Final Groundwater Monitoring Report

Former Port Heiden Radio Relay Station
Port Heiden, Alaska

Prepared for

611th Civil Engineer Squadron

March 2012

Prepared by

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March 2012

The following information is provided in compliance with *Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites*, prepared by the Alaska Department of Environmental Conservation, September 23, 2009.

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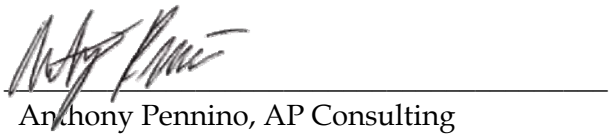

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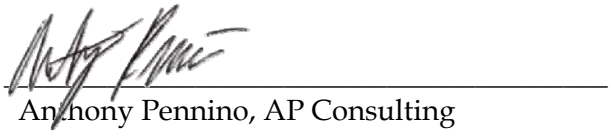
Qualified persons responsible for data reporting:



Anthony Pennino, AP Consulting

Site name:	Former Port Heiden Radio Relay Station
ADEC file number:	2637.38.002

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Abbreviations

µg/L	micrograms per liter
611 CES	611th Civil Engineer Squadron
AAC	*Alaska Administrative Code*
ADEC	Alaska Department of Environmental Conservation
Adminrec	Administrative Record
AOC	area of concern
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CA	cooperative agreement
COC	contaminant of concern
DCE	dichloroethene
DMC	DMC Technologies, Inc.
DO	dissolved oxygen
DOD	Department of Defense
DRO	diesel-range organic
°F	degrees Fahrenheit
GAC	granular activated carbon
GRO	gasoline-range organic
GWMR	groundwater monitoring report
mg/L	milligrams per liter
ND	not detected above specified detection limits
NAPL	non-aqueous phase liquids
NVPH	Native Village of Port Heiden
PCB	polychlorinated biphenyls
POL	petroleum, oils, and lubricants
PQL	practical quantitation limit
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RI/FS	remedial investigation/feasibility study
RRO	residual-range organic
RRS	radio relay station
TAH	total aromatic hydrocarbons

TAqH	total aqueous hydrocarbons
TCE	trichloroethylene
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
VC	vinyl chloride
VOA	volatile organic analysis
VOC	volatile organic compound

1.0 Introduction

The Native Village of Port Heiden (NVPH) and Boretide Consulting have developed this Groundwater Monitoring Report (GWMR). It summarizes groundwater monitoring results and activities that were conducted at the Former Port Heiden Radio Relay Station (RRS) during the 2011 field season. This GWMR details investigation activities that relate to groundwater; site soil investigation activities are summarized separately. Soil sampling results and a soil excavation summary will be presented in the *Site Characterization Report, Former Port Heiden Radio Relay Station, Port Heiden, Alaska,* which will be prepared later in 2012. Port Heiden is located 424 miles southwest of Anchorage, Alaska (Figure 1).

The groundwater monitoring activities discussed in this GWMR adhered to sampling and analysis requirements defined in Chapter 18, Section 75.355, of the *Alaska Administrative Code* (18 AAC 75.355). The contents of this GWMR meet applicable reporting requirements identified in 18 AAC 75.335. Field activities were conducted in accordance with the *Final Port Heiden RRS Remediation Work Plan* (NVPH, 2010b). Changes to the Work Plan are discussed in more detail in Section 3.3. Qualified persons, as defined in 18 AAC 75.990(100), were responsible for all sampling and reporting summarized herein. Thor Kallestad and Anthony Pennino, who are both qualified persons, where responsible for the groundwater sampling and the reporting, respectively.

The groundwater investigation project has its origins in the US Army Engineer Alaska District Cooperative Agreement (CA) "Remediate Former Port Heiden RRS." The scope of work for this project was derived from two CAs, Numbers 11AF-09-0100 and 11AF-10-0100. In keeping with the spirit of the CAs, mentoring has been a large part of this project. Boretide Consulting has been retained by the NVPH to provide advisory services and empower the local community to perform as much of the project work as possible. It is anticipated that within the next few years, several members of the NVPH will have become proficient with relevant regulations, hazardous material shipments, sampling techniques, surveying, remediation, reporting, and project controls required for similar projects. Thereafter, the NVPH and Boretide Consulting anticipate that outside contractor involvement will be minimized and the skills required to conduct similar projects will exist locally within the community of Port Heiden.

FIGURE 1
Port Heiden Location and Project Site Aerial View

1.1 Project Objectives

2011 was the second of a 3-year effort under the CA to delineate, define, and remove hazardous materials from the Former Port Heiden RRS. In 2010, the NVPH adopted a three-pronged approach for investigation of the Former RRS. The first strategy was to digest the previous site work performed, identify existing data gaps, and collect missing site information.

In its second strategy, the NVPH began excavation, removal, and off-site disposal of known site soils contaminated with polychlorinated biphenyls (PCBs). Additional soil delineation occurred during these 2010 and 2011 excavation activities. A summary of results related to the first two strategies is presented under separate cover in the *Site Characterization Report, Former Port Heiden Radio Relay Station, Port Heiden, Alaska* (NVPH, 2011d) and will also be presented in future reports.

The third NVPH strategy in 2010 and 2011 was to define the current nature and extent of groundwater contamination at select locations in the vicinity of the Former Port Heiden RRS. The 2011 groundwater sampling results, along with the previous results from 2010, are summarized in this GWMR.

1.2 Document Organization

This GWMR consists of the following six sections.

- **Section 1** provides the introduction and summarizes the GWMR organization.
- **Section 2** provides the project background. A description of the Former Port Heiden RRS and the local environmental setting is also provided.
- **Section 3** describes the field activities. Documentation, screening, sampling, and surveying methodologies are presented.
- **Section 4** presents the sampling and delineation results for three distinct groundwater plume locations in the Port Heiden vicinity. Additionally, natural attenuation results for trichloroethylene (TCE) plume at the Former RRS are interpreted and subsurface soil sampling is summarized
- **Section 5** provides a summary of the project. Recommendations for the three groundwater monitoring locations are presented.
- **Section 6** provides reference information for all works cited.

This draft GWMR will be revised and finalized during the review process. All revisions are subject to NVPH, the United States Air Force (USAF) 611th Civil Engineer Squadron (611 CES), United States Army Corps of Engineers (USACE), and Alaska Department of Environmental Conservation (ADEC) approval.

2.0 Project Background

Three groundwater areas of concern (AOCs) are under investigation in the Port Heiden vicinity:

- Former Port Heiden RRS area
- FPC-066 area
- FPC-215 area

As discussed in Section 4, the Former Port Heiden RRS area has two distinct plumes: one petroleum, oils, and lubricants (POL) plume and one TCE plume. FPC-215 has only a POL plume. FPC-066 also has only a POL plume. The locations of these three groundwater AOCs are shown in Figure 2.

2.1 Previous Investigations

The Department of Defense (DOD) has arranged for an Administrative Record (Adminrec) to be posted online. The Adminrec summarizes various Environmental Restoration projects conducted under DOD oversight. The Adminrec website identifying 611 CES projects in Alaska is listed below:

http://www.adminrec.com/PACAF.asp?Location=Alaska

At this website, the user can select the "Port Heiden" link for access to a list of historical Former Port Heiden RRS documents. Note that not all of the historical Port Heiden RRS documents are available at this link.

The most recent groundwater sampling activities that occurred at the three Port Heiden AOCs summarized in this GWMR occurred in three parts during 2004, 2009, and 2010. In 2004, Weston Solutions on behalf of the 611 CES conducted a detailed Remedial Investigation/Feasibility Study (RI/FS). Field sampling results and an extensive interpretation of the associated data were subsequently presented in the *Final Remedial Investigation/Feasibility Study, Port Heiden Radio Relay Station, Port Heiden, Alaska* (Weston Solutions, 2006). This RI/FS is the primary source of historical data for groundwater conditions in the region.

A second source of historical groundwater information is the *Final 2009 Groundwater Investigation, Former Pipeline Corridor Report, Port Heiden, Alaska* (DMC Technologies, Inc. [DMC], 2010). Groundwater sampling efforts conducted at FPC-066 and FPC-215 in 2009 are summarized in this document.

A third source of historical groundwater information is the *Final Groundwater Monitoring Report, Former Port Heiden Radio Relay Station, Port Heiden, Alaska* (NVPH, 2011a). Three groundwater areas were sampled during this sampling event:

- Former Port Heiden RRS area
- FPC-066 area
- FPC-215 area

Results from this sampling effort are presented in this report and compared to the 2011 sampling event.

Information presented in this GWMR includes sampling results and historical data from the RI/FS and the DMC document to provide the reader with an accurate, current, and complete summary of site conditions at the three groundwater AOCs.

2.2 Regional Environmental Setting

The Former Port Heiden RRS is situated on a low glacial moraine at an elevation of 95 feet above mean sea level. The topography of the site slopes gently to the west and southwest. Additional information about the environmental setting at Port Heiden is presented below. Much of this information is excerpted from the State of Alaska, Division of Community and Regional Affairs, on the Port Heiden page at the link below:

http://www.commerce.state.ak.us/dca/commdb/CF_BLOCK.htm

2.2.1 Location

Port Heiden is 424 miles southwest of Anchorage, at the mouth of the Meshik River, on the north side of the Alaska Peninsula. The community lies near the Aniakchak National Preserve and Monument. Its location is approximately 56.948390 North Latitude and -158.629020 West Longitude (Section 27, T037S, R059W, Seward Meridian.) Port Heiden is in the Kvichak Recording District. The area encompasses 50.7 square miles of land and 0.7 square mile of water.

2.2.2 History

The old village of Meshik was located at the current site of Port Heiden. Influenza epidemics during the early 1900s forced residents to relocate to other villages. During World War II, Fort Morrow was built nearby and 5,000 personnel were stationed at the base. The fort was closed after the war. A school was established in the early 1950s, which attracted people from surrounding villages. Port Heiden incorporated as a city in 1972. The

FIGURE 2
Port Heiden RRS Areas of Concern, Groundwater

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community relocated inland, because storm waves had eroded much of the old town site and threatened to destroy community buildings (State of Alaska, 2010).

2.2.3 Culture

Port Heiden is a traditional Alutiiq community, with a commercial fishing and subsistence lifestyle (State of Alaska, 2010).

2.2.4 Economy

Commercial fishing and government jobs provide the majority of cash income. In 2009, 12 residents held commercial fishing permits. Subsistence harvests of salmon, other fish, and marine mammals average 109 pounds per person. Game, birds, plants, and berries are also an important part of villagers' diets (State of Alaska, 2010).

2.2.5 Facilities

Individual domestic wells and septic tank systems are used by most homes in Port Heiden. The school operates its own domestic well and treatment system. Thirty-one of 37 occupied households are fully plumbed. The city provides septic pumping services and collects refuse three times a week. The permitted Class III Landfill is located 6.5 miles northeast of the community (State of Alaska, 2010). Note that no drinking water wells are located in the vicinity of any of the three groundwater investigation sites mentioned in this report.

2.2.6 Transportation

The state-owned airport consists of a 5,000-foot-long by 100-foot-wide, lighted, gravel runway and a 4,000-foot-long by 100-foot-wide, lighted, gravel crosswind runway. The airport can accommodate aircraft as large as a Boeing 737 aircraft, and regular air services are provided. The airstrip serves as a point of transfer for flights to the Pacific Ocean side of the Alaska Peninsula. There is a natural boat harbor but no dock. A boat haul-out, a beach off-loading area, and marine storage facilities are available. Cargo from Seattle is periodically delivered by chartered barge and is lightered and offloaded on the beach. Automobiles, all-terrain vehicles, and snow machines are the local means of transportation (State of Alaska, 2010).

2.2.7 Climate

Port Heiden has a maritime climate, with cool summers, relatively warm winters, and rain. Snowfall averages 58 inches per year. January temperatures average 25 degrees Fahrenheit (°F), and July temperatures average 50°F (State of Alaska, 2010).

3.0 Field Activities

Select groundwater monitoring wells at all three groundwater AOCs under investigation were purged and sampled in 2011. All fieldwork was conducted in accordance with the *Final Groundwater Monitoring Work Plan, Former Port Heiden Radio Relay Station, Port Heiden, Alaska* (NVPH, 2011b). Associated groundwater sampling results for the three AOCs are presented in Section 4.

3.1 Field Documentation

All notes collected during field activities were entered in the project logbook. The portions of the logbook that were associated with the field events described in this report are presented in Appendix B, which is provided as an electronic attachment.

3.2 Groundwater Field Screening

Monitoring wells were purged with low-flow methods before sampling. Static water levels were measured before purging in wells that produced adequate water. At least four well casing volumes of water were screened and removed from each of these wells before sample collection.

For wells that produced adequate water, water quality parameters were considered stable when four successive readings, collected from 3 to 5 minutes apart, indicated the following:

- ± 3% for temperature (minimum of ± 0.2°Celsius)
- ± 0.1 for pH
- ± 3% for conductivity
- ± 10 millivolts for oxidation reduction potential
- ± 10% for dissolved oxygen (DO)
- ± 10% for turbidity

After the removal of each well casing volume, the water temperature, pH, conductivity, DO, and turbidity were measured. The well was sampled after four volumes were removed and the above parameters were within tolerances described in the bulleted list above. All groundwater field screening was conducted according to the Quality Assurance Project Plan (QAPP), Appendix A, of the *Final Port Heiden RRS Remediation Work Plan* (NVPH, 2010b).

3.3 Groundwater Sampling

Groundwater wells were sampled in 2011 in a sequence that reflected clean to dirty. On the basis of 2010 groundwater data, well sampling began with upgradient wells with low contaminant concentrations. Distant downgradient wells that also had low contaminant concentrations were the second batch of wells sampled. The final batch for sampling consisted of those wells suspected to be in the heart of plumes with elevated contaminant concentrations.

The first sampling/purge activity performed at each monitoring well was collection of the depth measurement to static water level below the top of the well casing. No floating non-aqueous phase liquid (NAPL) was encountered in any wells sampled in 2011. At each of the three AOCs, a duplicate sample was collected for each analyte at a 1-to-10 ratio. Groundwater sampling methodologies used during the 2011 monitoring event were driven by guidance presented in the *Draft ADEC Field Sampling Guidance* (ADEC, 2010). All wells were sampled with dedicated bailers.

Although the 2011 Work Plan (NVPH, 2011b) stated that low-flow sampling methods would be used to collect groundwater samples, disposable bailers were used during the 2011 groundwater sampling event. In future groundwater sampling events, in accordance with *Draft Field Sampling Guidance* (ADEC, 2010), one of the following sampling methods will be used: bladder pumps, positive pressure submersible pumps, gear pumps, or other ADEC approved sampling methods. The appropriate sampling method will be chosen based on various site conditions, such as depth to groundwater and noted recharge rates.

3.3.1 Former RRS Groundwater Monitoring Wells

Once groundwater parameters had stabilized or the well was purged dry, well sampling commenced. Groundwater wells at the Former Port Heiden RRS were sampled for a variety of POL, chlorinated solvents, and natural attenuation analytes. Sampling requirements defined in the *Final Port Heiden RRS Remediation Work Plan* (NVPH, 2010b) guided analyte selection. Sample jars were filled in the following sequence:

- Volatile organic analysis (VOA)
- Extractable organics (semivolatiles, pesticides, herbicides, dioxins)
- Anions, cations (CN^-, SO_4^{-2}, Cl^-, NO_3^{-2}, NH_4^{+2})
- Metals (total and dissolved)

VOA jar headspace was avoided by filling the jar until a positive meniscus existed. The VOA bottle was then capped, turned upside down, and tapped gently to ensure there was no entrapped air. Containers were quickly and adequately sealed. Container rims and

threads were also cleaned before lids were tightened. Sample containers were then labeled, the information was entered into the project database, and the containers were prepared for shipment to the laboratory. Groundwater samples were collected in accordance with protocol presented in the *Draft ADEC Field Sampling Guidance* (ADEC, 2010).

3.3.2 FPC-066 Groundwater Monitoring Wells

Four monitoring wells were sampled at the FPC-066 AOC in 2011. Because the historical source of contamination at this location was a diesel spill, each well was analyzed for diesel-range organics (DRO).

The risers in each well were completed with 1.5-inch polyvinyl chloride (PVC) whereas the wells at the Former Port Heiden RRS were all completed with 2-inch PVC risers.

3.3.3 FPC-215 Groundwater Monitoring Wells

Three monitoring wells were sampled at the FPC-215 AOC in 2011. Each well was analyzed for benzene, toluene, ethylbenzene, and total xylenes (BTEX) and for DRO.

As was the case at FPC-066, the risers in each well were completed with 1.5-inch PVC.

4.0 Groundwater Sampling Results

Sampling and excavation results for the three groundwater AOCs where fieldwork was conducted at the Former Port Heiden RRS in 2011 are summarized below. SGS Analytical performed all laboratory analyses referenced in this GWMR.

Several groundwater contaminants of concern (COCs) were identified in the *Record of Decision for the Port Heiden Radio Relay Station, Port Heiden, Alaska* (USAF 611 CES, 2009). Several additional contaminants have been detected at concentrations that exceed applicable cleanup criteria in 18 AAC 75.345, Table C. These analytes and compounds and the associated Table C cleanup levels are listed below:

- Gasoline-range organics (GRO): 2.2 milligrams per liter (mg/L)
- DRO: 1.5 mg/L
- Residual-range organics (RRO): 1.1 mg/L
- Benzene: 0.005 mg/L
- TCE: 0.005 mg/L
- Cis-1,2-dichloroethene (DCE): 70 micrograms per liter (µg/L)
- Trans-1,2-DCE: 100 µg/L
- Vinyl chloride (VC): 2 µg/L

Determining statistical trends for the historical groundwater sampling events for the three groundwater AOCs is difficult because of the low number of sampling events and the years between sampling events. In addition to any natural attenuation/dechlorination, many other processes and factors may affect concentrations. Possible effects include differences in sampling methodologies, seasonal changes in groundwater levels, and changes in analytical methods during the years. These potential effects will be investigated and discussed in future groundwater sampling reports.

The laboratory analytical data are presented in Appendix C, and the ADEC Laboratory Quality Control Forms are presented in Appendix D. Both appendixes are provided as electronic deliverables.

4.1 Former Port Heiden RRS Contaminant Results

Select groundwater monitoring wells at the Former RRS were sampled in 2011 for volatile organic compounds (VOCs), various POL compounds, and natural attenuation analytes. Table 1 identifies those wells and provides a sampling summary.

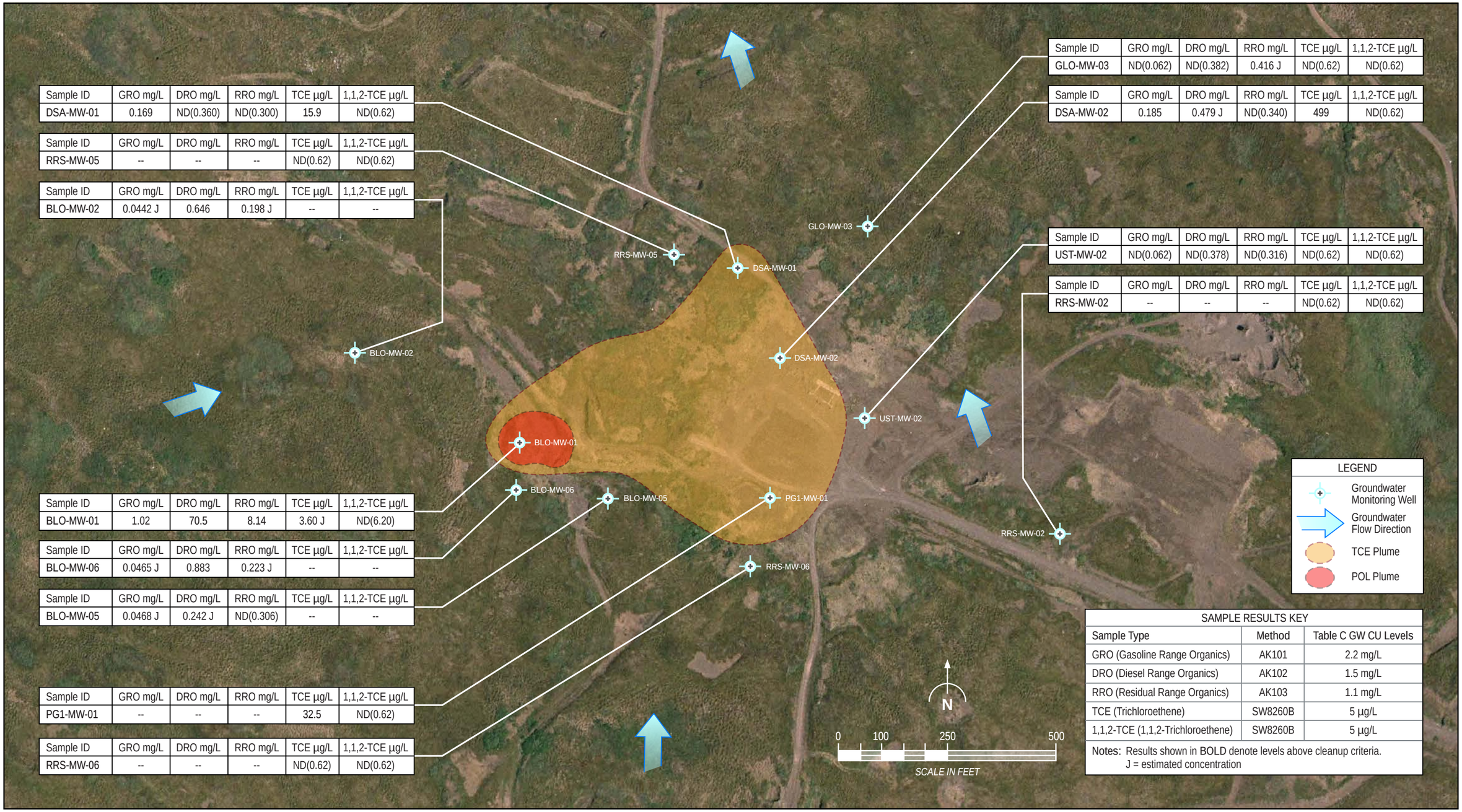
Table 1

2011 Groundwater Sampling Summary for Former Port Heiden RRS

Well ID	GRO	VOC	Natural Attenuation Suite	DRO	RRO
GLO-MW-03		1			
DSA-MW-02	1	1	1	1	1
UST-MW-02	1	1		1	1
DSA-MW-01		1	1		
DSA-MW-02	1	1	1	1	1
RRS-MW-05		1	1		
RRS-MW-06		1	1		
PG1-MW-01		1	1		
BLO-MW-01	1	1		1	1
BLO-MW-02		1			
BLO-MW-05		1			
BLO-MW-06	1	1		1	1

Historical analytical data collected during October 2004 sampling for the RI/FS and the 2010 sampling event are available for several monitoring wells sampled during 2011 field activities. These results are shown in Table 2. Note also that monitoring wells DSA-MW-03 and RRS-MW-04 are damaged and are no longer able to be sampled.

Groundwater monitoring results for VOC and POL samples collected during the 2011 groundwater monitoring event are shown in Figure 3. The inferred boundaries of the existing POL and TCE plumes in the Former Port Heiden RRS are also shown in this figure. Note that none of the daughter products for TCE (cis-1,2-DCE, trans-1,2-DCE, and VC) were detected in any groundwater samples.



Sample ID	GRO mg/L	DRO mg/L	RRO mg/L	TCE µg/L	1,1,2-TCE µg/L
DSA-MW-01	0.169	ND(0.360)	ND(0.300)	15.9	ND(0.62)

Sample ID	GRO mg/L	DRO mg/L	RRO mg/L	TCE µg/L	1,1,2-TCE µg/L
RRS-MW-05	--	--	--	ND(0.62)	ND(0.62)

Sample ID	GRO mg/L	DRO mg/L	RRO mg/L	TCE µg/L	1,1,2-TCE µg/L
BLO-MW-02	0.0442 J	0.646	0.198 J	--	--

Sample ID	GRO mg/L	DRO mg/L	RRO mg/L	TCE µg/L	1,1,2-TCE µg/L
BLO-MW-01	1.02	70.5	8.14	3.60 J	ND(6.20)

Sample ID	GRO mg/L	DRO mg/L	RRO mg/L	TCE µg/L	1,1,2-TCE µg/L
BLO-MW-06	0.0465 J	0.883	0.223 J	--	--

Sample ID	GRO mg/L	DRO mg/L	RRO mg/L	TCE µg/L	1,1,2-TCE µg/L
BLO-MW-05	0.0468 J	0.242 J	ND(0.306)	--	--

Sample ID	GRO mg/L	DRO mg/L	RRO mg/L	TCE µg/L	1,1,2-TCE µg/L
PG1-MW-01	--	--	--	32.5	ND(0.62)

Sample ID	GRO mg/L	DRO mg/L	RRO mg/L	TCE µg/L	1,1,2-TCE µg/L
RRS-MW-06	--	--	--	ND(0.62)	ND(0.62)

Sample ID	GRO mg/L	DRO mg/L	RRO mg/L	TCE µg/L	1,1,2-TCE µg/L
GLO-MW-03	ND(0.062)	ND(0.382)	0.416 J	ND(0.62)	ND(0.62)

Sample ID	GRO mg/L	DRO mg/L	RRO mg/L	TCE µg/L	1,1,2-TCE µg/L
DSA-MW-02	0.185	0.479 J	ND(0.340)	499	ND(0.62)

Sample ID	GRO mg/L	DRO mg/L	RRO mg/L	TCE µg/L	1,1,2-TCE µg/L
UST-MW-02	ND(0.062)	ND(0.378)	ND(0.316)	ND(0.62)	ND(0.62)

Sample ID	GRO mg/L	DRO mg/L	RRO mg/L	TCE µg/L	1,1,2-TCE µg/L
RRS-MW-02	--	--	--	ND(0.62)	ND(0.62)

LEGEND

- Groundwater Monitoring Well
- Groundwater Flow Direction
- TCE Plume
- POL Plume

SAMPLE RESULTS KEY

Sample Type	Method	Table C GW CU Levels
GRO (Gasoline Range Organics)	AK101	2.2 mg/L
DRO (Diesel Range Organics)	AK102	1.5 mg/L
RRO (Residual Range Organics)	AK103	1.1 mg/L
TCE (Trichloroethene)	SW8260B	5 µg/L
1,1,2-TCE (1,1,2-Trichloroethene)	SW8260B	5 µg/L

Notes: Results shown in **BOLD** denote levels above cleanup criteria.
J = estimated concentration

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FIGURE 3
Former Port Heiden RRS Groundwater Monitoring Sample Results

Table 2

2011 Groundwater Sampling Results for Former Port Heiden RRS

Analyte:	***TCE***	***GRO***	***DRO***	***RRO***
Groundwater Cleanup Level:[a]	***0.005***	***2.2***	***1.5***	***1.1***
BLO-MW-01	0.0036 J	1.02	**70.5**	**8.14**
DSA-MW-01	**0.0159**	0.169	ND (0.36)	ND (0.3)
DSA-MW-02	**0.499**	0.185	0.479 J	ND (0.34)
GLO-MW-03	ND (0.0006)	ND (0.062)	ND (0.382)	0.416 J
PG1-MW-01	**0.0325**	NA	NA	NA
RRS-MW-02	ND (0.0006)	NA	NA	NA
RRS-MW-05	ND (0.0006)	NA	NA	NA
RRS-MW-06	ND (0.0006)	NA	NA	NA
UST-MW-02	ND (0.0006)	ND (0.062)	ND (0.378)	ND (0.316)

Notes:

All concentration units are mg/L.

Bold text in result columns indicates concentration is above cleanup criteria.

[a] From Table C, 18 AAC 75.345

J: Analyte positively identified but quantitation is an estimate

NA: Not analyzed

ND: Not detected above specified detection limit

4.1.1 Former Port Heiden RRS Natural Attenuation Results

The primary guide for evaluating the performance of natural attenuation progress in the groundwater beneath the Former Port Heiden RRS is the United States Environmental Protection Agency (USEPA) document titled *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* (1998). According to this document and accepted industry knowledge, the most important process for the natural biodegradation of chlorinated solvents is reductive dechlorination. During this process, the chlorinated hydrocarbon compound is used as an electron acceptor, not as a source of carbon, and a chlorine atom is removed and replaced with a hydrogen atom. In general, reductive dechlorination occurs by sequential dechlorination from tetrachloroethene to TCE to DCE isomers to VC to ethene.

TCE is reductively dechlorinated under anaerobic conditions. In simple terms, microorganisms "breathe" the chlorinated solvent (use it as a terminal electron acceptor in place of oxygen) while "eating" other organics. Hydrogen is actually the electron donor. It is produced from organic substrates. Competition between the various electron acceptors for available hydrogen occurs in the aquifer. If oxygen is present, it neutralizes the hydrogen and inhibits reduction of all other electron acceptors. Nitrate and sulfate also

inhibit the reduction of all other electron acceptors. Hence, elevated concentrations of dissolved oxygen, nitrate, and sulfate retard reductive dechlorination.

The demonstration of natural attenuation as a viable remediation alternative involves a "weight of evidence" approach to show that it can be relied upon for protection of human health and the environment. In this approach, more than one method is used to generate data that document the occurrence and quantify the rates of attenuation. Typically, three lines of evidence can be used to demonstrate natural attenuation:

1. **Documented Loss of Contaminants at the Field Scale.** This documentation includes the results of analyzing historical trends for site contaminants to determine whether a reduction in the total mass of contaminants is occurring. Tracers can be used to correct observed concentrations for dispersion, sorption, and other abiotic means of contaminant attenuation.

2. **Contaminant and Geochemical Analytical Data.** These data include the results of evaluating geochemical indicator concentrations that are expected to change in a plume because of microbial activity, and identifying the biodegradation pathways that are occurring at the site.

3. **Direct Microbial Evidence.** This evidence includes information descriptions of sampling and identifying the types of microorganisms present that are hydrocarbon degraders or demonstrating biodegradation through laboratory microcosm studies.

The first two options provide the optimal methods to track attenuation effectiveness and associated degradation rates in groundwater at the Former Port Heiden RRS. At this time, the third option of actively studying the specific, local microbial colonies is premature.

To support the first option for line of evidence, the observed loss of contaminants at the field scale, the main data available for comparison are those for TCE in 2004, 2010, and 2011. Table 3 summarizes the TCE results for Former RRS monitoring wells that were sampled in those years. A cursory evaluation of this data indicates a slight overall statistical decrease in TCE concentrations. However, with additional sampling events, the number of years and quantity of wells to compare will increase. In turn, the credibility of future contaminant mass calculations and trend projections will significantly improve.

Table 3

Comparison of TCE Results from 2004, 2010, and 2011 for Former Port Heiden RRS

Analyte:	***TCE-2004***	***TCE-2010***	***TCE-2011***
Groundwater Cleanup Level:[a]	***0.005***	***0.005***	***0.005***
BLO-MW-01	**0.0056**	ND (0.02)[b]	ND (0.0036)
DSA-MW-01	**0.017**	**0.0117**	**0.00159**
DSA-MW-02	**0.69 J**	**0.508**	**0.499**
DSA-MW-03	**0.066**	**0.317**	**NS**
PG1-MW-01	**0.0078**	**0.0423**	**0.0325**

Notes:

All concentration units are mg/L.

Bold text in result columns indicates concentration is above cleanup criteria.

[a] From Table C, 18 AAC 75.345

[b] Note that detection limit of 20 micrograms per liter (µg/L) is higher than cleanup level of 5 µg/L

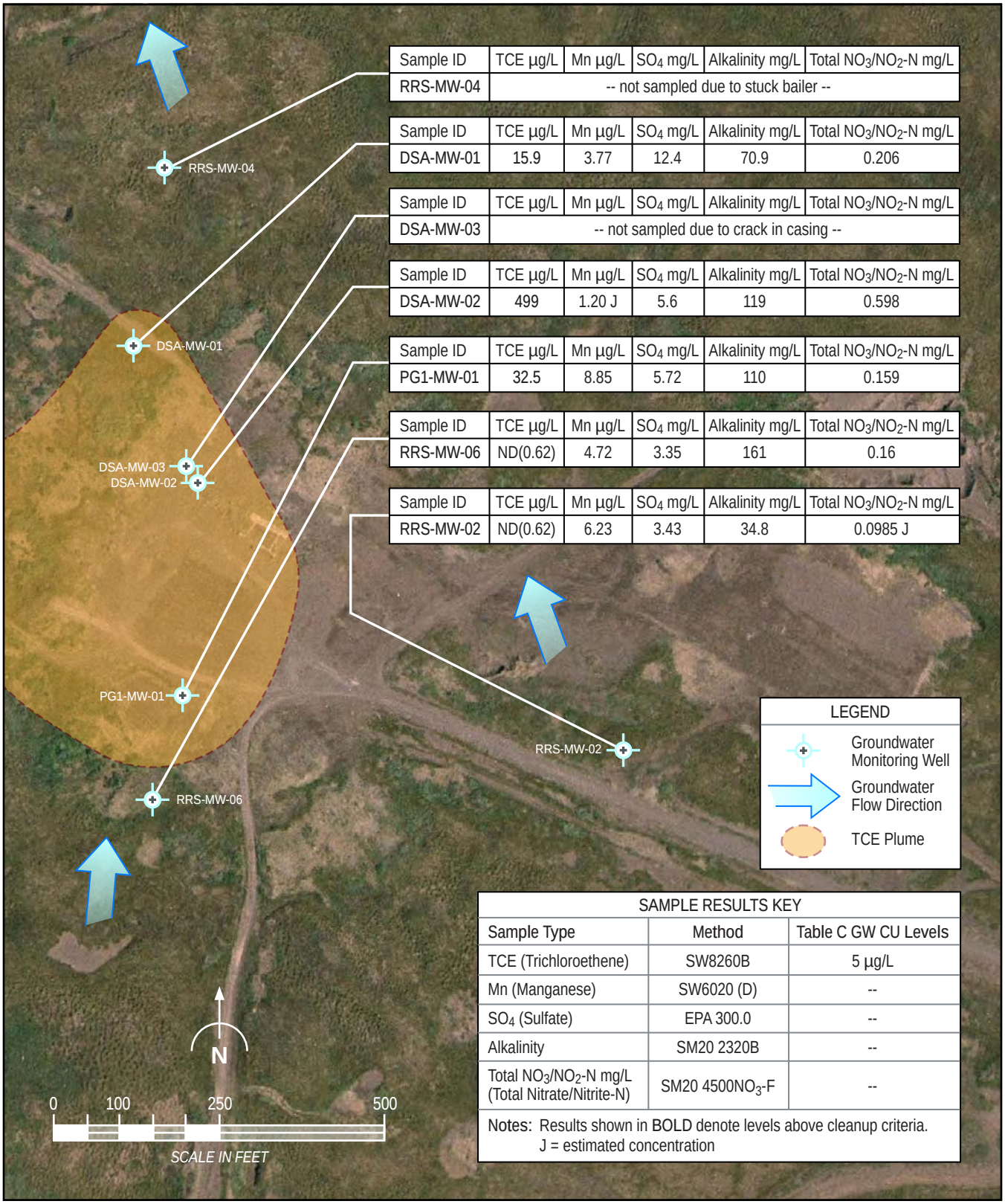
J: Analyte positively identified but quantitation is an estimate

ND: Not detected above specified detection limit

NS: Not sampled

The second line of evidence option, observed changes in geochemical data, such as O_2, $N0_3^-$, Fe^{+2}, Mn^{+2}, $S0_4^{-2}$, CH_4, and alkalinity, can provide solid evidence that biodegradation is occurring at a site. These observations can also be used to estimate the mass of contaminants that are biodegraded through natural attenuation. Accordingly, although data to make defensible claims about the ongoing effectiveness of natural attenuation in groundwater at the Former Port Heiden RRS are not sufficient, an excellent set of baseline data have been gathered. As shown in Figure 4, which presents attenuation data collected in 2011, a reasonably straight line of wells that is parallel to the groundwater gradient exists through the TCE plume.

Although sufficient annual attenuation data to evaluate trend changes in geochemical indicators are not yet available, the current data set and future data will be used to determine whether reductive dechlorination is occurring. These data are expected to include the results of analysis from future sampling events for standard geochemical indicator parameters, including DO, oxidation reduction potential, temperature, nitrate, ferrous iron, sulfate, and methane. These parameters will be used to evaluate aquifer conditions. Data from these parameters will indicate whether reductive chlorination is occurring within the aquifer, and will assist in future site management and long-term monitoring decisions for the site. Additionally, a summary of the daughter products (cis- and trans-1,2-DCE, VC, methane, and ethane) will be presented and discussed in future reports to support the occurrence of reductive chlorination.



Sample ID	TCE µg/L	Mn µg/L	SO_4 mg/L	Alkalinity mg/L	Total NO_3/NO_2-N mg/L
RRS-MW-04	-- not sampled due to stuck bailer --				

Sample ID	TCE µg/L	Mn µg/L	SO_4 mg/L	Alkalinity mg/L	Total NO_3/NO_2-N mg/L
DSA-MW-01	15.9	3.77	12.4	70.9	0.206

Sample ID	TCE µg/L	Mn µg/L	SO_4 mg/L	Alkalinity mg/L	Total NO_3/NO_2-N mg/L
DSA-MW-03	-- not sampled due to crack in casing --				

Sample ID	TCE µg/L	Mn µg/L	SO_4 mg/L	Alkalinity mg/L	Total NO_3/NO_2-N mg/L
DSA-MW-02	499	1.20 J	5.6	119	0.598

Sample ID	TCE µg/L	Mn µg/L	SO_4 mg/L	Alkalinity mg/L	Total NO_3/NO_2-N mg/L
PG1-MW-01	32.5	8.85	5.72	110	0.159

Sample ID	TCE µg/L	Mn µg/L	SO_4 mg/L	Alkalinity mg/L	Total NO_3/NO_2-N mg/L
RRS-MW-06	ND(0.62)	4.72	3.35	161	0.16

Sample ID	TCE µg/L	Mn µg/L	SO_4 mg/L	Alkalinity mg/L	Total NO_3/NO_2-N mg/L
RRS-MW-02	ND(0.62)	6.23	3.43	34.8	0.0985 J

LEGEND

- Groundwater Monitoring Well
- Groundwater Flow Direction
- TCE Plume

SAMPLE RESULTS KEY

Sample Type	Method	Table C GW CU Levels
TCE (Trichloroethene)	SW8260B	5 µg/L
Mn (Manganese)	SW6020 (D)	--
SO_4 (Sulfate)	EPA 300.0	--
Alkalinity	SM20 2320B	--
Total NO_3/NO_2-N mg/L (Total Nitrate/Nitrite-N)	SM20 4500NO_3-F	--

Notes: Results shown in BOLD denote levels above cleanup criteria.
J = estimated concentration

FIGURE 4
Former Port Heiden RRS Groundwater Monitoring Natural Attenuation Results

4.2 FPC-066 Contaminant Results

Historical analytical data were collected during the 2009 DMC groundwater monitoring event and the 2010 groundwater sampling event. In 2009, samples were collected for analysis of the petroleum hydrocarbon suite (GRO, DRO and RRO). DRO concentrations in one well (MW-05) were found to exceed cleanup levels. The results from the 2009 sampling events are shown in Table 4.

Table 4
2009 Groundwater Sampling Results for FPC-066

Method:	***AK101***	***AK102***	***AK103***
Analyte:	***GRO***	***DRO***	***RRO***
Groundwater Cleanup Level:[a]	***2.2***	***1.5***	***1.1***
MW-04	ND (0.1)	0.504 J	0.221 J
MW-05	0.0868 J	**2.25**	0.341 J
MW-06	0.105	ND (0.8)	ND (0.5)
MW-07	ND (0.1)	ND (0.8)	ND (0.5)

Notes:
All concentration units are mg/L.
Bold text in result columns indicates concentration is above cleanup criteria.
[a] From Table C, 18 AAC 75.345
J: Analyte positively identified but quantitation is an estimate
ND: Not detected above specified detection limit

In 2010, the same four wells were sampled for DRO only and the concentrations from well MW-05 remained above cleanup levels. The results from the 2010 sampling events are shown in Table 5.

Table 5

2009 and 2010 Groundwater Sampling Results for FPC-066

Method:	***AK102 – 2009***	***AK102 –2010***
Analyte:	***DRO***	***DRO***
Groundwater Cleanup Level:[a]	***1.5***	***1.5***
MW-04	0.504 J	ND (0.851)
MW-05	**2.25**	**4.50**
MW-06	ND (0.8)	ND (0.800)
MW-07	ND (0.8)	ND (0.899)

Notes:

All concentration units are mg/L.

Bold text in result columns indicates concentration is above cleanup criteria.

[a] From Table C, 18 AAC 75.345

J: Analyte positively identified but quantitation is an estimate

ND: Not detected above specified detection limit

The same four groundwater monitoring wells at the FPC-066 AOC (MW04 through MW-07) were sampled and analyzed for VOCs only during field activities in 2011 Analytical results for TCE and 1,1,2-TCE and the location of each well are shown in Figure 5.

4.3 FPC-215 Contaminant Results

Historical analytical data collected during the 2009 DMC groundwater monitoring event and 2010 monitoring event are available for the three wells that were sampled during 2011 field activities. Table 6 summarizes these data, which are derived from samples collected in 2009.

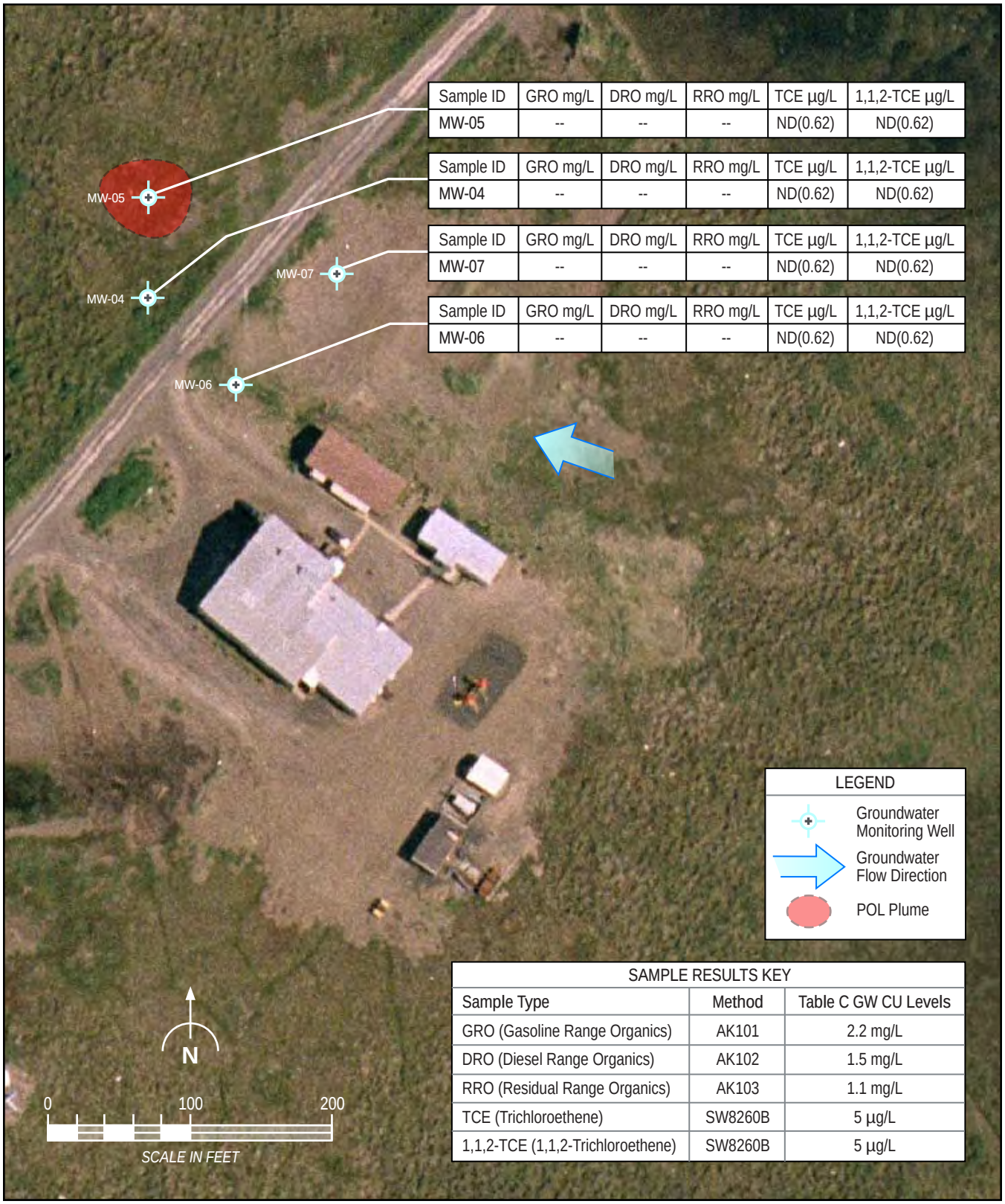


FIGURE 5
FPC-066 Groundwater Monitoring Sample Results - 2009 Results

Table 6

2009 Groundwater Sampling Results for FPC-215

Analyte:	***GRO***	***DRO***	***RRO***
Groundwater Cleanup Level:[a]	***2.2***	***1.5***	***1.1***
MW-08	ND (0.1)	ND (0.8)	ND (0.5)
MW-09	0.651	**4.18**	0.326 J
MW-10	0.0425 J	**3.99**	0.334J

Notes:

All concentration units are mg/L.

Bold text in result columns indicates concentration is above cleanup criteria.

[a] From Table C, 18 AAC 75.345

[b] MW-08D is a duplicate sample from MW-08.

J: Analyte positively identified but quantitation is an estimate

NA: Not analyzed

ND: Not detected above specified detection limit

Three groundwater monitoring wells at FPC-215 were sampled and analyzed for BTEX and DRO during field activities in 2010. No BTEX compounds were detected above applicable cleanup criteria in 18 AAC 75.345, Table C. Table 7 presents 2010 BTEX and DRO data.

Table 7

2010 Groundwater Sampling Results for FPC-215

Method:	***AK102***	***8021***	***8021***	***8021***	***8021***	***8021***
Analyte:	***DRO***	***Benzene***	***Toluene***	***Ethylbenzene***	***o-Xylene***	***P & M - Xylene***
Groundwater Cleanup Level:[a]	***1.5***	***0.005***	***1.0***	***0.7***	***Total for All Xylenes, 10***	
MW-08	ND (0.879)	ND (0.0005)	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)
MW-09	**9.68**	0.00057	0.00454	0.00206	0.0245	0.0153
MW-10	ND (0.856)	0.00065	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)

Notes:

All concentration units are mg/L.

Bold text in result columns indicates concentration is above cleanup criteria.

[a] From Table C, 18 AAC 75.345

J: Analyte positively identified but quantitation is an estimate

ND: Not detected above specified detection limit

Three groundwater monitoring wells at the FPC-066 AOC were sampled and analyzed for DRO and BTEX during field activities in 2011. Analytical results are shown in Figure 6 and presented in Table 8. In addition, the 3 years of DRO groundwater concentrations are compared in Table 9.

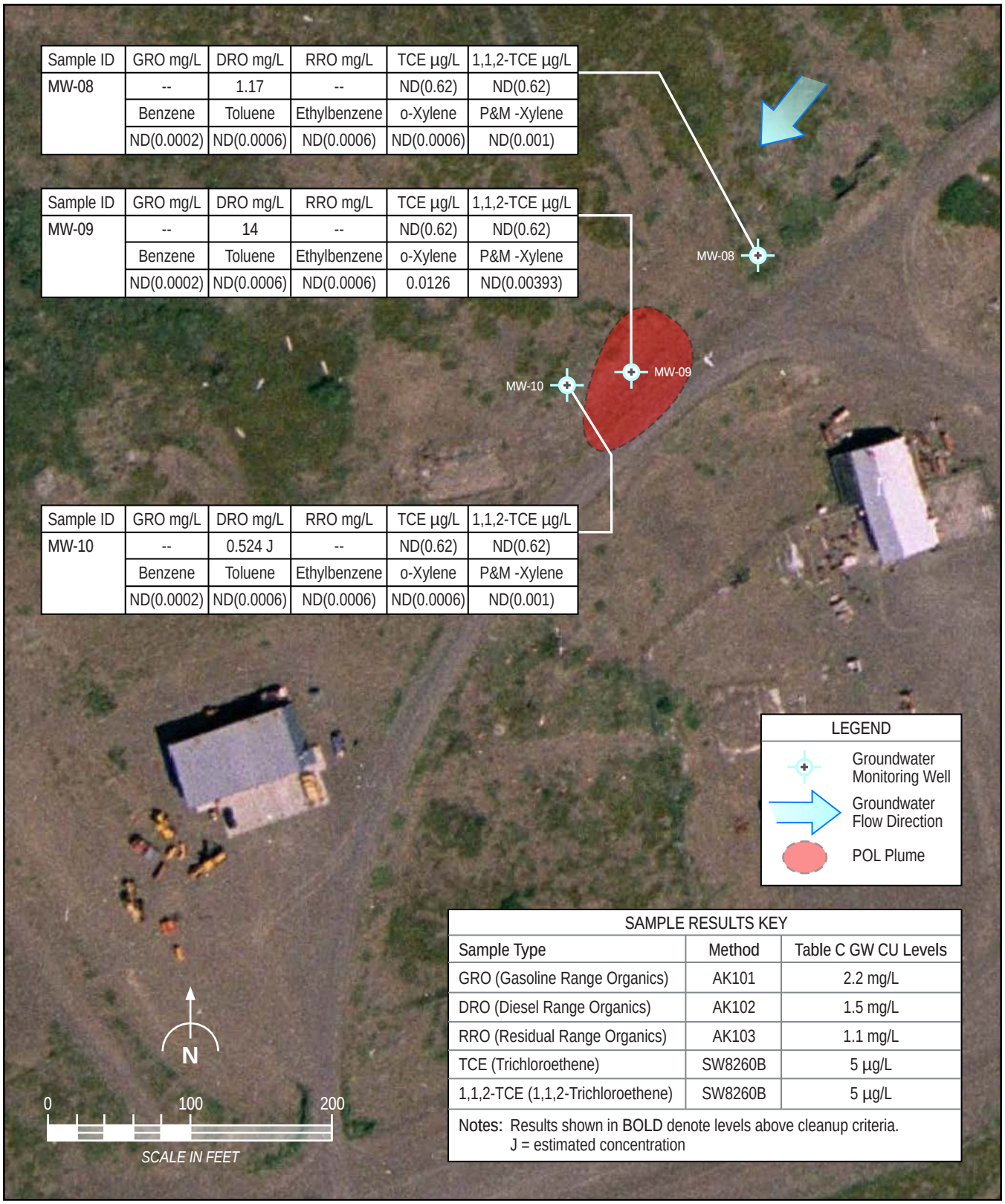


FIGURE 6
FPC-215 Groundwater Monitoring Sample Results

Table 8

2011 Groundwater Sampling Results for FPC-215

Method:	*AK102*	*8021*	*8021*	*8021*	*8021*	*8021*
Analyte:	*DRO*	*Benzene*	*Toluene*	*Ethylbenzene*	*o-Xylene*	*P & M - Xylene*
Groundwater Cleanup Level:[a]	*1.5*	*0.005*	*1*	*0.7*	*Total for All Xylenes, 10*	
MW-08	1.17	ND (0.0002)	ND (0.0006)	ND (0.0006)	ND (0.0006)	ND (0.001)
MW-09	**14.0**	ND (0002)	ND (0.0006)	ND (0.0006)	0.0126	0.00393
MW-10	0.524 J	ND (0.0002)	ND (0.0006)	ND (0.0006)	ND (0.0006)	ND (0.001)

Notes:

All concentration units are mg/L.

Bold text in result columns indicates concentration is above cleanup criteria.

[a] From Table C, 18 AAC 75.345

J: Analyte positively identified but quantitation is an estimate

ND: Not detected above specified detection limit

Table 9

2009, 2010, and 2011 DRO Groundwater Sampling Results for FPC-215

Analyte:	*DRO – 2009*	*DRO – 2010*	*DRO – 2011*
Groundwater Cleanup Level:[a]	*1.5*	*1.5*	*1.5*
MW-08	ND (0.8)	ND (0.879)	1.17
MW-09	**4.18**	**9.68**	**14.0**
MW-10	**3.99**	ND(0.856)	0.524 J

Notes:

All concentration units are mg/L.

Bold text in result columns indicates concentration is above cleanup criteria.

[a] From Table C, 18 AAC 75.345

J: Analyte positively identified but quantitation is an estimate

ND: Not detected above specified detection limit

4.4 FPC-086 Soil Contaminant Results

In addition to groundwater sampling, additional soil samples were collected in the area identified as FPC-086, which is located just north of FPC-066 along the road. The soil samples collected for FPC-086 are discussed in this groundwater report because, as described in the 2010 groundwater report (NVPH, 2010a), surface water samples were collected in this area. The FPC-086 area was historically a location of the military fuel pipeline and the location of a valve in the pipeline. All of the pipeline in Port Heiden was removed in 2008. The 2011 soil sample locations are shown in Figure 7.

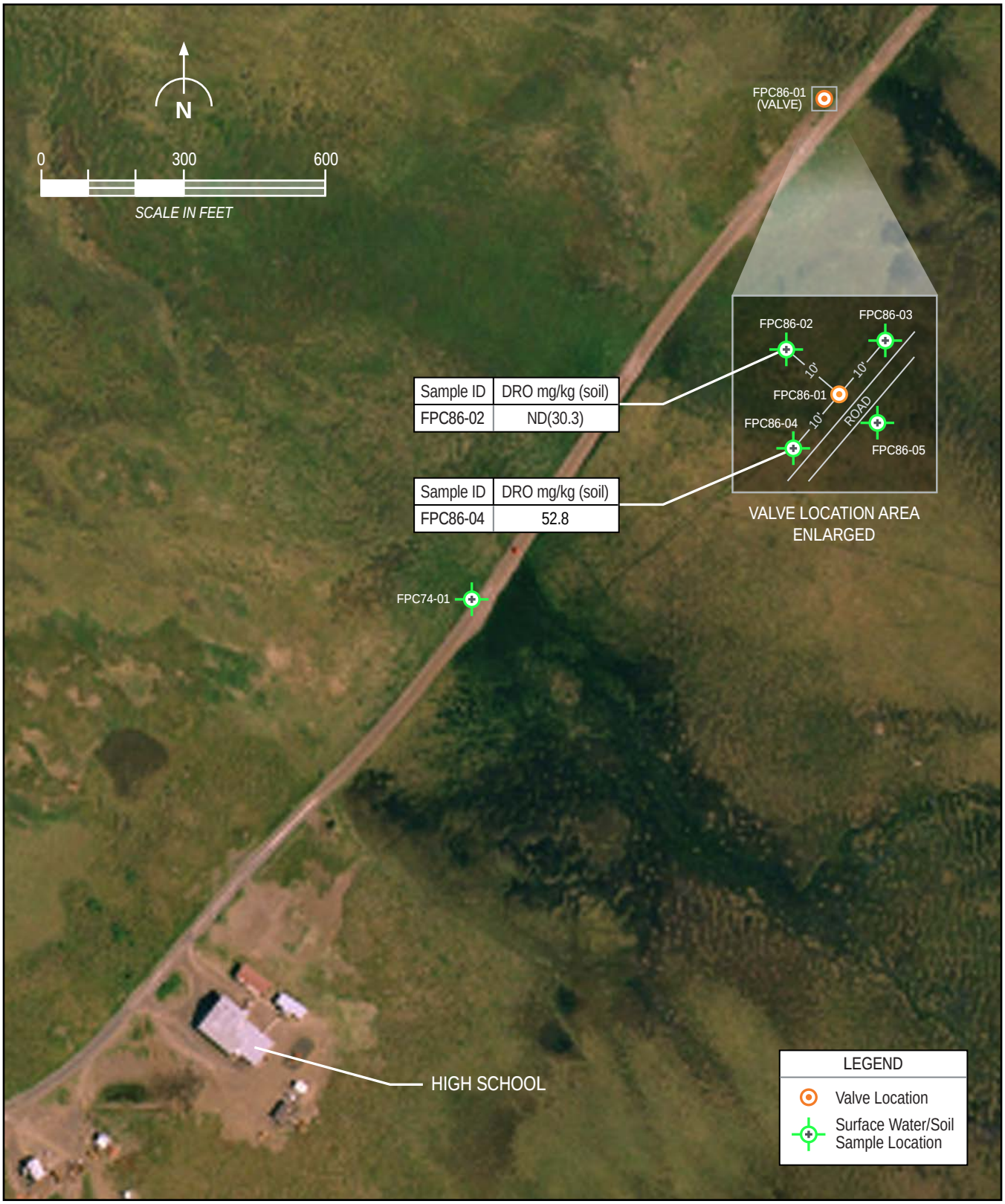


FIGURE 7
FPC-086 Subsurface Soil Sampling Locations

Prepared for 611 CES

Former Port Heiden RRS Groundwater Monitoring Report

4.5 Investigation Derived Waste

4.5.1 Purge Water Disposal

Purge water generated during well sampling activities was stored in the same tank as decontamination water generated during the project. These fluids were circulated through a granular activated carbon (GAC) filter. Before disposal, this water was sampled for the following analytes.

- Total aromatic hydrocarbons (TAH) by Method 8260B
- Total aqueous hydrocarbons (TAqH) by Method 8270 SIM
- PCBs by Method 8082

Approximately 2,000 gallons of purge/decontamination water were generated. Because of the small volume of water generated, one sample suite was collected upon conclusion of the 2011 field activities. The concentrations of all TAH/TAqH analytes were beneath 18 AAC 70 cleanup levels after the initial GAC filtration. However, the PCB concentration exceeded its 18 AAC 75.345, Table C, cleanup level of 0.0005 mg/L. Therefore, this water was refiltered and sampled (two more times) until the PCB concentration was below the cleanup threshold. The purge/decontamination water subsequently was discharged to the ground surface. This method for disposal of purge water was approved by ADEC before field activities.

4.5.2 Personal Protective Equipment Disposal

Personnel working on groundwater sampling activities wore personal protective equipment (PPE) such as disposable nitrile gloves and raingear. After sampling a well, the nitrile gloves and all discarded packing material were collected and placed in a trash bag. This minimal amount of waste was ultimately disposed of in a Super Sack that contained PCB-contaminated dirt.

4.6 Quality Assurance Summary

After reviewing the laboratory data reports, a chemist from AP Consulting completed Laboratory Data Review Checklists and wrote a quality assurance (QA) summary for each of the five data packages related to the groundwater sampling event. The summaries are presented in this section and the laboratory analytical reports and the checklists are provided in Appendixes C and D, respectively.

4.6.1 QA Summary for Laboratory Data Report 1114641

The samples analyzed as part of this laboratory report were collected from monitoring wells RRS-MW-05, GLO-MW-03, UST-MW-02, and MW-04 through MW-10.

Precision was demonstrated by the analysis of a laboratory duplicate sample, laboratory control duplicate sample, and/or a matrix spike duplicate sample in every sample batch. No duplicate samples were analyzed as part of this sample batch. All laboratory control duplicate samples and matrix spike duplicate samples met the laboratory criteria for precision.

Accuracy was demonstrated by the analysis of laboratory control samples, matrix spike samples, and spiked surrogate compounds. All laboratory control samples met the laboratory criteria for percent recovery. All matrix spike samples either met laboratory criteria for percent recovery or the parent sample was not associated with this project and the quality of this data set is not affected. All spiked surrogate compounds either met laboratory criteria or the recoveries were high. In the instances where the recoveries were high, the associated target analytes were nondetect and quality was not affected.

Comparability was demonstrated by keeping the analytical laboratory the same throughout the project. Analytical methods, laboratory procedures, and reporting limits were therefore consistent and comparable between laboratory reports.

Completeness was calculated at 100% for this data set, which meets the 85% goal identified in the QAPP (NVPH, 2011c).

Sensitivity goals were met for all analytes by comparison of the practical quantitation limit (PQL) and the cleanup levels. All method blank and trip blank results were less than the PQL.

4.6.2 QA Summary for Laboratory Data Report 1114822

The samples analyzed as part of this laboratory report were collected from monitoring wells DSA-MW02 and DSA-MW01. A duplicate sample from each well was also collected.

Precision was demonstrated by the analysis of a laboratory duplicate sample, laboratory control duplicate sample, and/or a matrix spike duplicate sample in every sample batch. All laboratory duplicate samples met laboratory criteria for precision. The laboratory control duplicate samples for chloroethane and acetone for the Method 8260B analysis did not meet quality control (QC) criteria (biased high). However, because chloroethane and acetone were not detected in any of the sample, the quality of the data is not affected. All matrix spike duplicate samples met the laboratory criteria for precision.

Accuracy was demonstrated by the analysis of laboratory control samples, matrix spike samples, and spiked surrogate compounds. The laboratory control samples did not meet QC criteria for chloroethane and anions (biased high). However, because chloroethane and anions were not detected in any of the samples, the quality of the data is not affected. The matrix spike samples did meet QC criteria for anions and total nitrate/nitrite (biased high). Results for total nitrate/nitrite should be considered biased high.

Comparability was demonstrated by keeping the analytical laboratory the same throughout the project. Analytical methods, laboratory procedures, and reporting limits were therefore consistent and comparable between laboratory reports.

Completeness was calculated at 100% for this data set, which meets the 85% goal identified in the QAPP (NVPH, 2011c).

4.6.3 QA Summary for Laboratory Data Report 1114956

The samples analyzed as part of this laboratory report were collected from monitoring wells RRS-MW-02, RRS-MW-06, PG1-MW-01, and BLO-MW-05.

Precision was demonstrated by the analysis of a laboratory duplicate sample, laboratory control duplicate sample, and/or a matrix spike duplicate sample in every sample batch. No duplicate samples were analyzed as part of this sample batch. All laboratory control duplicate samples and matrix spike duplicate samples met the laboratory criteria for precision.

Accuracy was demonstrated by the analysis of laboratory control samples, matrix spike samples, and spiked surrogate compounds. The laboratory control samples did not meet QC criteria for anions (biased high). However, because anions were not detected in any of the samples, the quality of the data is not affected. The matrix spike samples did meet QC criteria for total nitrate/nitrite (biased high). Results for total nitrate/nitrite should be considered biased high.

Comparability was demonstrated by keeping the analytical laboratory the same throughout the project. Analytical methods, laboratory procedures, and reporting limits were therefore consistent and comparable between laboratory reports.

Completeness was calculated at 100% for this data set, which meets the 85% goal identified in the QAPP (NVPH, 2011c).

Sensitivity goals were met for all analytes by comparison of the PQL and the cleanup levels. All method blank and trip blank results were less than the PQL.

4.6.4 QA Summary for Laboratory Data Report 1114762

The samples analyzed as part of this laboratory report were collected from monitoring wells BLO-MW-02, BLO- MW-05, and BLO-MW-06.

Precision was demonstrated by the analysis of a laboratory duplicate sample, laboratory control duplicate sample, and/or a matrix spike duplicate sample in every sample batch. No duplicate samples were analyzed as part of this sample batch. All laboratory control duplicate samples and matrix spike duplicate samples met the laboratory criteria for precision.

Accuracy was demonstrated by the analysis of laboratory control samples, matrix spike samples, and spiked surrogate compounds. All laboratory control samples met the laboratory criteria for percent recovery. All matrix spike samples either met laboratory criteria for percent recovery or the parent sample was not associated with this project and the quality of this data set is not affected. All spiked surrogate compounds either met laboratory criteria or the recoveries were high. In the instances where the recoveries were high, the associated target analytes were nondetect and quality was not affected.

Comparability was demonstrated by keeping the analytical laboratory the same throughout the project. Analytical methods, laboratory procedures, and reporting limits were therefore consistent and comparable between laboratory reports.

Completeness was calculated at 100% for this data set, which meets the 85% goal identified in the QAPP (NVPH, 2011c).

Sensitivity goals were met for all analytes by comparison of the PQL and the cleanup levels. All method blank and trip blank results were less than the PQL.

4.6.5 QA Summary for Laboratory Data Report 1114719

The samples analyzed as part of this laboratory report were collected from monitoring well BLO-MW-01.

Precision was demonstrated by the analysis of a laboratory duplicate sample, laboratory control duplicate sample, and/or a matrix spike duplicate sample in every sample batch. No duplicate samples were analyzed as part of this sample batch. All laboratory control duplicate samples and matrix spike duplicate samples met the laboratory criteria for precision.

Accuracy was demonstrated by the analysis of laboratory control samples, matrix spike samples, and spiked surrogate compounds. All laboratory control samples met the laboratory criteria for percent recovery. All matrix spike samples either met laboratory

criteria for percent recovery or the parent sample was not associated with this project and the quality of this data set is not affected. All spiked surrogate compounds either met laboratory criteria or the recoveries were high. In the instances where the recoveries were high, the associated target analytes were nondetect and quality was not affected.

Comparability was demonstrated by keeping the analytical laboratory the same throughout the project. Analytical methods, laboratory procedures, and reporting limits were therefore consistent and comparable between laboratory reports.

Completeness was calculated at 100% for this data set, which meets the 85% goal identified in the QAPP (NVPH, 2011c).

Sensitivity goals were met for all analytes by comparison of the PQL and the cleanup levels. All method blank and trip blank results were less than the PQL.

5.0 Summary

The recommendations presented in this section will be refined as input is received from project stakeholders during review of the GWMR. Annual sampling events are recommended at each of the three AOCs. To maintain data consistency, it is recommended these events occur in the fall, the season when the previous two sampling rounds were conducted.

5.1 Former Port Heiden RRS Monitoring Recommendations

From a review of currently available results, it is recommended that all Former Port Heiden RRS wells continue to be sampled for the same COCs that were targeted in 2011. However, it is recommended that natural attenuation sampling be augmented in coming years. The geochemical suite for attenuation samples in 2011 consisted of methane, alkalinity, sulfate, dissolved iron, manganese, and nitrate.

Natural attenuation is expected to be identified as the optimal remedial option for the Former RRS groundwater. A solid baseline of COC concentrations and attenuation data has been acquired, and it is recommended the same data be collected in 2012 and subsequent years to evaluate COC and geochemical indicator changes during time. Note also that monitoring wells DSA-MW-03 and RRS-MW-04 are damaged and are no longer able to be sampled. At this point, it is recommended that these wells be decommissioned. Additionally, it is recommended that one replacement well be installed in the area of monitoring wells DSA-MW-03 and RRS-MW-04 to continue monitoring groundwater concentrations in this area.

5.2 FPC-066 Monitoring Recommendations

The contaminants present at FPC-066 are in a one-well plume. Well MW-05 is the only one of the four wells sampled in 2011 that had a compound (DRO) above cleanup criteria. No additional wells are available for sampling in this area to better define this boundary. Unless it is deemed enough of a priority to install additional wells at the FPC-066 location, it is recommended that DRO sampling of these four wells continue annually. In 2011, wells in this area were only sampled for VOCs and all results were nondetect. It is recommended that all wells in this area be resampled for DRO and VOCs using appropriate sampling methods, as discussed in Section 3.3.

5.3 FPC-215 Monitoring Recommendations

Much like FPC-066, the contaminants present at FPC-215 are in a one-well plume. Well MW-09 is the only one of the three wells sampled in 2011 that had a compound (DRO) above cleanup criteria. No additional wells are available for sampling in this area for use in adding value to the existing delineation. Unless it is deemed enough of a priority to install additional wells at the FPC-215 location, it is recommended that DRO and BTEX sampling of these wells continue annually. It is recommended that the wells be sampled using appropriate sampling methods, as discussed in Section 3.3.

5.4 FPC-086 Monitoring Recommendations

On the basis of 2011 soil sampling results, for which all concentrations were found to be below cleanup levels, no future soil sampling is recommended at this location.

6.0 Works Cited

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Appendix A
Responses to Comments

Alaska Department of Environmental Conservation
Comments on the Draft Groundwater Monitoring Report Former Port Heiden Radio Relay Station Dated February 2011
Commenter: Louis Howard (ADEC), Comments Developed: February 15, 2012March 7, 2012

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
1.		Cover page	Date of report should be February 2012 not 2011.	***This Date change will be made.***
2.		General comments	There was no Quality Assurance (QA) summery as required by ADEC's "Technical Memorandum Environmental Laboratory Data and Quality Assurance Requirements" (March 2009). *The QA Summary must be included as a specific text section of the report.* All laboratory results, including laboratory quality control (QC) sample results, must be reviewed and evaluated for quality, validity and usability. *The text must include any affects on data validity and/or usability due to field sampling and laboratory quality control discrepancies.*	***This QA summary will be included in the Final version of the report.***
3.	1-1	1.0	Introduction Add text to 2nd paragraph that there were not any deviations to the approved work plan. If there were deviations or modifications performed in the field they would need to be included in the report. State the identities of the qualified persons that conducted the sampling and reporting of the results or were directly supervising others while they conducted sampling.	***These issues will be discussed in this Section.***
4.	3-2	3.3	The text states that all wells were sampled with dedicated bailers. Per ADEC Draft Field Sampling Guidance (March 2010): "Peristaltic pumps (section D2 of Groundwater Sample Equipment) and bailers (section D1) are not the preferred method for the collection of **volatiles or other air sensitive parameters**." Bailers should not be used to collect GRO and VOC sampling data nor will the results obtained from use of bailers be used to eliminate these contaminants of concern from the sampling program at Port Heiden RRS. The VOC (including BTEX)/GRO results obtained from use of bailers will be treated as qualitative data and not as quantitative or definitive data. Teflon® sampling equipment (e.g. tubing, bailers) is preferred. The use of HDPE equipment should be minimized to the extent practical. Studies have indicated that Teflon® shows the least absorption and leaching biases and should be the material of choice for detailed organic sampling purposes. Bottom Fill Bailer: Their low relative cost allows them to be utilized for a one-time use per well per sampling episode. However, despite the care taken to control aeration during the fill	***Further discussion of the use of bailers will be included in this section. Additionally, the rationale for using bailers in the groundwater sampling will be discussed and future sampling approaches will be discussed as well in the Final Report.***

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
			process, filling and emptying the bailer will alter dissolved oxygen concentrations. Due to these reasons (operator induced turbulence and air exposure) this device cannot be relied upon to deliver accurate and reproducible measurements of any air sensitive parameter including, but not limited to, dissolved oxygen, pH, carbon dioxide, iron and its associated forms (ferric and ferrous). Volatile organic analytical results may be biased low (due to aeration) and metals results may be biased high (due to turbidity). Dedicating a bailer and leaving it in a well for long term monitoring is NOT recommended due to the potential risk of accumulated contamination. ADEC will require the Air Force to cease using dedicated bailers for groundwater sampling and conduct future sampling with either bladder pumps (section D3), positive pressure submersible pumps (section D4), gear pumps (section D5), passive diffusion bag samplers (section D6), or samplers like HydraSleeve (section D8) or Snap Samplers (section D9) which are preferred to reduce the loss of volatiles during sampling (Field Sampling Guidance May 2010). The final approved work plan's QAPP (May 2011) on Page 4-8 states: "**Groundwater Sample Collection.** Positive pressure, submersible, low-flow pumps will be used to collect groundwater sample for this project. These pumps are considered the best possible option to preserve volatiles during the sampling process (ADEC, 2010). Groundwater sampling will be performed by using low-flow methodology."	

Alaska Department of Environmental Conservation
Comments on the Draft Groundwater Monitoring Report Former Port Heiden Radio Relay Station Dated February 2011
Commenter: Louis Howard (ADEC), Comments Developed: February 15, 2012March 7, 2012

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
5.	4-2	4.1	The text states that DSA-MW-03 and RRS-MW-04 are damaged and no longer able to be sampled. ADEC will require that these wells be decommissioned and at least one replacement well be installed as soon as possible. DSA-MW-03 had tricholorethylene (TC) at 0.066 mg/L (66 ug/L) in 2004 and in 2010 had increased to 0.317 mg/L (317 ug/L) and RRS-MW-04 was a downgradient well that served as a sentinel well. There are no clean true downgradient wells of DSA-MW-01 which is the furthest downgradient well with TCE contamination above cleanup levels. GLO-MW-03 and RRS-MW-05 are cross-gradient wells. DSA-MW-03 is currently being served by the nearby well DSA-MW-02. Data package 1114762 states that for sampling results for BLO-MW-02, BLO-MW-05 and BLO-MW-06: 2-3 containers were received frozen, no good. Samples were recollected for VOCs and all samples were run for GRO. ADEC requests this issue be discussed in the Quality Assurance Summary text that is missing from this report.	***The recommendation that these wells be decommissioned and replaced will be discussed in this section.*** ***This issue will be discussed in the Quality Assurance Summary text.***
6.		Figure 3	Please ensure that all duplicate sample results that are higher than the primary result are reported (e.g. NVPH11-DSA-MW01-01D). ADEC Technical Memorandum 08-001 "Guidelines for Data Reporting, Data Reduction, and Treatment of Non-Detect Values" (August 12, 2008). Data Reporting 2. Data reduction from field duplicate samples ADEC regulates based on the maximum result or statistically valid 95% upper confidence limit (UCL) per 18 AAC 75.380(c)(1). *Therefore, ADEC requires that the most conservative detectable sample result of the primary and duplicate results be used for management decision making purposes.* Primary and duplicate results shall not be averaged. If the primary and duplicate results are both reported as non-detect (ND), the minimum detection limit (DL) should be presented with the data qualification flag denoting the result as ND (U-qualified). If one of the results is reported as non-detect and the other is a detectable concentration, the detected value should be used.	***This comment is noted and the appropriate groundwater concentrations will be used.***

Alaska Department of Environmental Conservation
Comments on the Draft Groundwater Monitoring Report Former Port Heiden Radio Relay Station Dated February 2011
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7.	5-1	5.1	Recommendations See comment #5 regarding RRS-MW-04 replacement.	***See above response for Comment #5.***
8.	5-1	5.2	FPC-066 Monitoring Recommendations ADEC does not agree with wells not being sampled for VOCs and does not agree that the wells in this area no longer be sampled. This is based on the statements in the report that bailers were used for sampling in 2011 (dedicated or otherwise, bailers are inappropriate sampling devices for VOCs in groundwater).	***This comment will be addressed and it will be recommended that appropriate sampling methods be used in future sampling events.***
9.	5-2	5.3	FPC-215 Monitoring Recommendations ADEC concurs with the sampling for DRO and BTEX. Sampling for BTEX shall not include the use of bailers (dedicated or otherwise, bailers are inappropriate sampling devices for BTEX in groundwater).	***See above response to Comment #8.***
10.	5-2	5.4	FPC-086 Monitoring Recommendations ADEC concurs with the recommendations.	***Comment is noted***
11.	6-1	6.0	Works Cited Add the following ADEC. Technical Memorandum 08-001. Guidelines for Data Reporting, Data Reduction, and Treatment of Non-Detect Values. August 12, 2008.	***This ADEC memo will be cited in the Final Version.***