrete.

A pilot study AS well will be installed with using 4.25 I.D. hollow stem auger tooling. AS wells will be constructed with 2-inch PVC schedule 40 riser and 0.010 slot screen. Two feet of screen will be used in each well with the remainder being constructed with solid riser. Coated Bentonite chips will be used during the installation event to ensure that the seal is effective at depths below the groundwater table. AS wells will be installed in the deep aquifer with the top of screened installed 10 feet below the groundwater elevation at

the well location. Surface completions will be constructed with 12-inch flush mount monuments set in concrete to allow space for a gate valve at the well head.

Vapor monitoring points will be constructed using approximately 10 feet of screen that is installed with approximately 4 feet screen below the groundwater interface and 6 feet of screen above the groundwater interface. Silica sand will be placed from the bottom of the vapor point to approximately 6 inches above the screened interval. The annular space around the solid vapor point casing will then be sealed with hydrated granular bentonite from the top of the silica sand pack to the surface. These vapor points will be completed with 8-inch monuments placed in concrete.

Soil cuttings will be placed in steel 55 gallon open top drums with plastic liners for disposal at the Flathead County Class II Landfill in Kalispell, MT. Soils will be drummed and left on site until analytical results for disposal can be obtained. The Kalispell landfill requires that all drums be emptied of soil at the landfill and that drums are disposed of separately. This takes additional time in handling and disposal.

3.5 Air Sparge Technology and System Application

Air sparging is an in-situ remediation technology commonly applied at petroleum release sites. The technology involves injecting ambient air below the water table through specially designed wells. As air migrates upward, volatile petroleum constituents partition from groundwater and LNAPL adsorbed to soils into the air stream. The initial remediation benefit of air sparging is the physical removal of volatile petroleum hydrocarbons. Constituents such as benzene, toluene, ethylbenzene, xylenes (BTEX), and other volatile gasoline-range compounds readily partition into the injected air. As these constituents transfer from groundwater and saturated soils into the vapor phase, contaminant mass is removed from the subsurface. The highest rates of volatilization typically occur early in system operation when contaminant concentrations are greatest. Air sparging is therefore particularly effective at reducing source mass and dissolved-phase concentrations in areas with substantial impacts. These vapors can be captured using a soil vapor extraction (SVE) system to allow for controlled vapor extraction and discharge if vapor intrusion is anticipated in adjacent structures but is not required for the use of this technology.

An additional benefit of air sparging is the enhancement of aerobic biodegradation. Petroleum degradation is frequently limited by oxygen availability within groundwater. Air sparging introduces atmospheric oxygen directly into saturated soils and groundwater, substantially increasing dissolved oxygen concentrations. Elevated oxygen levels stimulate indigenous aerobic microorganisms capable of degrading gasoline and other petroleum hydrocarbons. Through microbial metabolism, petroleum hydrocarbons are converted into carbon dioxide, water, and microbial biomass. ITRC and USACE guidance recognize that biodegradation often becomes a significant treatment mechanism after initial volatilization rates decline. The increased oxygen availability can extend well beyond the immediate radius of influence, resulting in sustained biological treatment within the aquifer and downgradient of the active treatment zone.

The direct removal and enhancement of biodegradation in areas upgradient of the seep zone along the Whitefish River will protect this sensitive receptor by reducing contaminant concentrations in groundwater before they discharge through seeps and impact surface water. Smear zone mass reduction decreases the total hydrocarbon loading available for transport and enhanced aerobic biodegradation. This further remediates dissolved petroleum constituents as groundwater flows through the oxygenated treatment zones. The implementation of this technology will create a treatment area that functions as an active remediation barrier between the source area and the Whitefish River. As dissolved hydrocarbon concentrations decline, the mass flux reaching surface water will be reduced or eliminated, addressing risks to the aquatic ecosystems and minimizing the potential for surface water quality exceedances.

3.6 Air Sparge Pilot Study

During the pilot study air flow will be increased incrementally in stages from 1 standard cubic foot per minute (SCFM) to the maximum flow from the rotary vane compressor. This is anticipated to be between 5 and 7 SCFM depending on back pressure from subsurface lithology. It is anticipated that the system will be operated at approximately 3 SCFM per well during normal operation. This flow rate would demand approximately 30 SCFM from the system. Excessive flow rates need to be avoided to prevent the development of preferential air channels and the reduction of oxygen transfer efficiency. Minimum adequate flow to achieve the desired ROI limits groundwater mounding, vapor migration, and the potential of short circuiting of injected area to the vadose zone.

The AS pilot study well will be installed 10 feet from MW12 and 20 feet from MW15. Three additional soil vapor points will be installed at a radial distance of 5 feet, 15 feet and 25 feet from this sparge well. Static pressure at distance from the AS well will be recorded in the vapor points and monitoring wells during this pilot test. The soil pressures recorded during the AS pilot test will be used to calculate the radius of influence (ROI) that can be expected from AS system well enabling the design of a full scale system extending from the north side of the Town Pump Convince store to the embankment near the seep.

System equipment used during the pilot test will consist of one 1.5 horse power rotary vane compressor, an inline flow gauge, and valving that will allow adjustment of both pressure and flow to the well head. This pilot system will be directly manifolded to the wellhead throughout the pilot study period. The ROI will be calculated based on the pressure that is measured in wells at radial 5 foot distance from the AS pilot study well head.

3.7 Report Preparation

WCEC will prepare and submit a remedial investigation report following the completion of the AS pilot study and two semiannual sampling events. Laboratory analytical data will be validated using DEQ's Data Validation Summary Form, with an individual Form appended for each laboratory analytical report. This report will include a summary of the results and observations, data and analytical collected during monitoring and system installation, well abandonment, and the AS Pilot Study. An interim data submittal will be completed following the initial groundwater monitoring event to provide the most current data to DEQ to allow information dissemination to local the local government as requested by the Mayor of Whitefish and City Council.

Following receipt of groundwater monitoring analytical, WCEC will prepare and submit a Remedial Investigation Pilot Study Report detailing the results of all sampling completed during the groundwater monitoring events and AS pilot study. The report will follow the MTDEQ PTCS guidance and include:

- a. Presentation and discussion of all soil and groundwater data collected prior to and during the completion of the pilot study.
- b. Detailed discussion and evaluation of the AS Pilot study.
- c. Monitoring and system well installation logs
- d. Presentation of 2-dimensional and 3-dimensional conceptual site models that depict LNAPL and petroleum constituent distribution within various environmental media, lithologic conditions, hydrologic conditions, site features, and receptors. This site model will be used in the generation of future RCPs.
- e. Recommendations for additional remedial actions and discussion of the potential for implementation and design of an AS system for continued remediation at the facility.

The report will include well logs, figures depicting historic, current, and planned site features, cumulative data tables for soil and groundwater. The Release Closure Plan (RCP) will be updated to include data collected during the additional investigation and a thorough evaluation and discussion regarding the remedial investigation with recommendations for further corrective actions which will be presented in the RCP and Remedial Activities Report.

3.8 Cost Estimates

The scope of work outlined in this work plan is tentatively scheduled to begin in October/November 2026, pending approval from the MTDEQ. The attached *Estimated Remedial Actions Costs* spreadsheet and *PTRCB Groundwater Sampling & Unit Cost Worksheet* detail anticipated project costs for completion of this corrective action plan.

4.0 References

Olympus Technical Services, Inc (Olympus, 2019). *LIF Geoprobe Investigation, Groundwater Monitoring, and Remedial Alternatives Analysis Report*. May 23, 2019

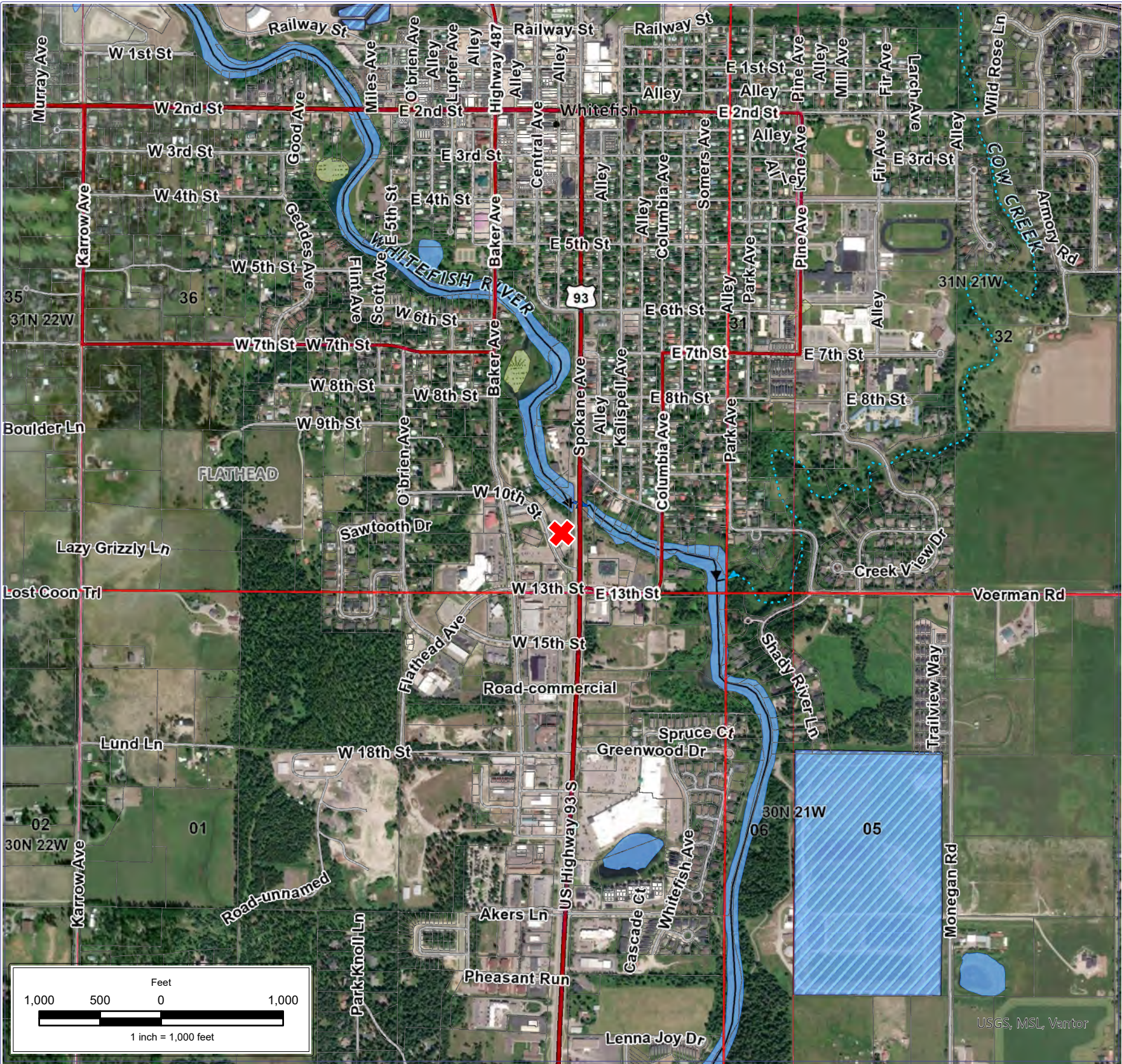
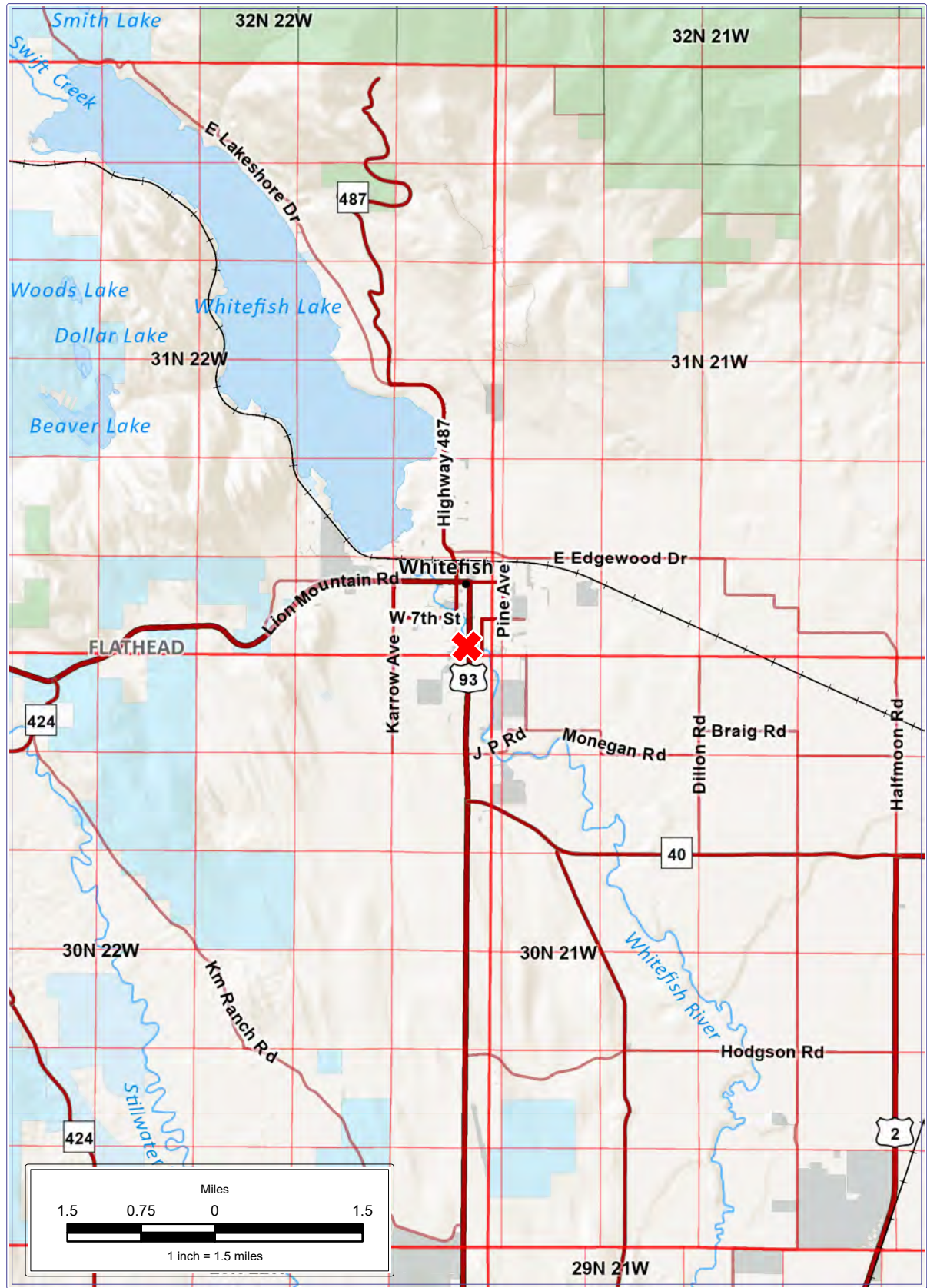
List of Figures

Figure 1: Site Location Map

Figure 2: Site Details Map

Figure 3: Existing Well Locations

Figure 4: Proposed Monitoring Well, Air Sparge Well & Vapor Points



✗ Site Location



Site Location

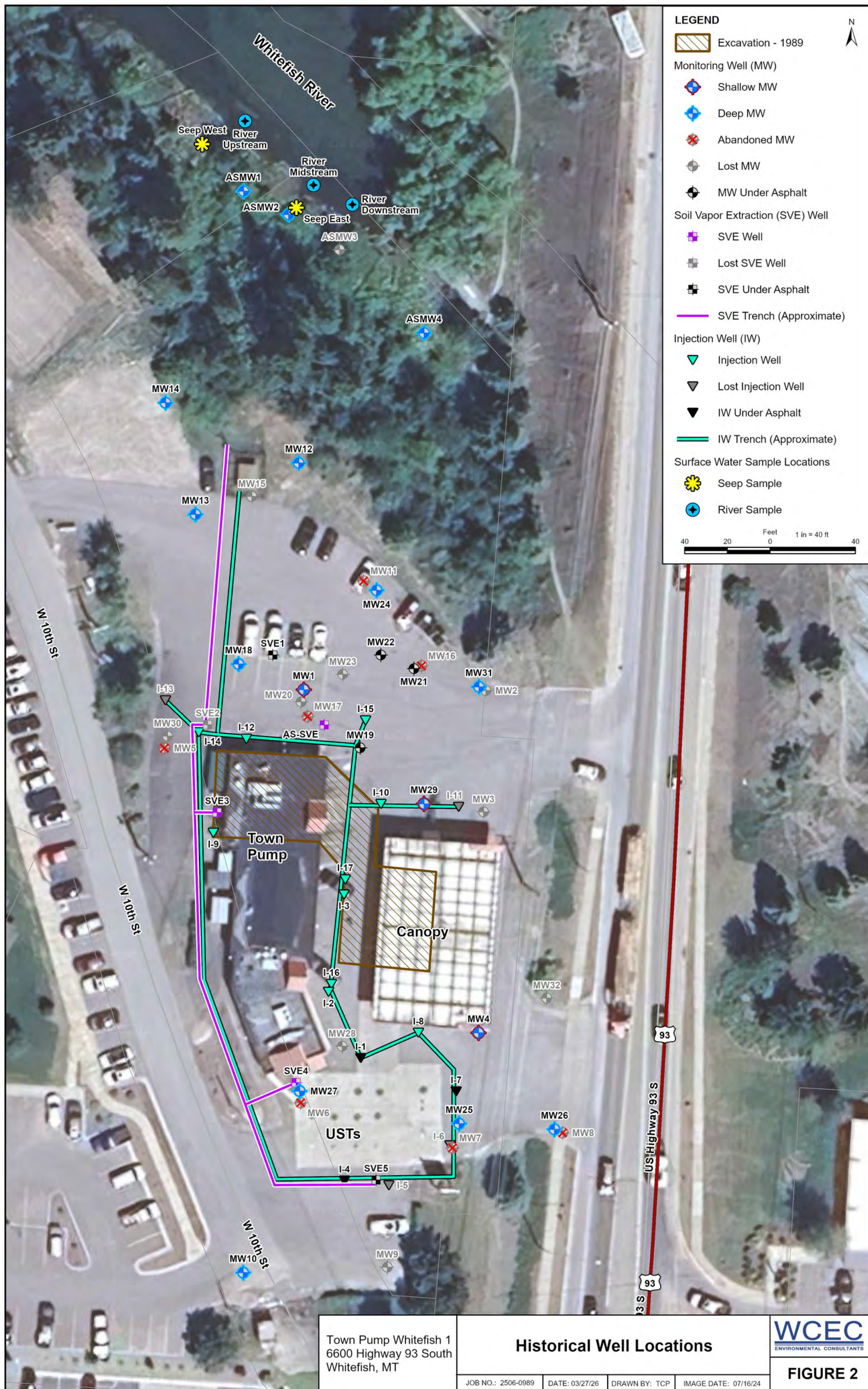
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Whitefish, MT

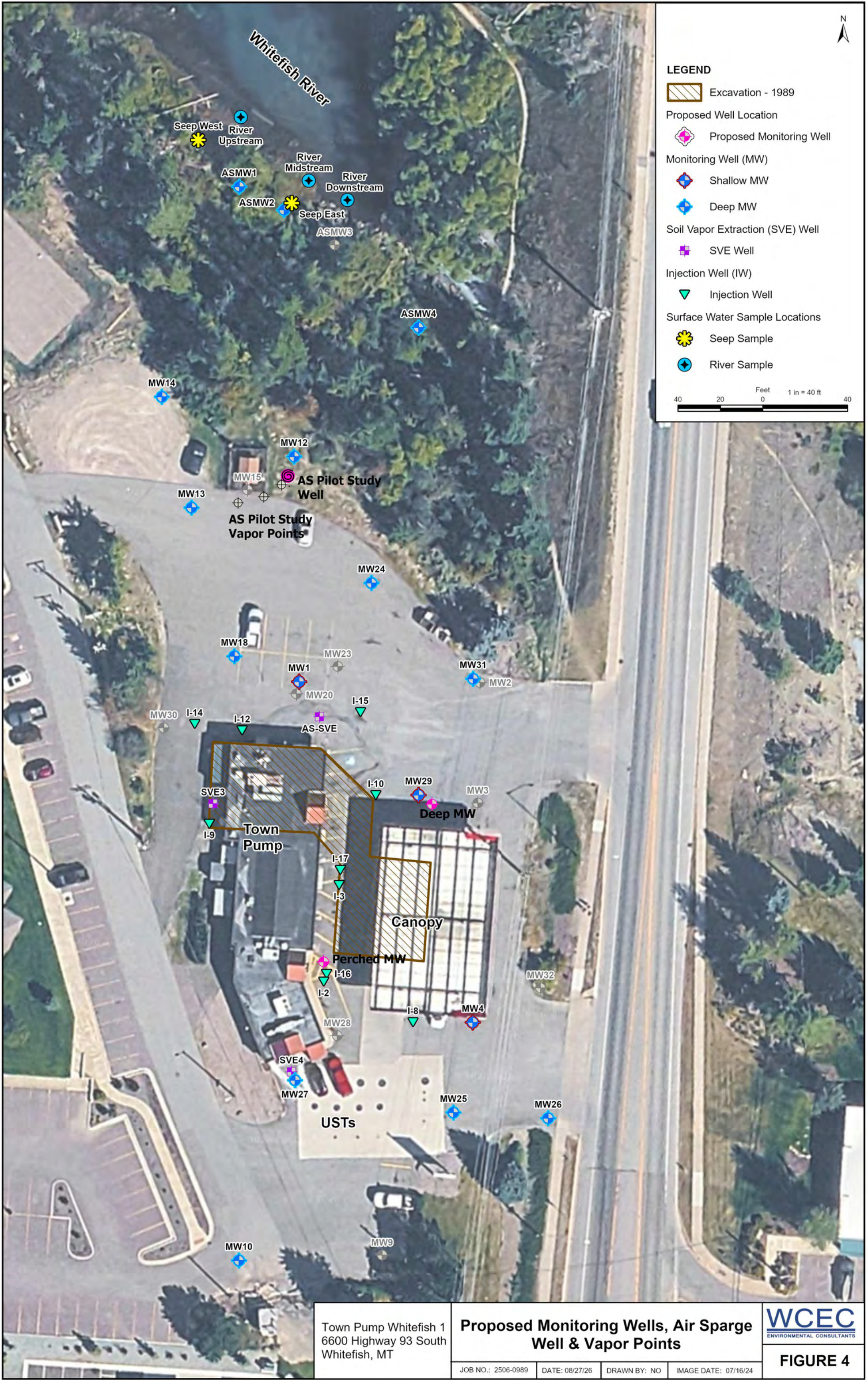
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DATE: 07/14/25
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PROJECT NUMBER: 2506-0989 IMAGE SOURCE: ESRI BASEMAPS

FIGURE 1





Cost Estimates

Corrective Action Plan 35156 & 35157 Estimated Costs