FINAL

2022 Remedial Action-Operation and Long-Term Management Report North River Radio Relay Site Sites SO001, SS001, SS003

April 2023

611 CES North Group
Optimized Remediation Contract, Alaska
USACE Contract W911KB20D0002, Task Order W911KB20F0135

Prepared for:

Air Force Civil Engineer Center
PACAF Regional Support Center

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TITLE AND APPROVAL PAGE

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Air Force Civil Engineer Center
PACAF Regional Support Center

Prepared by:

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ACRONYMS AND ABBREVIATIONS

%	percent
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
bgs	below ground surface
Brice	Brice Engineering, LLC
BSNC	Bering Straits Native Corporation
CDQR	Chemical Data Quality Review
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CES	Civil Engineer Squadron
COC	contaminant of concern
CSM	conceptual site model
cy	cubic yards
DD	Decision Document
DEW	Distant Early Warning
DRO	diesel range organics
FD	field duplicate
GRO	gasoline range organics
IC	institutional control
IDW	investigation-derived waste
LCL	lower control limit
LTM	long-term management
LUC	land use control
mg/kg	milligram per kilogram
mg/L	milligram per liter
MS	matrix spike
MSD	matrix spike duplicate
ND	non-detect
ORC	Optimized Remediation Contract
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
POL	petroleum, oil, lubricants
PSL	project screening level
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RA-O	remedial-action operation
ROD	Record of Decision
RPD	relative percent difference
RRO	residual range organics

ACRONYMS AND ABBREVIATIONS (CONTINUED)

RRS	Radio Relay Site
TCB	trichlorobenzene
UNC	Unalakleet Native Corporation
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
UST	underground storage tank
VOC	volatile organic compound
WACS	White Alice Communications System

EXECUTIVE SUMMARY

This report presents the 2022 annual remedial action-operation (RAO) and long-term management (LTM) activities conducted by Brice Engineering, LLC (Brice) for Sites SO001, SS001, and SS003 at the North River Radio Relay Station (RRS) between 30 August and 31 August 2022.

The LTM activities consisted of visual inspection, completion of a visual inspection checklist, groundwater sampling and analyses, and photo documentation of each site. Visual inspection results noted that all site conditions were largely unchanged from the previous year's inspections.

At SO001, during the time of the inspection, the previously reported open excavation had been filled. The groundwater monitoring well inspections indicated that the wells were in good condition; however, the inner casing of V-MW01 was frost jacked and the well was not secure. Analytical results for DRO for monitoring wells V-MW01, V-MW03, and V-MW06 were non-detect.

At SS001, an institutional control/land use control (IC/LUC) sign was installed along the northwest boundary facing the access road. Orange construction fencing was observed around the monitoring well stickups; previously reported fencing around the excavation site perimeter had been removed. No evidence of trespass, unauthorized excavation, or groundwater use was observed.

At SS003, an IC/LUC sign was installed on the west boundary facing the access road. No evidence of unauthorized excavation or groundwater use was observed. Tire tracked were observed, possibly from the 2022 work activities performed. Appeared to be a turnaround site.

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1.0 INTRODUCTION

This report presents the 2022 annual remedial action-operation (RAO) and long-term management (LTM) activities conducted by Brice Engineering, LLC (Brice) for Sites SO001, SS001, and SS003 at the North River Radio Relay Station (RRS) under the 611 Civil Engineer Squadron (CES) North Group Optimized Remediation Contract (ORC), U.S. Army Corps of Engineers (USACE), Alaska District, Contract W911KB20D0002, Task Order W911KB20F0135.

1.1 Purpose and Project Objectives

The purpose of this project is to conduct institutional control/land use control (IC/ULUC) inspections, sampling and analyses of groundwater, sign placement, and well repair/replacement, as needed, for the following sites to maintain compliance with U.S Air Force (USAF) and regulatory requirements:

- SO001 – Vehicle Maintenance Building Underground Storage Tank (UST)
- SS001 – Drum Storage Yard and polychlorinated biphenyl (PCB) Trail
- SS003 – Drums and Stained Soil

The field activities documented in this report were conducted between 30 August and 31 August 2022 in accordance with the Alaska Department of Environmental Conservation (ADEC) approved Work Plan, *Final Work Plan, Remedial Action-Operation and Long-Term Management, North River Radio Relay Station* (Air Force Civil Engineer Center [AFCEC] 2021), hereafter referred to as the Work Plan. This Work Plan was amended in January 2022 (AFCEC 2022a) to include the updated ADEC *Field Sampling Guidance* (ADEC 2022).

1.2 Project Background

The North River RRS is located approximately 8 miles east of the town of Unalakleet, Alaska. Unalakleet is 395 miles northwest of Anchorage and 148 miles southeast of Nome and has a population of 750. It is on the Norton Sound, at the mouth of the Unalakleet River. The North River RRS is accessed from Unalakleet via gravel roads and encompasses 26 acres of land on a bluff north of the Unalakleet River.

The North River RRS was constructed in 1957 and was operated by the Radio Corporation of America/Alascom until it was abandoned in 1978. The North River RRS was one of the original 31 White Alice Communications System (WACS) facilities used for defense and civilian communications and relayed information between similar stations at Granite Mountain, Anvil Mountain, and Kotzebue. Through these connections, Aircraft Control and Warning system sites could link with the Distant Early Warning (DEW) system relaying critical information to Elmendorf and Eielson Air Force Bases. Four parabolic dish antennas were situated on the hilltop of Site OT001, the highest point of the North River RRS. Support facilities consisting of a composite building, barracks, petroleum storage and distribution facilities, equipment maintenance building, water tower, and temporary garage surrounded the hilltop antennas. All of the structures on the site, including the distinct parabolic antennas, were demolished by the Air Force by 1995.

Current landowners include the USAF, the Unalakleet Native Corporation (UNC), and the Bering Straits Native Corporation (BSNC). The lands at Site SO001 are owned by the UNC; lands at Site SS001 are still owned by USAF; and the surface soil of Site SS003 is owned by UNC, while the subsurface soil is owned by BSNC.

A Decision Document (DD) is in place for Site SO001 (USAF 2010a). In 2010, a Record of Decision (ROD) was completed for Sites SS001 and SS003 and was amended in 2019, which changed the boundaries of Site SO001 (USAF 2010; USAF 2019b). Table 2-1 presents a summary of the current selected remedy for each site.

Table 1 Site Summary

SITE	ADEC FILE NUMBER	HAZARD ID	SITE STATUS	REMEDY	COCs
SO001	630.38.001	4367	RA-O	Onsite Landfarming of Fuel Contaminated Soil Exceeding the ADEC Method Two Cleanup Criteria with Long-Term Monitoring of Groundwater	GRO, DRO, POL-constituents (soil) DRO (groundwater)
SS001	630.38.001	4367	LTM	Offsite Disposal of Contaminated Soil, Capping, and LUCs	PCB; 1,2,4-TCB (soil)
SS003	630.38.001	4365	LTM	Offsite Disposal of Contaminated Soil, Capping, and LUCs	PCB, DRO, RRO (soil)

Notes:
For definitions, refer to Acronyms and Abbreviations section.

1.2.1 Site SO001 Description

Site SO001 (Vehicle Maintenance Building UST) is an RA-O site (Figure 2). The site historically consisted of the vehicle maintenance building, a temporary dormitory, and a 500-gallon underground storage tank. A 4-inch floor drain was present in the vehicle maintenance building that led to an outfall. In 1995, the facilities were demolished and much of the building debris was placed in a permitted and closed construction/demolition landfill constructed at Site OT001.

Since 1985, numerous environmental activities have been conducted at the site including building demolition and debris removal, sample collection, and soil remediation activities. In 2007, a remedial investigation was conducted to determine the nature and extent of contamination at the site. Soil and groundwater samples were collected and analyzed for PCBs and petroleum, oil, and lubricants (POL) constituents. The results of the investigation indicated that additional remedial action would be necessary at this site (USAF 2010a).

In 2010, a DD was authored describing the selected remedy for soil at the site as onsite landfarming and institutional controls. The contaminants of concern in soil at the site were identified as gasoline range organics (GRO), diesel-range organics (DRO), and various POL constituents. The selected remedy for groundwater at the site was LTM; the COC in groundwater at the site was identified as DRO (USAF 2010a).

In 2015, excavation of POL-contaminated soil began at the site and continued through 2018. Additionally, three groundwater wells (V-MW01, V-MW03, and V-MW06) were installed and sampled in 2015, 2016, 2018, and 2019.

In 2017, test pits were advanced at the site to determine the extent of contamination. Thirteen test pits were advanced to groundwater and the soil was sampled for POL constituents. Results indicated contaminants were still present and the report recommended the excavation of approximately 1,800 additional cubic yards (cy) of soil.

In 2018, excavation continued at the site and approximately 3,507 cy of POL-contaminated soil were removed and placed in a landfarm for treatment. Excavation confirmation samples were collected from the sidewalls and floors of the excavation and indicated that the limits of the contamination had been

reached. The excavation was secured with fencing and signs until treatment is completed on the excavated soil and the treated soil can be placed back at the site as backfill. Treatment of the contaminated soil is anticipated to be complete in approximately two years (USACE 2019a).

In 2019, groundwater wells V-MW03 and V-MW06 were sampled for DRO. Results were either non-detect or below the ADEC Table C cleanup level (1.5 milligrams per liter [mg/L]). Well V-MW01 was dry and was not sampled. Additionally, remedial actions were being conducted at the site. Fencing and signs were in place around the open excavation and are anticipated to remain until treatment of the soil is complete and returned to the excavation as backfill (USACE 2019c).

In 2020, field activities and observations were similar to 2019. Groundwater wells V-MW03 and V-MW06 were sampled for DRO. Groundwater well V-MW03 was initially purged dry, and the sample was collected the following day after the well recovered. Results were either non-detect or below the ADEC Table C cleanup level (1.5 mg/L). Well V-MW01 was dry and not sampled. At the time of the inspection, an open excavation was present as SO001. Water was present in the bottom of the excavation. No sheen was observed on the water. Chain link fencing was present across the old road to prevent access and safety fencing was present around the southwest, south, and southeast extent of the excavation. No fencing was present on the north side of the site, but the area is heavily wooded to the north of the old road. Grass and shrubs had grown on the previous excavations and the slope of the current excavation. No stained soil or stressed vegetation were observed. Cobbles, likely from the excavation, were stockpiled south of the excavation (AFCEC 2021b).

In 2021, field observations were similar to 2020. Groundwater wells V-MW03 and V-MW06 were sampled for DRO. Results were either non-detect or below the ADEC Table C cleanup level (1.5 mg/L). Well V-MW01 was dry and not sampled. An open excavation was still present as SO001 (AFCEC 2022b).

1.2.2 Site SS001 Description

Site SS001, also known as the Drum Storage Yard and PCB trail, is an LTM site. The site is located west-southwest of Site SO001 (Figure 3) and historically consisted of a drum storage area on the east side of the site, as well as an all-terrain vehicle (ATV) trail that led to a recreational cabin. The drum storage area was likely associated with the vehicle maintenance activities that occurred at Site SO001. The ATV trail, which extends approximately 0.75 miles from the main site road to access a recreational cabin, is not part of the property.

In 2003, a time-critical removal action was initiated to remove PCB-contaminated soil and continued in 2004 and 2005. PCB-contaminated soil was removed from the ATV trail and drum storage area. In 2005, confirmation samples indicated PCB-contaminated soil was still present at depths of 3 to 6 feet below ground surface (bgs). The excavation was left open, secured with a fence surrounding the excavated area.

In 2007, a site characterization/remedial investigation activity was conducted at the site to delineate the nature and extent of contamination remaining at the site. Sampling activities identified and delineated approximately 7.5 cy of PCB-contaminated soil at the site (USAF 2010b).

In 2010, a ROD was authored describing the selected remedy for soil at the site as offsite disposal of contaminated soil; the COC in soil was identified as PCBs (USAF 2010b).

In 2012 and 2013, remedial activities were conducted at Site SS001, which included the excavation and delineation of PCB-contaminated soil and staging the soil for offsite shipment and disposal. Approximately 2,400 cy of PCB-contaminated soil was removed, extending the previously excavated area (USACE 2016). The final excavation dimensions were approximately 75 feet by 60 feet and extended to a maximum depth of 13 feet bgs. The excavation extended past the depth of groundwater and fractured bedrock was

encountered in some areas. During the excavation activities, a fuel odor was noted, and additional sampling was conducted. Analytical results indicated concentrations of 1,2,4-trichlorobenzene (TCB) in soil above the ADEC cleanup level. During 2013 site activities, soil samples were also collected from an ATV trail that led from the site to the recreational cabin. The samples were analyzed for PCBs to confirm the effectiveness of previous remedial actions along the trail. During this sampling, a drum was discovered near the cabin and samples were collected from around the drum and analyzed for POL constituents. The drum and its contents were removed and disposed of offsite (USACE 2014a).

In 2014, vegetation sampling was conducted around the excavation and on the trail. Roots, leaves, and berries were collected and analyzed for PCBs. A total of 111 samples were collected from Sites SS001 and SS003; results of 88 of the samples were non-detect for PCBs. All other results were below the PCB cleanup level in soil (1 milligram per kilogram [mg/kg]). Soil samples were also collected from around the drum that had been found and removed in 2013. Based on these sample results, approximately 1.5 cy of contaminated soil was recommended for removal (USACE 2019b).

In 2015, the excavation at Site SS001 was lined, backfilled, and the area was restored to match the surrounding grade. The fencing and signs that had previously surrounded the open excavation were removed. Five groundwater wells were installed, four around the perimeter and one downgradient as a sentry well and sampled. All results were below the ADEC Table C cleanup levels (USACE 2016).

In 2016, stockpiles were constructed at Site SS001 for storage of POL-contaminated soil from Site SO001 prior to transfer to the landfarm located at Site OT001. During this field effort, groundwater samples were collected from the Site SS001 wells. All results were below ADEC Table C cleanup level, and it was recommended that groundwater sampling at this site be discontinued.

In 2018, POL-contaminated soil from Site SO001 that had been previously stockpiled for storage was transferred to the landfarm located at Site OT001. Bedding and liner material were placed in super sacks and transported offsite for disposal. The area at Site SS001 was then used to create a second landfarm for the treatment of POL-contaminated soil from Site SO001 (USACE 2019a).

In 2019, a ROD amendment was approved to change the remedy selected for the site. The remedy was updated to address contamination that remains in the ground due to the presence of groundwater and bedrock limiting excavation activities. The new selected remedy is Offsite Disposal of Contaminated Soil, Capping, and LUCs for Site SS001 (USACE 2019b).

In 2019, four monitoring wells (C-MW07, C-MW09, C-MW15, and C-TW10) located at the site were sampled for PCBs and volatile organic compounds (VOC). Analytical results for PCBs were either non-detect or below the ADEC Table C cleanup level. Analytical results for VOCs results were either non-detect or below ADEC Table C cleanup levels with the exception of bromodichloromethane (ranged from non-detect to 0.0019 mg/L), cis-1,2-dichloroethene (ranged from non-detect to 0.250 mg/L), tetrachloroethene (ranged from non-detect to 0.400 mg/L), trichloroethylene (non-detect to 0.290 mg/L), and 1,1,2-trichloroethane (ranged from non-detect to 0.001 mg/L). Additionally, it was noted that remedial actions were still being conducted at the site (USACE 2019c).

In 2020, three groundwater wells (C-MW7, C-MW9, and C-MW15) were sampled. Monitoring wells C-MW7 and C-MW9 had insufficient volume and were not sampled. Monitoring well C-MW15 was sampled for DRO, VOCs, and PCBs. Concentrations of cis-1,2-dichloroethene, 1,1,2-trichlorethane, and trichloroethylene exceeded ADEC Table Cleanup levels. All other analytes were either non-detect or below cleanup levels (AFCEC 2021b). At the time of the investigation Site SS001 was covered with land-farmed soil. Orange safety fencing and silt fencing were present around the site. Orange safety fencing was not present around the south and southeast portion of the site and was downed along the southwest portion of the site. The silt fencing was damaged in multiple locations around the site. Grass and shrubs were

present around the soil and trees are present to the south and southeast. No stained soil or stressed vegetation were observed (AFCEC 2021b).

In 2021, soil samples were collected from the OT001 and SS001 landfarm areas using both discrete and incremental sampling methodology (ISM) collection methods. Soil samples were analyzed for GRO, DRO, select mid-level VOCs, and select SVOCs. One ISM sample result exceeded the ADEC cleanup level for DRO (250 mg/kg) with a result of 259 mg/kg. Results for all other analytes were below both the DD and ADEC cleanup levels (USAF 2021a).

Also in 2021, Site SS001 was visually inspected. At the time of inspection, the site was covered with landfarmed soils. Orange construction fencing and silt fencing were observed; however, the fencing appeared to be fallen and torn in multiple areas. No IC/LUC signs were in place; however, a "Danger – Keep Out" sign was secured to the construction fencing on the north side of the site. No signs of stained or stressed vegetation, evidence of trespass, unauthorized excavation, or groundwater use were observed (AFCEC 2022b).

In 2021, the first Five-Year Review for Site SS001 was prepared. A protectiveness determination on the remedy at Site SS001 could not be made until further information is obtained, including evaluation of human health and ecological risk associated with the presence of five VOCs (bromodichloromethane, cis-1,2-dichloroethene, tetrachloroethene, 1,1,2-trichloroethane, and trichloroethylene) in groundwater; additional site characterization through replacement of the monitoring well C-MW15, monitoring groundwater from all site wells, and conducting an assessment of the risk associated with the VOCs. Additionally, the USAF LUC Management Plan requires updating to reflect LUC management as outlined in the 2020 ROD Amendment; signs need to be installed at SS001 that inform the public of potential risks and limit human exposure; and a Notice of Activity and Use Limitation (NAUL) filed for Site SS001 (USAF 2021b).

1.2.3 Site SS003 Description

Site SS003 is an LTM site where drums have been discovered. In 2003, nine 55-gallon drums were removed from the site, three contained product which resembled used motor oil. Soil samples were collected and analyzed for DRO, residual-range organics (RRO), VOCs, polycyclic aromatic hydrocarbons (PAHs), and PCBs. Results indicated PCB and POL contamination at the site.

In 2007, a site characterization/remedial investigation activity was conducted at the site to delineate the nature and extent of contamination remaining at the site. Sampling activities identified and delineated approximately 380 cy of PCB- and POL-contaminated soil at the site (USAF 2010b).

In 2010, a ROD was authored describing the selected remedy for soil at the site as offsite disposal of contaminated soil; COCs were identified as DRO, RRO, and PCBs (USAF 2010b).

In 2012, approximately 1,260 cy of commingled PCB- and POL-contaminated soil was delineated, excavated, and transported off site for disposal. Confirmation sampling at the site indicated additional excavation was necessary (USACE 2013).

In 2013, remedial activities continued at Site SS003 that included the excavation and delineation of PCB-contaminated soil, commingled with POL-contaminated soil. Approximately 578 cy of PCB- and POL-contaminated soil was removed. Analytical confirmation samples were collected and indicated that contamination remained; however, the excavation had extended to bedrock. It was recommended that further excavation not take place and the site was secured for the winter (USACE 2014). The final excavation was approximately 75 feet by 60 feet and extended to maximum depth of 13 feet bgs.

In 2014, vegetation sampling was conducted around the excavation and on the trail. Roots, leaves, and berries were collected and analyzed for PCBs. A total of 111 samples were collected from Sites SS001 and SS003; results of 88 of the samples were non-detect for PCBs. All other results were below the PCB cleanup level (1 mg/kg) in soil (USACE 2019b). Additionally, soil borings were advanced downgradient of the open excavation. Soil samples were collected and analyzed for DRO, RRO, and PCBs. All results were below ADEC cleanup levels indicating that remaining contamination was not migrating off site (USACE 2019c).

In 2015, the excavation at Site SS003 was lined, backfilled, and the area was restored to match the surrounding grade. The fencing and signs that had previously surrounded the open excavation were removed.

In 2019, an inspection of the site indicated that surface vegetation was present and noted to be sparse in the center of the site where the excavation activities had occurred in 2013. The site was noted to be free of debris and visible impacts of contamination (USACE 2019c).

In 2019, a ROD amendment was approved to change the remedy selected for this site. The remedy was updated to address the contamination that remains in the ground due to the presence of bedrock limiting excavation activities. The new selected remedy is Offsite Disposal of Contaminated Soil, Capping, and LUCs for Site SS001 (USACE 2019b).

During the 2020 inspection, no stressed vegetation was observed. Access to the site was not controlled, and signs of site trespassing (shell casings) were observed adjacent to the site (AFCEC 2021b).

During the 2021 inspection, no stressed vegetation was observed. Access to the site was not controlled, and signs of site trespassing (tire marks) were observed (AFCEC 2022b).

In 2021, the second Five-Year Review for Site SS003 was prepared. No issues were identified, and the selected remedies met the remedial action objectives for the short-term. In order for the remedy to be protective in the long-term, the USAF LUC Management Plan requires updating to reflect LUC management as outlined in the ROD Amendment and signs need to be installed at Site SS003 that inform the public of potential risks and limit human exposure. An environmental covenant for Site SS003 should be filed, and stakeholders should concur with LUCs and deed restrictions for the site (USAF 2021b).

2.0 FIELD ACTIVITIES

This section presents field activities conducted at North River RRS during the annual 2022 IC/LUC inspections performed in accordance with the Work Plan for three sites between 30 August and 31 August 2022. Activities consisted of visual inspection, completion of a visual inspection checklist, groundwater monitoring, and photo documentation of each site. Appendix A includes the field logbook documenting field inspections, Appendix B includes the completed Inspection Checklists for all sites, and Appendix C includes a photographic log of all field activities. The access road to the sites, North River Road, was observed to be eroding near the bridge where the road is adjacent to the river. The approximate location of the erosion is shown on Figure 1. The 2022 field inspections for each site are summarized below.

2.1 Institutional Control/Land Use Control Inspections

2.1.1 SO001

At the time of the inspection, the previously open excavation had been filled under an approved Work Plan to return landfarmed soil to the excavation. The site was graded and grass was observed growing in rows in the topsoil. There was orange construction fencing around the well stickups remaining from the excavations; previously reported dilapidated fencing was removed. No IC/LUC signs are in place. No evidence of trespass, unauthorized excavation, or groundwater use was observed. A visual inspection checklist for SO001 was completed and supporting photographic documentation was obtained.

2.1.2 SS001

Site SS001 was visually inspected to determine whether the site is being disturbed. The site appeared to have been graded to match SO001, possibly after use as backfill to fill in the excavation, and then hydroseeded to match the other site. Grass was observed growing in rows out of freshly churned soil. Orange construction fencing and silt fencing was observed at the site around well stickups; previously reported dilapidated fencing had been removed. An IC/LUC sign was installed during this event. No signs of stained or stressed vegetation were observed. No evidence of trespass, unauthorized excavation, or groundwater use was observed. A visual inspection checklist for SS001 was completed and supporting photographic documentation was obtained.

2.1.3 SS003

Site SS003 was visually inspected to determine whether the site is being disturbed. The site is a large field sloped away from the road and no fencing is present. No signs of stained or stressed vegetation were observed. No evidence of unauthorized excavation or groundwater use was observed. Tire marks were observed onsite. An IC/LUC sign was installed during this event. A visual inspection checklist for SS003 was completed and supporting photographic documentation was obtained.

2.2 Sign Replacement

Two IC/LUC signs were installed at sites SS001 and SS003. The IC/LUC sign installed at Site SS001 was placed along the northwest boundary facing the access road. The IC/LUC sign installed at Site SS003 was placed on the west boundary also facing the access road. There were no signs previously observed at the sites.

2.3 Monitoring Well Conditions

During the 2022 monitoring event, the condition of monitoring wells to be sampled at SO001 was documented in field notes and photographs. All wells were located. The access road to the wells is being eroded by the North River in some locations. Table 2 presents monitoring well conditions. Appendix A contains the field notes, Appendix B contains field forms, and Appendix C contains a photograph log.

Table 2 North River RRS Site SO001 Monitoring Well Conditions

Well ID	Sampled (Y/N)	Well Diameter (inches)	Depth to Water (ft btoc)	Total Depth (ft btoc)	Observed Well Condition
SO001					
V-MW01	Y	2	9.94	11.77	Frost jacked. Inner casing approximately 1-2 inches above outer casing. Well redeveloped.
V-MW03	Y	2	7.83	11.14	Good, with slight frost jacking, but cap still lockable.
V-MW06	Y	2	13.13	16.89	Frost jacked. Inner casing approximately 1-2 inches above outer casing.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

2.4 Groundwater Sampling Methodology

Groundwater samples were collected in accordance with the Work Plan (AFCEC 2021a). First each well was gauged using an oil/water interface probe. Non-aqueous phase liquid (NAPL) was not observed at any of the monitoring wells. A submersible centrifugal stainless-steel pump with low-flow controller and Teflon-lined poly tubing was used to collect groundwater samples. When sufficient water was present in the well, field stabilization parameters including pH, temperature, conductivity, dissolved oxygen, and oxidation-reduction potential were measured using a calibrated Aquatroll multi-parameter water quality sonde during the purging process prior to sample collection. Final field-measured water quality parameters are included on the groundwater collection field forms (Appendix B). Water levels in V-MW03 and V-MW06 exceeded the minimum drawdown (less than 0.3 feet) during purging, and water quality parameters did not stabilize, so groundwater samples were collected after three well volumes were purged. Monitoring well V-MW01 was redeveloped using a purge/surge cycle with deionized water and was sampled the following day when the well recovered to over 80 percent (%) of well volume.

2.5 Groundwater Sampling Results

On 30 August and 31 August groundwater samples were collected from Site SO001 from monitoring wells V-MW01, V-MW03, and V-MW06 and analyzed for DRO only. Analytical results were compared to the ADEC Table C cleanup level for DRO (1.5 mg/L; ADEC 2023). DRO concentrations from all wells were non-detect.

2.6 Investigation Derived Waste

Purge water was filtered through a 5-gallon granulated activated carbon treatment system, visually inspected to confirm that no sheen was present, then discharged at a distance greater than 100 feet away from the nearest surface water body. General refuse (e.g., paper towels, nitrile gloves) was disposed at a facility in town.

2.7 Work Plan Deviations

The following deviations from the Work Plan occurred:

- An equipment blank was not collected due to an oversight; however, all DRO results were non-detect and usability was not impacted.
- Monitoring wells V-MW01 and V-MW06 were not trimmed due to an oversight.

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3.0 DATA QUALITY REVIEW

A total of 4 groundwater samples, including 1 field duplicate (FD), were collected, and analyzed. The project-required frequency of one FD for every 10 or fewer primary samples, per analyte, per matrix, was met. The sample summary table in Chemical Data Quality Control Report (CDQR; Appendix D) includes all field samples submitted to the analytical laboratory.

Matrix spike (MS)/matrix spike duplicates (MSDs) were collected and submitted to the laboratory at the project-required frequency of one set for every 20 or fewer project samples (5%) and one for every preparatory batch (designated MS/MSD samples were included with each shipment). A trip blank was not required since no volatile analyses were submitted. An equipment blank was not collected due to an oversight; however, all DRO results were ND and usability was not impacted.

All samples were shipped to Nashville, TN, via Alaska Airlines Goldstreak where they were picked up by a lab-designated courier and transported to Pace Analytical in Mt. Juliet, TN. The cooler was received with temperature blank and ambient cooler temperatures between 0 and 6 °C at 3.0°C. No discrepancies were noted at receipt at the lab, and all samples were received in good condition.

All samples were extracted and/or analyzed within the recommended holding times and were properly preserved for the analytical procedures used.

Sample LOQs and LODs for non-detects were compared to the project screening levels (PSLs) to determine whether the laboratory data met the acceptance criteria for sensitivity. The PSLs for soil samples were defined as the ADEC 18 AAC 75 Table C Groundwater cleanup levels (ADEC 2023). All reported limits of detection for non-detect results met the acceptance criteria for sensitivity.

The quality of the project data was acceptable; however, completeness goals (95%) were met. One AK102 result out of the 5 was qualified as estimated and flagged X due to a surrogate recovery less than the lower cutoff limit of 10%. However, this result is consistent with historical data and the parent sample. Therefore, the data are considered usable, and the X flag was amended to QL.

Qualified data are considered acceptable for use with the limitations discussed within the CDQR report and the ADEC Laboratory Data Review Checklists regarding the qualifiers applied to the results.

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4.0 PERFORMANCE MODEL/STATISTICAL TREND ANALYSIS

As the intent of the ORC is to advance site cleanup, this section presents the following items to assess remedy progress for SO001:

- Updated Conceptual Site Model (CSM)
- Predicted Degradation Curve/Statistical Trend Analysis

The purpose of the RA-O activities for Site SO001 is to characterize concentrations of COCs in groundwater for comparison to DD levels and determine concentration trends.

4.1 Updated CSM

A site-specific CSM for SO001 was developed for the work plan in accordance with *ADEC Guidance on Developing Conceptual Site Models* (ADEC 2017). Following 2022 field activities there were no changes made to the CSM.

4.1.1 Geology and Soil

Subsurface lithology at the North River RRS consists mostly of sandy and gravel of sedimentary and metasedimentary bedrock ranging from 3 to 15 feet bgs. Although it has been reported that discontinuous permafrost exists in the area, it has not been encountered during previous investigation and remediation activities at the site (USACE 2019).

4.1.2 Hydrogeology

The depth to the water table fluctuates between 4 and 11 feet bgs at Site SO001, although it has been encountered as shallow as 2 feet bgs. No seeps or surface water were observed to be present at the site prior to beginning excavation activities, so it is not likely that contamination from the site is migrating off site. Groundwater in the area is not currently used as drinking water. The source of drinking water for the nearest village of Unalakleet is located outside of the Unalakleet River Basin and is not affected by any contamination present at the North River RRS (USAF 2010).

4.1.3 Nature and Extent of Contamination

Site SO001 historically consisted of the vehicle maintenance building, a temporary dormitory, and a 500-gallon underground storage tank. A 4-inch floor drain was present in the vehicle maintenance building that led to an outfall. In 1995, the facilities were demolished and much of the building debris was placed in a permitted and closed construction/demolition landfill constructed at Site OT001.

Historical site activities have led to spills and leaks at the site, which contaminated the soil with POL constituents. In 2015, excavation of POL-contaminated soil began and was completed in 2018.

The primary COCs in soil are GRO, DRO, and POL constituents. The primary COC in groundwater is DRO. Excavation confirmation samples collected in 2018 indicate the extent of soil contamination has been excavated. All groundwater sample results were below the ADEC Table C cleanup level for DRO.

4.1.4 Exposure Pathways and Receptors

Impacted media at the site include soil and groundwater. Complete pathways for soil include incidental soil ingestion and dermal absorption by current and future construction workers; subsistence harvesters;

subsistence consumers; site visitors, trespassers, or recreational users; and wildlife, as well as future residents and commercial or industrial workers.

Complete pathways for groundwater include incidental ingestion and dermal absorption by future residents; commercial or industrial workers; and construction workers; however, this pathway is considered insignificant as concentrations of DRO are below the ADEC Table C cleanup level.

Inhalation of outdoor air is a complete pathway for future residents and commercial or industrial workers, as well as current and future site visitors, trespassers, or recreational users; construction workers; and subsistence harvesters.

4.2 Statistical Trend Analysis

In 2015 and 2016, groundwater samples were collected from monitoring wells V-MW01, V-MW03, and V-MW06 and analyzed for DRO. All results were below the ADEC Table C cleanup level (1.5 mg/L). From 2018 through 2021, monitoring well V-MW01 has been dry and only monitoring wells V-MW03 and V-MW06 have been sampled. Analytical concentrations for DRO from both wells were below the ADEC Table C cleanup level for all events from 2018 through 2021. All three wells were sampled in 2022 and results were less below the ADEC Table C cleanup level.

To evaluate the potential impacts and effectiveness of the remedy at SO001, DRO concentrations from V-MW03 and V-MW06 were analyzed using the Mann-Kendall test to identify statistically significant increasing or decreasing concentration trends. Well V-MW01 does not currently have enough data for the Mann-Kendall test. For the analysis, a significance value of 0.05 was selected as the threshold for statistical significance, which corresponds to 95% confidence. The remedy for SO001 was implemented in 2015; therefore, data used in the analysis were restricted to the period from 2015 onwards to isolate potential changes caused by the remedy, with the 2015 results serving as a baseline. The current and historical DRO results for the wells are presented in Table 3.

Table 3 SO001 Historical DRO Results

WELL ID	2015	2016	2017	2018	2019	2020	2021	2022
V-MW01	-	0.13 J, JS-	-	-	-	-	-	ND [0.40] QL
V-MW03	0.35 J	0.24 J, JM-	-	0.43 JT, J, B	0.53 J1	0.52 J	ND [0.2]	ND [0.42] QL
V-MW06	ND [0.11]	0.09 J, JM-	-	0.084 J	ND [0.11]	ND [0.40]	ND [0.2]	ND [0.40]

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
- Not Sampled
B – The analyte was detected in the method blank.
J – The analyte was positively identified, but the associated result was less than the LOQ but greater than or equal to the DL.
J1 – The result is estimated due to discrepancies in QC criteria.
JM- – The result is estimated, biased low, because the analyte recovery was less than the LCL in the MS or MSD samples.
JS- – The result is estimated, biased low, because the surrogate recovery was less than the LCL.
JT – The result is estimated due to elevated cooler temperatures.
QL – The result is an estimated value, bias low due to a QC failure.
Red, bold indicates the result is above the ADEC Table C cleanup level (1.5 mg/L).
V-MW01 not sampled 2017-2021 due to low recharge.

Table 4 SO001 Statistical Trend Analysis Summary (2015-2022)

MONITORING WELL	NUMBER OF SAMPLE EVENTS EVALUATED (n)	DATE RANGE OF SAMPLE EVENTS	DRO			
			MOST RECENT CONCENTRATION (mg/L)	MANN-KENDALL STATISTIC (S)	P-VALUE	TREND
V-MW03	7	2015-2022	0.42	-4	0.649	No Trend
V-MW06	7	2015-2022	0.40	-7	0.127	No Trend

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

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5.0 SUMMARY AND RECOMMENDATIONS

5.1 Summary

On 30 August and 31 August 2022, the annual North River RRS RA-O/LTM events for sites SO001, SS001, and SS003 took place. The inspections consisted of visual inspection, completion of a visual inspection checklist, and photo documentation for each site and groundwater monitoring and sampling at site SO001. Visual inspection results noted that all site conditions were largely unchanged from the previous year's inspections.

At the time of the inspection, the previously reported open excavation had been filled at SO001. The groundwater monitoring well inspections indicated that the wells were in good condition; however, the inner casing of V-MW01 was frost jacked and the well was not secure. Analytical results for DRO for monitoring wells V-MW01, V-MW03, and V-MW06 were non-detect.

At SS001, an IC/LUC sign was installed along the northwest boundary facing the access road. Orange construction fencing was observed around the monitoring well stickups; previously reported fencing around the excavation site had been removed. No evidence of trespass, unauthorized excavation, or groundwater use was observed.

At SS003, an IC/LUC sign was installed on the west boundary facing the access road. No evidence of unauthorized excavation or groundwater use was observed.

5.2 Recommendations

At SO001, it is recommended that groundwater monitoring continues to evaluate the effectiveness of previous remedial activities. As recommended in the 2021 report, it is recommended that the inner casing of monitoring wells V-MW01 and V-MW06 be trimmed in order to secure the well and the existing lock replaced since these activities were not completed in 2022 due to an oversight. Also, as recommended in the 2021 report, it is recommended that IC signage be installed at Site SO001.

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6.0 REFERENCES

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AFCEC. 2021b. *Draft 2020 Remedial Action Operations, Institutional Control/Land Use Control Report, North River Radio Relay Station, Alaska, SO001, SS001, and SS003.* March.

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FIGURES

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1 INCH

N

APPROXIMATE LOCATION OF ROAD EROSION

VICINITY OF NORTH RIVER RADIO RELAY STATION SITES

UNALAKLEET

REMEDIAL ACTION-OPERATION AND LONG-TERM MANAGEMENT REPORT

NORTH RIVER RADIO RELAY STATION, ALASKA

SITE LOCATION AND VICINITY MAP

Legend

- Site Access Road
- Site Boundary

Notes

1. For conceptual purposes only. All locations are approximate.

References

1. Imagery source: Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 7, US SURVEY FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

4,000 2,000 0 4,000 8,000

Feet

PROJECT No.:	DATE:	FIGURE:
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P.M.: M.O.	DRAWN: T.A.	

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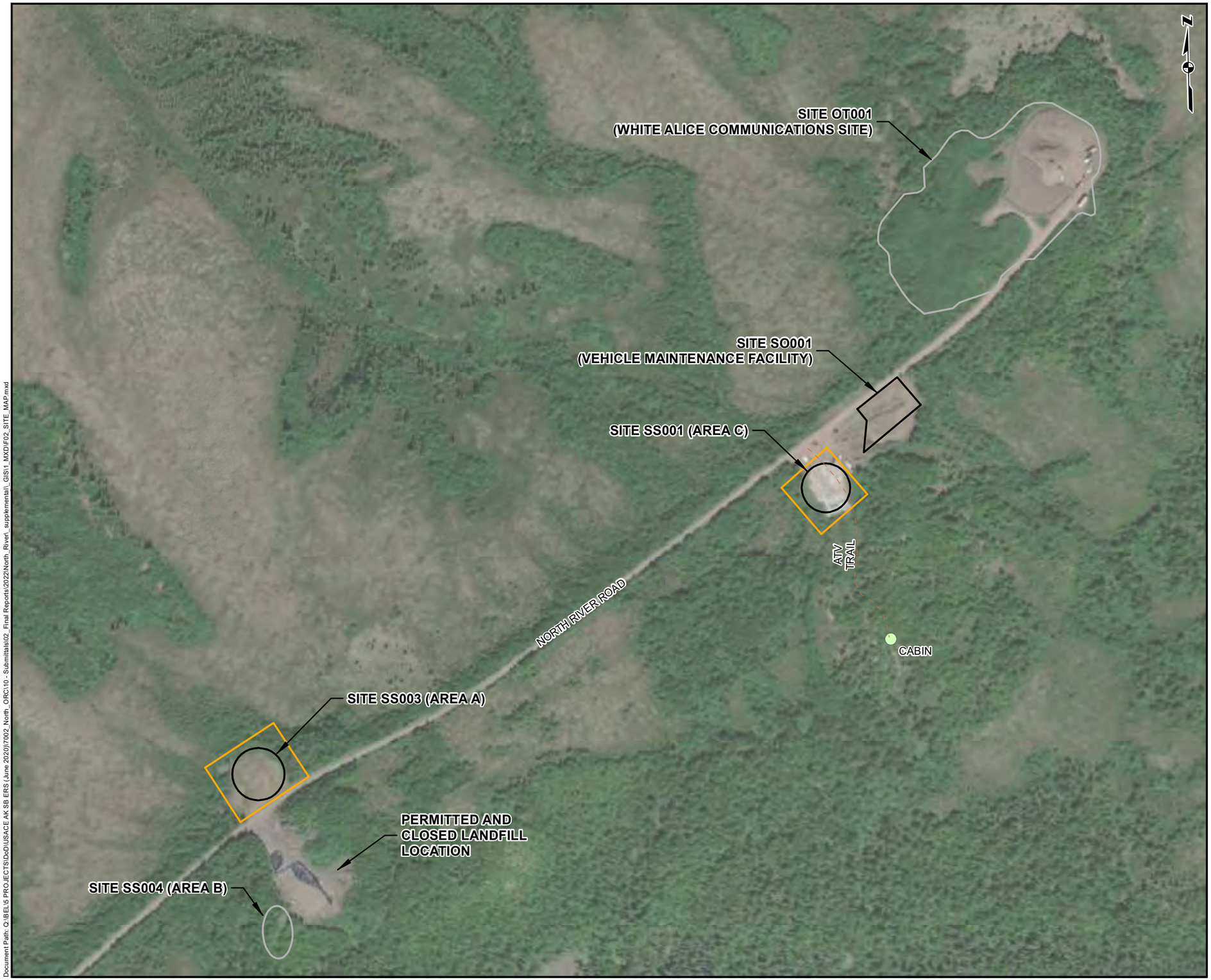
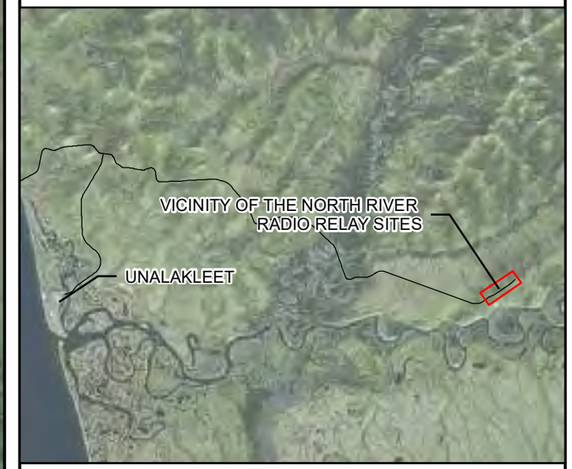


REMEDIAL ACTION-OPERATION AND LONG-TERM MANAGEMENT REPORT

NORTH RIVER RADIO RELAY STATION, ALASKA

PROJECT SITES



Legend

- ATV Trail
- Inactive Site Boundaries
- Active Site Boundaries
- LUC Boundaries
- Area of Interest

Abbreviations

LUC land use control

Notes

1. For conceptual purposes only. All locations are approximate.
2. Map produced using ESRI ArcMap v. 10.7.

References

1. Imagery source: Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Source of site features: Jacobs Engineering Group and Eagle Eye Electric, 2019. *2018 Site Activities Report. Unalakleet, Alaska.* April.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 7, US SURVEY FEET
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Feet

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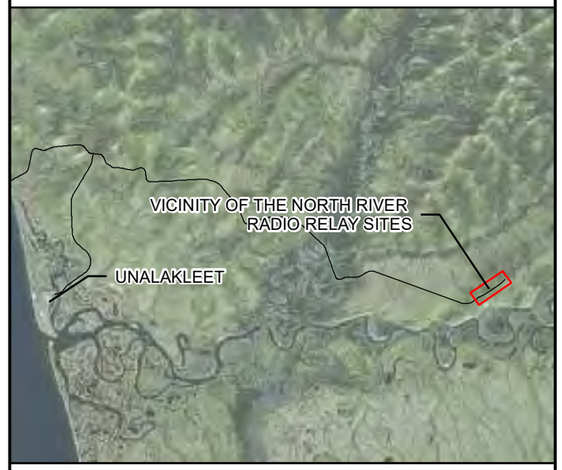
REMEDIAL ACTION-OPERATION AND LONG-TERM MANAGEMENT REPORT

NORTH RIVER RADIO RELAY STATION, ALASKA

SITE SO001 (VEHICLE MAINTENANCE FACILITY)



Legend

- Monitoring Well
- ATV Trail
- Active Site Boundaries
- Previous Excavation
- Former Landfarm
- LUC Boundaries

Abbreviations

LUC land use control

Notes

1. For conceptual purposes only. All locations are approximate.
2. Map produced using ESRI ArcMap v. 10.7.

References

1. Imagery source: Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Source of site features: Jacobs Engineering Group and Eagle Eye Electric, 2019. *2018 Site Activities Report. Unalakleet, Alaska*. April.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 7, US SURVEY FEET
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Feet

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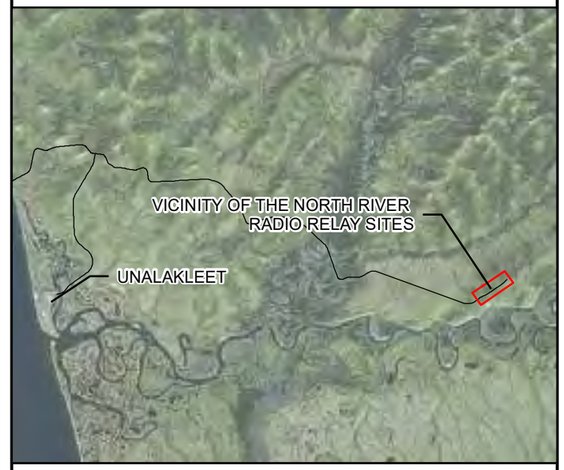
REMEDIAL ACTION-OPERATION AND LONG-TERM MANAGEMENT REPORT
NORTH RIVER RADIO RELAY STATION, ALASKA

SITE SS001 (AREA C)



Legend

- ATV Trail
- Active Site Boundaries
- Previous Excavation
- Site Boundaries
- Former Landfarm
- LUC Boundaries

Abbreviations

LUC land use control

Notes

1. For conceptual purposes only. All locations are approximate.
2. Map produced using ESRI ArcMap v. 10.7.

References

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2. Source of site features: Jacobs Engineering Group and Eagle Eye Electric, 2019. *2018 Site Activities Report. Unalakleet, Alaska.* April.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 7, US SURVEY FEET
HORIZONAL DATUM: NAD83 (2011)| VERTICAL DATUM: NAVD88

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Feet

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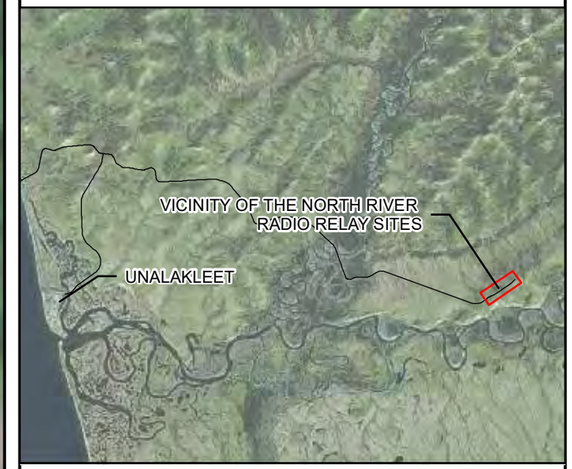
SITE SS003 (AREA A)

NORTH RIVER ROAD

REMEDIAL ACTION-OPERATION AND LONG-TERM MANAGEMENT REPORT

NORTH RIVER RADIO RELAY STATION, ALASKA

SITE SS003 (AREA A)



Legend

- Site Boundaries
- LUC Boundaries

Abbreviations

LUC land use control

Notes

1. For conceptual purposes only. All locations are approximate.
2. Map produced using ESRI ArcMap v. 10.7.

References

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2. Source of site features: Jacobs Engineering Group and Eagle Eye Electric, 2019. *2018 Site Activities Report. Unalakleet, Alaska.* April.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 7, US SURVEY FEET
HORIZONAL DATUM: NAD83 (2011)| VERTICAL DATUM: NAVD88

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Feet

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APPENDIX A
FIELD NOTES

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Rite in the Rain®

ALL-WEATHER

ENVIRONMENTAL

№ 550F

WNTF

NORTH RIVER

30

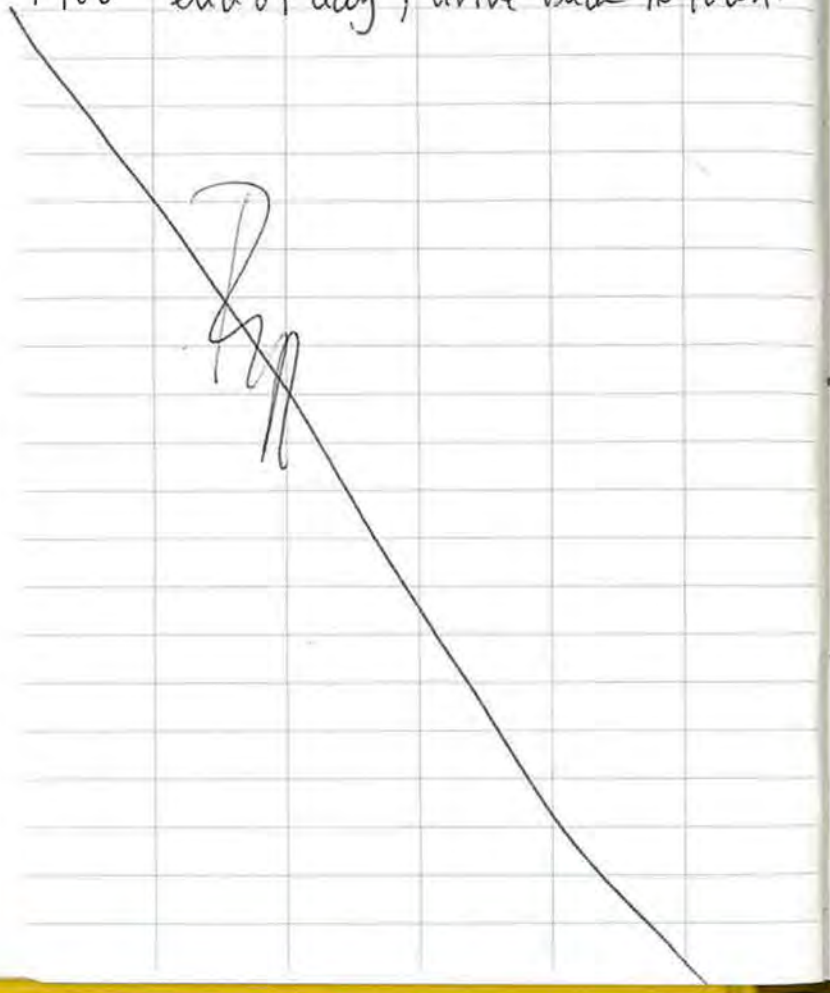
Location North River RRS Date 8/30/22

Project / Client USACE

1800 Begin install of LUC sign @ site SS001

1935 Begin install of LUC sign @ site SS003.

1900 End of day, drive back to town.



31

Location North River RRS / WNTF Date 8.31-22

Project / Client USACE

Wx: overcast, light rain, ~ 45°

0900 Work on pump controller

1000 Pump working again, headed to site to GW sample, cal. AquaTroll

1030 @ V-MW01

1045 Collect 22NRRS-V-MW01 - DRO

1046 Collect 22NRRS-V-MW019 - DRO

1050 @ V-MW03

1135 Collect 22NRRS-V-MW03 - DRO - MS/MSD

1150 @ V-MW06

1210 Collect 22NRRS-V-MW06 - DRO

1230 Finished decon & breakdown, head to town to pick up for the afternoon flight

1400 Settle hotel bill, gas up & head to airport

1900 Land in Nome

1940 @ PZ-3R

1950 Collect 22ST001-R1-PZ3R - VOC, DRO

APPENDIX B
FIELD FORMS

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VISUAL INSPECTION CHECKLIST

NAME OF LANDFILL / SITE: SO 001 North River RCS
NAME OF INSPECTOR / DATE: M. Williams, Rebecca Reyes
WEATHER CONDITIONS / TEMPERATURE (°F) Cloudy, 50°F

MONITORING ITEM	Y	N	NOTES
LUC Signs in place?		X	
Monitoring Well Condition *See also monitoring well sampling sheet*			Well ID (Good, Fair, Poor) See Well Inspection forms
Evidence of settlement within or on surface of landfill?		X	
Ponded water within, against, or on surface of landfill?	X		Small pools throughout < 10ft across
Evidence of surface erosion on disposal area walls or on exterior berms?			
Erosion of access roads?	X		Significant erosion on road
Discoloring of vegetation downslope?		X	
Any evidence of leakage or escape of waste from cells?		X	
Airborne ash or dust particles?		X	
Evidence of wildlife or birds present? Include number and type of birds on site.		X	
Windblown litter in cells or along access roads?		X	
Landfill odors?		X	
Fire or combustion in the waste?		X	
Evidence of trespass or inconsistent site usage?		X	Road is used by locals
Damage to the structural integrity of a dike wall, culvert, or erosion control?		X	None
Is revegetation occurring?	X		Cap appears to have been hydroseeded.
Estimated Percent Vegetative Cover: On cap surface: 50%. On sideslopes: N/A Comments:			

GENERAL COMMENTS: Site Recently remediated, grass growing, monitoring Wells covered in high-vis netting since construction. Caps were found removed from wells.

CORRECTIVE ACTION TAKEN: Put caps back on. Unable to lock them due to damage

VISUAL INSPECTION CHECKLIST

NAME OF LANDFILL / SITE: North Rivers RRS SS001
NAME OF INSPECTOR / DATE: M. Williams R. Reyes
WEATHER CONDITIONS / TEMPERATURE (°F) cloudy, 50°F

MONITORING ITEM	Y	N	NOTES
LUC Signs in place?		X	Put LUC sign in place
Monitoring Well Condition *See also monitoring well sampling sheet* ✓			Well ID (Good, Fair, Poor) see monitoring well form
Evidence of settlement within or on surface of landfill?		X	
Ponded water within, against, or on surface of landfill?	X		small ponds present by Road.
Evidence of surface erosion on disposal area walls or on exterior berms?		X	
Erosion of access roads?	X		Significantly eroded
Discoloring of vegetation downslope?		X	
Any evidence of leakage or escape of waste from cells?		X	
Airborne ash or dust particles?		X	
Evidence of wildlife or birds present? Include number and type of birds on site.		X	
Windblown litter in cells or along access roads?		X	
Landfill odors?		X	
Fire or combustion in the waste?		X	
Evidence of trespass or inconsistent site usage?		X	locals use access road
Damage to the structural integrity of a dike wall, culvert, or erosion control?	X		Liner exposed on cap surface
Is revegetation occurring?	X		
Estimated Percent Vegetative Cover: On cap surface: 30%. On sideslopes: N/A Comments:			

GENERAL COMMENTS: Monitoring wells covered in high-visibility netting, caps on and locked. Liner exposed in two small areas appears to be less than 1ft each

CORRECTIVE ACTION TAKEN: N/A placed LUC sign on site.

VISUAL INSPECTION CHECKLIST

NAME OF LANDFILL / SITE: North River RRS 55003
NAME OF INSPECTOR / DATE: M. Williams, R. Reyes
WEATHER CONDITIONS / TEMPERATURE (°F) Cloudy, 50°

MONITORING ITEM	Y	N	NOTES
LUC Signs in place?		X	Installed
Monitoring Well Condition *See also monitoring well sampling sheet*			Well ID (Good, Fair, Poor) no wells
Evidence of settlement within or on surface of landfill?		X	
Ponded water within, against, or on surface of landfill?		X	
Evidence of surface erosion on disposal area walls or on exterior berms?		X	
Erosion of access roads?	X		
Discoloring of vegetation downslope?		X	
Any evidence of leakage or escape of waste from cells?		X	
Airborne ash or dust particles?		X	
Evidence of wildlife or birds present? Include number and type of birds on site.		X	
Windblown litter in cells or along access roads?	X		Small pieces of plastic
Landfill odors?		X	
Fire or combustion in the waste?		X	
Evidence of trespass or inconsistent site usage?		X	
Damage to the structural integrity of a dike wall, culvert, or erosion control?		X	
Is revegetation occurring?	X		
Estimated Percent Vegetative Cover: On cap surface: 99% On sideslopes: 99% Comments:			

GENERAL COMMENTS: Site condition appears unchanged. LUC Sign Installed

CORRECTIVE ACTION TAKEN: LUC sign installed

MONITORING WELL INSPECTION CHECKLIST

NAME OF SITE: North River RRS
NAME OF INSPECTOR: M. Williams, Rebecca Reyes
WEATHER CONDITIONS / TEMPERATURE (°F) Rain, 50°F

WELL-ID: MW-01
WELL TYPE: PVC - 2inch
DATE/TIME: 08/30/22, 1230

INSPECTION ITEMS			
WELL IDENTIFICATION	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Is the well number or ID clearly legible?	X		
Is the well identification correct?	X		
Does the outermost casing have a lockable cap or lid?	X	X	Lockable Cap broken
Is the lock present?	X	X	not able to be attached
If flush mounted, is the cap lockable (and locked) or is a lock applied to the well plug?			N/A
If flush mounted, are all of the bolts present to secure the lid?			N/A
INNER WELL CASING	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Is the inner or outer casing corroded, bent, dent, cracked, or frost jacked?	X	X	Inner casing jacked above protective casing. cannot close lid.
Has the well casing sustained vehicular or other damage?		X	
Is the inner or outer casing loose (annular seal problem)?		X	Needs gravel in protective casing
If flush mounted, is the gasket seal in good condition?			N/A
DOWNHOLE CONDITION	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Is dedicated sampling equipment present in the well?	X		
Is a reference point clearly marked on the top of casing or top of well cap?	X		
What is the measured depth of the well from top of casing (reference mark)?			11.76
Do any obstructions occur within the well (comment on ice or other obstruction)?		X	
Is the bottom of the well soft (mud on the measurement line)?		X	
OUTER STRUCTURES	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Are the protective posts damaged?		X	
Do the protective posts require painting for visibility?		X	
Is a concrete pad installed?	X		
Is the concrete pad cracked or deteriorated?		X	
Does the pad slope away from the casing?	X		
WELL ACCESS	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Is the well safely accessible?	X		
Does the access road or general area require weed-eating, mowing, additional gravel or other maintenance?		X	
Does accessing the well require special access considerations (e.g., within other restricted/specially authorized areas)?		X	

MONITORING WELL INSPECTION CHECKLIST

NAME OF SITE: North River RRS
NAME OF INSPECTOR: RR | MW
WEATHER CONDITIONS / TEMPERATURE (°F) 50°, overcast

WELL-ID: V-MW03
WELL TYPE: 2" PVC
DATE/TIME: 8/30/22 @ 1735

INSPECTION ITEMS			
WELL IDENTIFICATION	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Is the well number or ID clearly legible?	X		under royar cap
Is the well identification correct?	X		
Does the outermost casing have a lockable cap or lid?	X		
Is the lock present?	X		
If flush mounted, is the cap lockable (and locked) or is a lock applied to the well plug?		NA	
If flush mounted, are all of the bolts present to secure the lid?		NA	
INNER WELL CASING	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Is the inner or outer casing corroded, bent, dent, cracked, or frost jacked?		X	cap still locks on but slight jacking has occurred
Has the well casing sustained vehicular or other damage?		X	
Is the inner or outer casing loose (annular seal problem)?		X	could use pea gravel in pro casing annulus
If flush mounted, is the gasket seal in good condition?		NA	
DOWNHOLE CONDITION	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Is dedicated sampling equipment present in the well?	X		
Is a reference point clearly marked on the top of casing or top of well cap?	X		
What is the measured depth of the well from top of casing (reference mark)?			11.13' BTOC
Do any obstructions occur within the well (comment on ice or other obstruction)?		X	
Is the bottom of the well soft (mud on the measurement line)?		X	
OUTER STRUCTURES	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Are the protective posts damaged?		X	
Do the protective posts require painting for visibility?	X		
Is a concrete pad installed?	X		
Is the concrete pad cracked or deteriorated?		X	
Does the pad slope away from the casing?	X		
WELL ACCESS	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Is the well safely accessible?	X		
Does the access road or general area require weed-eating, mowing, additional gravel or other maintenance?		X	road near bridge is being washed away by the river, a few miles away
Does accessing the well require special access considerations (e.g., within other restricted/specially authorized areas)?		X	

MONITORING WELL INSPECTION CHECKLIST

NAME OF SITE: North River RRS
NAME OF INSPECTOR: R. Reyes / M. Williams
WEATHER CONDITIONS / TEMPERATURE (°F): 50°F, 10-15 wind overcast
WELL-ID: V-MW06
WELL TYPE: 2" PVC
DATE/TIME: 8/30/22 @ 1710

INSPECTION ITEMS			
WELL IDENTIFICATION	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Is the well number or ID clearly legible?	X		written on silver royar cap for J-plug
Is the well identification correct?	X		
Does the outermost casing have a lockable cap or lid?	X		does not fit on through due to jacking PVC
Is the lock present?	X		
If flush mounted, is the cap lockable (and locked) or is a lock applied to the well plug?		NA	
If flush mounted, are all of the bolts present to secure the lid?		NA	
INNER WELL CASING	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Is the inner or outer casing corroded, bent, dent, cracked, or frost jacked?	X		PVC jacked above pro. casing
Has the well casing sustained vehicular or other damage?		Y	
Is the inner or outer casing loose (annular seal problem)?			PVC loose in pro. casing due to no pea gravel present in annulus
If flush mounted, is the gasket seal in good condition?		NA	
DOWNHOLE CONDITION	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Is dedicated sampling equipment present in the well?	X		
Is a reference point clearly marked on the top of casing or top of well cap?	X		
What is the measured depth of the well from top of casing (reference mark)?			16.85' BTOC
Do any obstructions occur within the well (comment on ice or other obstruction)?		X	
Is the bottom of the well soft (mud on the measurement line)?		X	
OUTER STRUCTURES	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Are the protective posts damaged?		X	
Do the protective posts require painting for visibility?		X	wrapped in high viz fencing
Is a concrete pad installed?	X		but buried under large rocks, likely from construction crew
Is the concrete pad cracked or deteriorated?			unknown due to build up of rock & soil
Does the pad slope away from the casing?			unknown due to build up of rock & soil
WELL ACCESS	**Y**	**N**	**NOTES/PHOTOGRAPHS**
Is the well safely accessible?	X		
Does the access road or general area require weed-eating, mowing, additional gravel or other maintenance?		X	
Does accessing the well require special access considerations (e.g., within other restricted/specially authorized areas)?		X	road erosion occurring near North River a few miles away

WELL DEVELOPMENT FORM

WELL ID: V-MW01

Project Name:	NRRS	Total Depth (BTOC):	11.76
Project Number:	700261	Depth to Water (BTOC):	9.86
Sampling Team:	R. Reyes / M. Williams	Water Column (ft):	1.90
Date:	8/30/22	Casing Volume (gal):	0.31 (x3 = 0.93)
Start Time:	1235	Screen Interval:	—
End Time:	1315	Measured Stick-up:	4"
Depth to Top of Product (BTOC):	—	Depth to Oil/Water Interface (BTOC):	—

Diameter	Volume (gal/lin ft)
1"	0.041
2"	0.163
3"	0.367
4"	0.653
8"	2.61

Method of Purging (circle one):

Pump: (SUB) BLDR PERIST OTHER:

Pump Type: Mini Monsoon Flow Rate (gpm): —

Pump Time: varies per purge

Bailer: TEFLON SS OTHER:

Required Pulls:

Vol. Purged (gal):

WELL DEVELOPMENT DATA

Activity (surge, purge, recovery)	Time	Water Level (ft BTOC)	Drawdown (ft BTOC)	Cumulative Purged Volume (gal)	Turbidity (NTU)	Notes (clarity, odor, color, particulates, etc)
Purge	1240	10.66	-0.8	0.25	>1000	Brown, v. turbid, no odor
Add DI	1245	9.55	+0.31	—	—	Add 0.3 gal.
Surge	1250	9.59	+0.27	—	—	—
Purge	1255	10.80	-0.94	0.55	>1000	Brown, v. turbid, no odor
Add DI	1300	9.10	-0.76	—	—	Add 0.2 gal
Surge	1305	9.20	0.66	—	—	—
Purge	1310	10.67	-0.81	1.0	>1000	Brown, v. turbid, no odor
Recovery						

Note: Well is developed when 1) GW is clear to the unaided eye, **or** 2) turbidity is <100 NTU, **or** 3) TD is re-established due to sediment removal, **or** 4) 3 GW parameters have stabilized (4, if using temperature).

If well can be purged dry: first purge well dry, then allow to refill with formation water. If recovery rate is too slow, add up to one well casing volume of potable water. With water in well, surge for approximately 10 minutes. Add more water, as necessary. Purge well dry again to complete the development process.

The goal of well development is to repair damage caused during drilling and well implacement to the area immediately adjacent to the well to ensure proper hydraulic connection to the aquifer.

Comments:

Redeveloped well 8/30, sampled well 8/31.
↳ GW still v. turbid after redevelopment.

References: ADEC, 2013. Monitoring Well Guidance, September.
ASTM D5521, 2018. Standard Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers. ASTM International

GROUNDWATER SAMPLING DATA FORM

Well ID: V-MW01

Project Name:	North Gate RRS	Date:	8-31-22
Project Number:	700261	Start Time:	1035
Sampling Team:	RR/MW	End Time:	1045
Sample ID:	22NRRS-V-MW01	Time:	1045 (primary) dup other: —
Sample ID:	22NRRS-V-MW019	Time:	1046 primary (dup) other: —
Sample ID:	—	Time:	— primary dup other: —
Depth to Top of Product (BTOC):	—	Total Depth (BTOC):	11.76
Depth to Oil/Water Interface (BTOC):	—	Depth to Water (BTOC)	9.94
Casing Diameter: / *gal/ft of casing:*	*1 in.* 0.041 / *2 in.* 0.163 / *4 in.* 0.653	Water Column (ft)	1.82
		Casing Volume (gal)	0.3
Pump Intake Depth:	10.7	Screen Interval	—
Stable DTW (BTOC):	—	Measured Stick-up	4

Method of Purging (circle one):

Pump: (SUB) BLDR PERIST OTHER:

Pump Type: submersible Flow Rate (gpm): —

Pump Time: ~10 min

Bailer: TEFLON SS OTHER:

Required Pulls: Bailer Vol. (gal): 0.25 / 0.33

Vol. Purged (gal):

WELL STABILIZATION DATA

Time	Total Volume Purged (gallons)	Water Level (ft BTOC)	Draw Down	Temp. (°F or °C)	pH	Conductivity (µS/cm)	ORP (mV)	D.O. (mg/L)	Turbidity (NTU)
				± 3%	± 0.1	± 3%	± 10mV	± 10%	± 10% or <10 NTU

Notes: Drawdown should be less than 0.3 feet from the original DTW. Minimal drawdown achieved and measured by: 1) pumping at a low rate (approx. 1 liter/3 minutes or 0.26 gallons/3 minutes or 50-500 mL/min) **and** 2) continually measuring water levels in the well.
Sample after 1) removing min. of 3 casing volumes **or** 2) min. of 3 parameters stabilize (4, if using temp.), **or** 3) for low yield wells, entire well casing is evacuated (ADEC, 2013).

Sensory Observations

Color: Clear, Amber, Tan, (Brown), Gray, Milky White, Other

Odor: None, Low, Medium, High, Very Strong, H2S, Fuel-Like, Chemical ?, Unknown

Turbidity: None, Low, Medium, High, (Very Turbid), Heavy Silts

Comments:

well redeveloped yesterday, no parameters necessary prior to sample collection

GROUNDWATER SAMPLING DATA FORM

Well ID: V-MW03

Project Name:	North River RRS	Date:	8-31-22
Project Number:	700261	Start Time:	1050
Sampling Team:	RR/MW	End Time:	1140
Sample ID:	22NRRS-V-MW03	Time: 1135	primary / dup / other: MS/MSD
Sample ID:	—	Time:	primary / dup / other: —
Sample ID:	—	Time:	primary / dup / other: —
Depth to Top of Product (BTOC):	—	Total Depth (BTOC):	11.14
Depth to Oil/Water Interface (BTOC):	—	Depth to Water (BTOC)	7.83
Casing Diameter:	*1 in.* / *2 in.* / *4 in.*	Water Column (ft)	3.31
gal/ft of casing:	*0.041* / *0.163* / *0.653*	Casing Volume (gal)	0.54 (x3 = 1.6)
Pump Intake Depth:	9.5	Screen Interval	—
Stable DTW (BTOC):	—	Measured Stick-up	3.5

Method of Purging (circle one):

Pump: SUB BLDR PERIST OTHER:

Pump Type: Minimonsoon Flow Rate (gpm): 300mL/min

Pump Time: 1130

Bailer: ~~TEFLON~~ SS OTHER:

Required Pulls: Bailer Vol. (gal): 0.25 / 0.33

Vol. Purged (gal):

WELL STABILIZATION DATA

Time	Total Volume Purged (gallons)	Water Level (ft BTOC)	Draw Down	Temp. (°F or °C) ± 3%	pH ± 0.1	Conductivity (µS/cm) ± 3%	ORP (mV) ± 10mV	D.O. (mg/L) ± 10%	Turbidity (NTU) ± 10% or <10 NTU
1130	1.75	8.5		10.40	5.90	14.29	124.1	6.91	~~3.66~~ 3.65
1137	1.5	8.2		10.91	5.79	0.08	134.3	6.65	0.0
1174	1.25	8.4		10.09	5.85	0.08	133.2	4.64	~~365~~ 0.0

Notes: Drawdown should be less than 0.3 feet from the original DTW. Minimal drawdown achieved and measured by: 1) pumping at a low rate (approx. 1 liter/3 minutes or 0.26 gallons/3 minutes or 50-500 mL/min) **and** 2) continually measuring water levels in the well.
Sample after 1) removing min. of 3 casing volumes **or** 2) min. of 3 parameters stabilize (4, if using temp.), **or** 3) for low yield wells, entire well casing is evacuated (ADEC, 2013).

Sensory Observations

Color: Clear, Amber, Tan, Brown, Gray, Milky White, Other

Odor: None, Low, Medium, High, Very Strong, H2S, Fuel-Like, Chemical ?, Unknown

Turbidity: None, Low, Medium, High, Very Turbid, Heavy Silts

Comments:

drawdown unstable, sample collected once 3 x well volumes were removed purged dry ~2.3 gal total

2x500mL DRO only
Amb, HCl

GROUNDWATER SAMPLING DATA FORM

Well ID: V-MW06

Project Name:	North River RRS	Date:	8-31-22
Project Number:	700261	Start Time:	1150
Sampling Team:	RR/MW	End Time:	1215
Sample ID:	22NRRS-V-MW06	Time:	1210 (primary) dup other: —
Sample ID:	—	Time:	— primary dup other: —
Sample ID:	—	Time:	— primary dup other: —
Depth to Top of Product (BTOC):	—	Total Depth (BTOC):	16.89
Depth to Oil/Water Interface (BTOC):	—	Depth to Water (BTOC)	13.13
Casing Diameter: / *gal/ft of casing:*	*1 in.* 0.041 / *2 in.* 0.163 / *4 in.* 0.653	Water Column (ft)	3.76
		Casing Volume (gal)	0.6 (x3=1.8)
Pump Intake Depth:	15.2	Screen Interval	—
Stable DTW (BTOC):	13.8	Measured Stick-up	4'

Method of Purging (circle one):

Pump: (SUB) BLDR PERIST OTHER:

Pump Type: Min. Immersion Flow Rate (gpm): Varies, 500mL/min

Pump Time: 1155-

Bailer: ~~TEFLON~~ SS OTHER:

Required Pulls: Bailer Vol. (gal): ~~0.25~~ / 0.33

Vol. Purged (gal):

WELL STABILIZATION DATA

Time	Total Volume Purged (gallons)	Water Level (ft BTOC)	Draw Down	Temp. (°F or °C)	pH	Conductivity (µS/cm)	ORP (mV)	D.O. (mg/L)	Turbidity (NTU)
				± 3%	± 0.1	± 3%	± 10mV	± 10%	± 10% or <10 NTU
	1.0								
	1.5								

Notes: Drawdown should be less than 0.3 feet from the original DTW. Minimal drawdown achieved and measured by: 1) pumping at a low rate (approx. 1 liter/3 minutes or 0.26 gallons/3 minutes or 50-500 mL/min) **and** 2) continually measuring water levels in the well.
Sample after 1) removing min. of 3 casing volumes **or** 2) min. of 3 parameters stabilize (4, if using temp.), **or** 3) for low yield wells, entire well casing is evacuated (ADEC, 2013).

Sensory Observations

Color: Clear, Amber, (Tan), Brown, Gray, Milky White, Other

Odor: (None), Low, Medium, High, Very Strong, H2S, Fuel-Like, Chemical ?, Unknown

Turbidity: None, (Low), Medium, High, Very Turbid, Heavy Silts

Comments:

drawdown did not stabilize parameters collected but 3x well volume was removed (~2.5 gal total) so sample collected

Low-Flow Test Report:

Test Date / Time: 8/31/2022 11:35:13 AM
Project: North River RRS
Operator Name:

Location Name: V-MW03 **Initial Depth to Water: 7.83 ft**	**Estimated Total Volume Pumped: 2160 ml** **Flow Cell Volume: 130 ml** **Final Flow Rate: 360 ml/min** **Final Draw Down: 0 ft**	**Instrument Used: Aqua TROLL 500** **Serial Number: 793739**

Test Notes: Date and Time listed in table are incorrect. Parameters recorded at 3 minute increments on 31 August 2022.

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 0.3	
6/17/2021 9:22 PM	00:00	5.85 pH	10.09 °C	0.08 µS/cm	6.91 mg/L	0.00 NTU	133.2 mV	7.83 ft	360.00 ml/min
6/17/2021 9:25 PM	03:00	5.79 pH	10.91 °C	0.08 µS/cm	6.65 mg/L	0.00 NTU	134.3 mV	7.83 ft	360.00 ml/min
6/17/2021 9:28 PM	06:00	5.90 pH	10.40 °C	14.29 µS/cm	4.64 mg/L	368.50 NTU	124.1 mV	7.83 ft	360.00 ml/min

Samples

Sample ID:	Description:
22NRRS-V-MW03	Primary with a MS/MSD

Low-Flow Test Report:

Test Date / Time: 8/31/2022 12:10:38 PM
Project: North River RRS (2)
Operator Name:

Location Name: V-MW06	**Estimated Total Volume Pumped: 4307700 ml** **Flow Cell Volume: 130 ml** **Final Flow Rate: 500 ml/min**	**Instrument Used: Aqua TROLL 500** **Serial Number: 793739**

Test Notes: Date and Time listed in table are incorrect. Parameters recorded at 3 minute increments on 31 August 2022.

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 0.3	
6/17/2021 10:00 PM	00:00	6.34 pH	6.97 °C	0.08 µS/cm	8.39 mg/L	62.89 NTU	111.4 mV		500.00 ml/min
6/17/2021 10:03 PM	03:00	6.37 pH	5.68 °C	12.43 µS/cm	8.49 mg/L	645.28 NTU	111.1 mV		500.00 ml/min
6/17/2021 10:06 PM	06:00	6.32 pH	6.36 °C	0.09 µS/cm	8.31 mg/L	630.78 NTU	115.7 mV		500.00 ml/min
6/23/2021 9:36 PM	23:35:24	7.27 pH	17.19 °C	0.06 µS/cm	7.52 mg/L	308.22 NTU	108.6 mV		500.00 ml/min

Samples

Sample ID:	Description:
22NRRS-V-MW06	Primary sample

APPENDIX C
PHOTOGRAPH LOG

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Photograph 1: SO001, Monitoring well V-MW06 mounded soil and rock around casing, view West, 08302022

Photograph 2: SO001, Sampling monitoring well V-MW06, view northwest, 08302022

Photograph 3: SO001, Monitoring well V-MW03, view east, 08302022.

Photograph 4: SS001, IC/LUC sign installed, view southeast, 08302022

Photograph 5: SS003 IC/LUC sign installed, view north, 08302022

Photograph 6: SS003, View of site SS003, view west, 08302022

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APPENDIX D
CHEMICAL DATA QUALITY REVIEW AND ADEC CHECKLISTS

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
%	percent
%R	percent recovery
µg/L	micrograms per liter
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
Brice	Brice Engineering, LLC
CCV	continuing calibration verification
CDQR	chemical data quality review
CFR	Code of Federal Regulations
CoC	chain-of-custody
DL	detection limit
DoD	Department of Defense
DQO	data quality objective
DRO	diesel range organics
EB	equipment blank
EPA	U.S. Environmental Protection Agency
FD	field duplicate
GC	gas chromatography
ICV	initial calibration verification
LCL	lower control limit
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
MB	method blank
MS	matrix spike
MSD	matrix spike duplicate
ND	non-detect
Pace TN	Pace National, Mt. Juliet, Tennessee
PSL	project screening level
QA	quality assurance
QC	quality control
QSM	Quality Systems Manual
RPD	relative percent difference
SDG	sample delivery group
SOP	standard operating procedure
UCL	upper control limit

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1.0 INTRODUCTION

This quality assurance (QA)/quality control (QC) report summarizes the evaluation of laboratory data collected during remedial action-operation and long-term management activities at North River Radio Relay Site (RRS)/near Unalakleet, Alaska. These data have been reviewed to evaluate compliance with acceptance criteria based on data quality objectives (DQOs) specified in the approved *Final Work Plan Remedial Action-Operation and Long-Term Management, North River Radio Relay Site* (U.S. Air Force [USAF] 2021) hereafter referred to as the Work Plan.

This chemical data quality review (CDQR) includes the report narrative; a sample summary, including all samples collected and submitted to the laboratory for the associated sample delivery group (SDG) in Attachment D-1; complete analytical results presented in crosstab format in Attachment D-2; and the Alaska Department of Environmental Conservation (ADEC) Laboratory Data Review Checklists in Attachment D-3.

2.0 DATA VERIFICATION, DATA QUALITY REVIEW, AND QUALIFICATION

Pace Analytical in Mt. Juliet, Tennessee (Pace-TN) was the primary laboratory for this project. Pace-TN holds current ADEC laboratory approval and Department of Defense (DoD) Environmental Laboratory Accreditation Program certifications for all requested analyses, and chemical analyses for all parameters were performed in accordance with the DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.4 (DoD 2021a), hereafter referred to as the QSM. Samples were prepared and analyzed in accordance with analytical methods specified in *Test Methods for Evaluating Solid Waste SW-846* (U.S. Environmental Protection Agency [EPA] 2015); *Field Sampling Guidance* (ADEC 2022a); and laboratory standard operating procedures (SOPs).

An experienced QA chemist performed the data quality review and assessment independent of the analytical laboratory. This evaluation included completion of the ADEC Laboratory Data Review Checklist and review of analytical data including QC sample results, field and laboratory documentation, and all data submittals for each SDG. Groundwater analytical results were compared to project screening levels (PSLs), which were defined as the 18 Alaska Administrative Code (AAC) 75, Table C groundwater cleanup levels (ADEC 2021).

All project data were reviewed on an analytical-batch basis by assessing QC samples and associated field sample results. Data quality review and usability assessment were performed using the acceptance criteria defined in QSM (DoD 2021a); *Technical Memorandum 22-001, Guidelines for Data Reporting* (ADEC 2022b); *Data Validation Guidelines Module 1 for Organic Analysis by GC/MS* (DoD 2020), *Data Validation Guidelines Module 4 for Organic Analysis by GC* (DoD 2021b); specific method guidance, such as the ADEC *Underground Storage Tanks Procedures Manual* (ADEC 2017); *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium (SW-846)*, through Revision 7 (EPA 2018); and the laboratory SOPs, in that order.

The following information was reviewed as part of the data quality review and assessment:

- Sample handling and chain-of-custody (CoC)
- Sample preservation and holding time compliance

- Field QC samples, including field duplicates (FDs)
- Laboratory reporting limits, including limits of detection (LODs) and limits of quantitation (LOQs)
- Method blanks (MBs)
- Laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) recoveries
- Surrogate spike recoveries
- Matrix spike (MS) and matrix spike duplicate (MSD) recoveries
- Initial and continuing calibration summary information
- Internal standards performance (gas chromatography/mass spectrometry [GC/MS])
- Precision, including relative percent difference (RPD) values for duplicate analyses
- Case narrative review, laboratory flagging review, and other analytical method-specific criteria

The data quality review and assessment identified results requiring qualification and potential effects on data usability based on the acceptance criteria defined in the Work Plan. The following acceptance criteria were used for this data quality review and assessment:

- *Precision* is a measure of the reproducibility of measurements, which can be used to verify laboratory procedures, determine matrix effect, or sample homogeneity. Precision was measured by the RPD between LCS and LCSDs, MS and MSDs, or primary and FD results.
- *Accuracy* is a measure of the correctness or closeness to the true value. Accuracy was evaluated by reviewing the following elements: calibrations, surrogates, LCS, LCSD, MS, MSD, MBs, relative response factors and relative standard deviations (RSD), tune criteria, second column confirmations, and internal standards.
- *Representativeness* is a measure of the degree to which the samples reflect site characteristics. Representativeness was measured by reviewing sampling design, sampling procedures, sample documentation, holding times, and preservations.
- *Completeness* is a measure of the amount of valid data obtained compared to the amount that was expected to be obtained under correct, normal conditions. For completeness requirements, valid results were all results not rejected and determined to be usable in the context of the DQOs. Completeness was evaluated for each analytical method for a particular sampling event with respect to each DQO or end data use. The completeness goal is 95 percent (%) for this project.
- *Comparability* is a measure of the confidence with which one data set can be compared to another. The following were reviewed to ensure comparability: use of standard methods for sampling and analysis, reporting in standard units, operating instruments within calibrated ranges, and using standard and comprehensive reporting formats.
- *Sensitivity* is a measure of the ability of a method or instrument to detect the target analyte at the level of interest. The laboratory-specific limits were evaluated against the project PSLs to determine whether the analytical methods and/or laboratory procedures were able to meet the project DQOs.
- The qualifiers listed in Table 1 were applied to the analytical data set, as appropriate.

Table 1 Data Qualifiers

QUALIFIER	DESCRIPTION
ND [LOD]	The analyte was not detected and was reported as less than the LOD. The LOD has been adjusted for any dilution or concentration of the sample.
J	Analyte is considered an estimated value because the result is greater than or equal to the DL and less than the LOQ.
B	Analyte result is considered a high estimated value due to contamination present in an associated blank (e.g., MB or TB).
H	Analyte result is considered a low estimate due to a holding time exceedance.
QH/QL/QN	Analyte result is considered an estimated value biased (high, low, uncertain) due to a QC failure.
X	The sample results (including ND) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and acceptance criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.
R	Analyte result is rejected due to serious QC failures – result is not usable. *Note that R replaces the chemical result (no result shall be reported with an R flag).*

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

Qualification may not be required in the following circumstances:

- Surrogate or MS recoveries were outside QC limits, and dilution of the sample resulted in surrogate or spike dilution to a level beyond quantitation.
- MS recoveries were outside QC limits, and the spiked concentration was less than that of the parent sample.
- An analyte was detected in the associated blank, but there was no detection in the associated sample.
- MS/MSD or LCS/LCSD recoveries exceeded upper control limits (UCLs) and there was no detection in the sample(s).

Data quality exceptions that do not result in qualifications are not discussed in this report and are addressed in the associated ADEC Laboratory Data Review Checklists (Attachment D-3).

3.0 CHEMICAL DATA QUALITY REVIEW

The data verification and CDQR were performed to assess the overall quality and usability of the data collected to support sampling activities for North River RRS groundwater monitoring event.

Complete details for the review and evaluation of field samples and associated QC samples are included in this CDQR and in the ADEC Laboratory Data Review Checklists (Attachment D-3). During the data quality review, analytical results or recoveries that fell outside acceptance criteria were identified and qualifiers were applied to the results, where appropriate, in accordance with the project Work Plan. Qualified results are considered estimated, and whenever possible, direction of potential bias was assigned and effects on usability are discussed.

3.1 Analytical Sample and Field Quality Control Sample Summary

A total of 4 groundwater samples, including 1 FD, were collected and analyzed in support of project activities. The overall project-required frequency of one FD for every 10 or fewer primary samples, per analyte, per matrix, was met. The sample summary table in Attachment D-1 includes all field samples submitted to the analytical laboratory.

MS/MSDs were collected and submitted to the laboratory at the project-required frequency of one set for every 20 or fewer project samples (5%) and one for every preparatory batch (designated MS/MSD samples were included with each shipment).

An EB was not submitted due to an oversite; however, all sample results were non-detect.

A TB was not required as no volatile analyses were submitted with this SDG.

3.2 Sample Handling and Chain-of-Custody

CoC forms and laboratory case narratives were reviewed to assess sample handling procedures that may affect the integrity of the samples and quality of the resulting data. Copies of CoCs and cooler receipt forms are included in the final laboratory report. Samples were required to be maintained at 0 to 6 degrees Celsius (°C) following collection, during storage, and upon receipt at the laboratory.

Samples were packed with frozen gel packs in accordance with the Work Plan (USAF 2021) and the packaging and shipping SOP, BE-SOP-03 Labeling, Packaging, and Shipping Samples. All samples were shipped to Nashville, TN, via Alaska Airlines Goldstreak where they were picked up by a lab-designated courier and transported to the laboratory in Mt. Juliet, TN. The cooler was received with temperature blank and ambient cooler temperatures between 0 and 6 °C at 3.0°C.

No discrepancies were noted at receipt at the lab, and all samples were received in good condition.

3.3 Sample Preservation and Holding Time Compliance

All samples were extracted and/or analyzed within the recommended holding times and were properly preserved for the analytical procedures used for this project.

3.4 Sample Limits of Detection and Limits of Quantitation

Sample LOQs and LODs for non-detects (ND) were compared to PSLs to determine whether the laboratory data met the acceptance criteria for sensitivity. PSLs for soil samples were defined as the ADEC 18 AAC 75 Table C Groundwater cleanup levels (ADEC 2021). All reported LODs for ND results met acceptance criteria for sensitivity.

3.5 Analytical Methods

The following sections describe the results of the review and assessment of data for each analytical method. QC parameters met acceptance criteria and QSM criteria except where noted. A complete summary of qualified results is presented in Table 3, located at the end of this report.

3.5.1 Diesel Range Organics – ADEC Method AK102

3.5.1.1 Method Blank Analysis

An MB was included with each preparatory batch of 20 or fewer samples, as required. MB detections are indicative of laboratory cross-contamination. No target analytes were detected in the MBs.

3.5.1.2 Laboratory Control Sample/Laboratory Control Sample Duplicate Analysis

An LCS and LCSD were included with each preparatory batch, as required. LCS and LCSD %R and LCS/LCSD RPD were compared to the acceptance criteria. All LCS/LCSD recoveries were within method control limits and LCS/LCSD precision was within the RPD limit.

3.5.1.3 Matrix Spike/Matrix Spike Duplicate Analysis

MS/MSD samples were collected and submitted at the project-required frequency of one for each preparatory batch and one MS/MSD per 20 or fewer samples. MS and MSD samples were prepared and analyzed for each laboratory batch.

MS/MSD recoveries and MS/MSD RPD were compared to acceptance criteria and met the criteria with the following exceptions.

DRO recovery was less than the LCL of 75% in the MS/MSD (69.5%/61.8%) prepared from sample V-MW03. The ND result in the parent sample is qualified as estimated and flagged QL; The ND LOD was well below the PSL; therefore, data usability was not affected.

3.5.1.4 Surrogate Spike Recoveries

Surrogates were included with all laboratory QC and field samples, as required. Surrogate recoveries were reviewed and compared to method control limits. All surrogate recoveries were within method control limits for laboratory QC and field samples, except as noted below.

Surrogate o-terphenyl recovery was less than the LCL of 50% at 23.2% in sample V-MW01, and 5.24% in the FD V-MW019. The form I data pages indicate that a heavy emulsion was produced during extraction, contributing to the low recoveries (matrix interference). The ND result for V-MW01 is qualified as estimated and flagged QL. The ND result for V-MW019 is flagged X because the surrogate recovery is less than 10%. Usability is not significantly affected; however, the results are consistent between the two samples and with low or non-detect historical results in this well and the other two nearby wells and can be used for project decisions. The X flag was updated to QL.

3.5.1.5 Equipment Blank Analysis

An EB was not collected due to oversight. However, all DRO results were ND; therefore, usability was not impacted.

3.5.1.6 Initial Calibration Verification/Continuing Calibration Verification

Second source ICV and all CCVs met acceptance criteria of less than 20% difference.

3.5.1.7 Other Quality Control Items

No additional QC items that required data qualification were identified.

3.6 Field Duplicate Precision

FD precision was evaluated by calculating the RPD between the parent sample result and the FD result when both results were greater than the LOQ, and when one or both results fell between the LOD and the LOQ. Acceptance criteria were less than 30% for water results.

One FD sample was submitted and analyzed for 3 primary groundwater samples. The FD pair was analyzed for AK102. Both results were ND; therefore, no qualifications were made based on field duplicate precision.

4.0 COMPLETENESS

Completeness is a measure of the amount of valid data obtained compared with the amount that was expected to be obtained under correct, normal conditions. For completeness requirements, valid results are all results not rejected and determined to be usable in the context of project DQOs.

Completeness was evaluated using the formula below. The goal for completeness was 95% for all methods and matrices.

$$\%\ Completeness\ =\ 100\ x\ (\frac{V}{n})$$

Where: V = number of measurements judged valid (not rejected)
n = total number of measurements

The field duplicate DRO result was flagged for potential rejection due to low surrogate recovery (matrix interference). However, the results are consistent with historical data and the parent sample; therefore, the data are considered usable and the qualifier amended to QL. The completeness goal of 95% for all methods and matrices was met.

5.0 OVERALL DATA QUALITY AND USABILITY ASSESSMENT

The overall quality of the project data was acceptable, and completeness goals were met.

Qualified data are considered acceptable for use with the limitations discussed within this QA/QC report and the ADEC Laboratory Data Review Checklists regarding the qualifiers applied to the results.

Table 2 includes all qualified results and reasons for qualification.

6.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2017. *Underground Storage Tanks Procedures Manual, Guidance for Treatment of Petroleum-Contaminated Soil and Standard Sampling Procedures.* March.

ADEC. 2021. 18 Alaska Administrative Code (AAC) 75, *Oil and Other Hazardous Substances Pollution Control.* February.

ADEC. 2022a. *Field Sampling Guidance*. January.

ADEC. 2022b. *Technical Memorandum 22-001, Guidelines for Data Reporting.* August.

Department of Defense (DoD). 2020. *Data Validation Guidelines Module 1 for Organic Analysis by GC/MS*. May.

DoD. 2021a. *Quality Systems Manual for Environmental Laboratories, Version 5.4.* October.

DoD. 2021b. *Data Validation Guidelines Module 4: Data Validation Procedure for Organic Analysis by GC.* March.

U.S. Environmental Protection Agency (EPA). 2018. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium (SW-846), through Revision 7.* December.

U.S. Air Force (USAF). 2021. *Final Work Plan Remedial Action-Operation and Long-Term Management, North River Radio Relay Site.* July.

Table 2 Qualified Results Summary

LOCATION ID	SAMPLE ID	MATRIX	METHOD	ANALYTE	RESULT	UNITS	QUALIFIER	REASON
V-MW01	22NRRS-V-MW01	Water	AK102	DRO	ND	µg/L	QL	Surr < LCL
V-MW01	22NRRS-V-MW019	Water	AK102	DRO	ND	µg/L	QL	Surr < 10%
V-MW03	22NRRS-V-MW03	Water	AK102	DRO	ND	µg/L	QL	MS/MSD<LCL

Attachment D-1
Sample Summary

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SAMPLE SUMMARY TABLE
2021 611 CES North Group ORC - North River RRS
August 2022

										ANALYSES:	AK102
SAMPLE ID	**LOCATION ID**	**LAB ID**	**COLLECTION DATE**	**MATRIX**	**QC TYPE**	**LAB SDG**	**LAB**	**SAMPLER**	**COOLER(S)**	**CONTAINER(S)**	**DRO**
22NRRS-V-MW01	V-MW01	L1532264-01	08/31/22 10:45	GW	N	L1532264	Pace TN	RR	1	2 x 100 mL AG TLC	X
22NRRS-V-MW019	V-MW01	L1532264-02	08/31/22 10:46	GW	FD	L1532264	Pace TN	RR	1	2 x 100 mL AG TLC	X
22NRRS-V-MW03	V-MW03	L1532264-03	08/31/22 11:35	GW	N, MS/MSD	L1532264	Pace TN	RR	1	6 x 100 mL AG TLC	X
22NRRS-V-MW06	V-MW06	L1532264-04	08/31/22 12:10	GW	N	L1532264	Pace TN	RR	1	2 x 100 mL AG TLC	X
										Preservative:	**HCL**

Notes:
All samples for the North River RRS project were submitted under NPDL WO# 21-025.
All sample results were submitted to Pace Analytical in Mt. Juliet, TN, on standard turnaround time.
°C – degrees Celsius
AG – amber glass
COC – chain-of-custody
DRO – diesel range organics
FD – field duplicate
GW – groundwater
HCl – hydrochloric acid
mL - milliliter
MS/MSD – matrix spike/matrix spike duplicate
N – normal environmental sample
NPDL – north pacific division laboratory
QC – quality control
RR - Rebecca Reyes
SDG – sample delivery group
TLC - teflon lined cap

Temperature:
Cooler Unk-01 3.0°C

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Attachment D-2
Data Summary Table

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611 CES North Group ORC – 2022 Analytical Results
North River Groundwater

				Sample ID	22NRRS-V-MW01	22NRRS-V-MW019	22NRRS-V-MW03	22NRRS-V-MW06
				Lab Sample ID	L1532264-01	L1532264-02	L1532264-03	L1532264-04
				Location ID	V-MW01	V-MW01	V-MW03	V-MW06
				Collection Date	8/31/2022 10:45:00 AM	8/31/2022 10:46:00 AM	8/31/2022 11:35:00 AM	8/31/2022 12:10:00 PM
				Matrix	Groundwater	Groundwater	Groundwater	Groundwater
				QC Type	Primary	Duplicate of	Primary, MS/MSD	Primary
Method	**Analyte**	**PAL[1]**	**Units**			**22NRRS-V-MW01**		
AK102	Diesel Range Organics	1500	µg/L		ND [400] QL	ND [420] QL	ND [400] QL	ND [400]

Notes:

[1] Project action level (PAL) 18 AAC 75, Table C Groundwater Cleanup Levels (ADEC 2020).

Bold/red indicates that a detected result exceeds the PAL.

Yellow/Bold indicates the LOD for a non-detect results exceeds the PAL.

Limit of detection (LOD) shown in brackets [ ].

µg/L – micrograms per liter

H – the result is considered a low estimate due to a hold time exceedance.

J – the result is an estimated value greater than or equal to the DL and below the LOQ.

MS/MSD – matrix spike/matrix spike duplicate

ND – not detected

NS – not specified

QH/QL/QN – the result is an estimated value, bias high/low/indeterminate, due to a QC failure.

X - the result is an estimated value due to a QC failure, and is recommended for exclusion from the data set.

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Attachment D-3

ADEC Laboratory Data Review Checklists

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ADEC Contaminated Sites Program Laboratory Data Review Checklist

Completed By:	Victoria Pennick	**CS Site Name:**	North River RRS Area C SS001 & SO001	**Lab Name:**	Pace Analytical TN
Title:	North ORC-North River RRS RA-O/LTM	**ADEC File No.:**	630.38.001	**Lab Report No.:**	L1532264
Consulting Firm:	Brice Engineering, LLC	**Hazard ID No.:**	4367	**Lab Report Date:**	19 Sept 2022

Note: *Any N/A or No box checked must have an explanation in the comments box.*

1. **Laboratory**

   a. Did an ADEC Contaminated Sites Laboratory Approval Program (CS-LAP) approved laboratory receive and perform all of the submitted sample analyses?
   Yes ☒ No ☐ N/A ☐
   Comments: Click or tap here to enter text.

   b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses CS-LAP approved?
   Yes ☐ No ☐ N/A ☒
   Comments: All analyses were performed at Pace TN.

2. **Chain of Custody (CoC)**

   a. Is the CoC information completed, signed, and dated (including released/received by)?
   Yes ☒ No ☐ N/A ☐
   Comments: Click or tap here to enter text.

   b. Were the correct analyses requested?
   Yes ☒ No ☐ N/A ☐
   Analyses requested: Click or tap here to enter text.
   Comments: Click or tap here to enter text.

3. **Laboratory Sample Receipt Documentation**

   a. Is the sample/cooler temperature documented and within range at receipt (0° to 6° C)?
   Yes ☒ No ☐ N/A ☐
   Cooler temperature(s): 3.0 °C
   Sample temperature(s): Click or tap here to enter text.

Comments: Click or tap here to enter text.

b. Is the sample preservation acceptable – acidified waters, methanol preserved soil (GRO, BTEX, VOCs, etc.)?
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

c. Is the sample condition documented – broken, leaking, zero headspace (VOA vials); canister vacuum/pressure checked and no open valves, etc.?
Yes ☒ No ☐ N/A ☐
Comments: No anomalies noted on CRF

d. If there were any discrepancies, were they documented? For example, incorrect sample containers/preservation, sample temperature outside of acceptable range, insufficient or missing samples, canister not holding a vacuum, etc.?
Yes ☐ No ☐ N/A ☒
Comments: No anomalies noted on CRF

e. Is the data quality or usability affected?
Yes ☐ No ☐ N/A ☒
Comments: No qualifications were made

4. Case Narrative

a. Is the case narrative present and understandable?
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

b. Are there discrepancies, errors, or QC failures identified by the lab?
Yes ☒ No ☐ N/A ☐
Comments: Surr and MSD %R exceedances
Note: Surrogate exceedances for MW01 and FD MW019 noted on form 1 as due to a heavy emulsion produced during the extraction process.

c. Were all the corrective actions documented?
Yes ☐ No ☐ N/A ☒
Comments: No corrective actions noted.

d. What is the effect on data quality/usability according to the case narrative?
Comments: CN does not address usability or data quality. Discussed in sections below.

5. Sample Results

a. Are the correct analyses performed/reported as requested on CoC?
Yes ☒ No ☐ N/A ☐

Comments: Click or tap here to enter text.

b. Are all applicable holding times met?
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

c. Are all soils reported on a dry weight basis?
Yes ☐ No ☐ N/A ☒
Comments: No soils submitted with this SDG

d. Are the reported limits of quantitation (LoQ) or limits of detections (LOD), or reporting limits (RL) less than the Cleanup Level or the action level for the project?
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

e. Is the data quality or usability affected?
Yes ☐ No ☒ N/A ☐
Comments: No qualifications were made

6. QC Samples

a. Method Blank

i. Was one method blank reported per matrix, analysis, and 20 samples?
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

ii. Are all method blank results less than LOQ (or RL)?
Yes ☒ No ☐
Comments: Click or tap here to enter text.

iii. If above LoQ or RL, what samples are affected?
Comments: NA

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?
Yes ☐ No ☐ N/A ☒
Comments: Click or tap here to enter text.

v. Data quality or usability affected?
Yes ☐ No ☒ N/A ☐
Comments: Click or tap here to enter text.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics – Are one LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

ii. Metals/Inorganics – Are one LCS and one sample duplicate reported per matrix, analysis and 20 samples?
Yes ☐ No ☐ N/A ☒
Comments: Only organic analyses performed

iii. Accuracy – Are all percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable? (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

iv. Precision – Are all relative percent differences (RPD) reported and less than method or laboratory limits and project specified objectives, if applicable? Was the RPD reported from LCS/LCSD, and or sample/sample duplicate? (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments: NA

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?
Yes ☐ No ☐ N/A ☒
Comments: Click or tap here to enter text.

vii. Is the data quality or usability affected?
Yes ☐ No ☒ N/A ☐
Comments: No qualifications were made based on LCS/LCSD recoveries.

c. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

i. Organics – Are one MS/MSD reported per matrix, analysis and 20 samples?
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

ii. Metals/Inorganics – Are one MS/MSD reported per matrix, analysis and 20 samples?
Yes ☐ No ☐ N/A ☒
Comments: Only organic analyses performed

iii. Accuracy – Are all percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable?
Yes ☐ No ☒ N/A ☐
Comments: V-MW03 was provided as the MS/MSD sample. MS recovery (69.5%) and MSD recovery (61.8%) both recovered below the LCL of 75%.

iv. Precision – Are all relative percent differences (RPD) reported and less than method or laboratory limits and project specified objectives, if applicable? RPD reported from MS/MSD, and or sample/sample duplicate.
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments: V-MW03

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?
Yes ☒ No ☐ N/A ☐
Comments: Flagged QL in primary sample

vii. Is the data quality or usability affected?
Yes ☐ No ☒ N/A ☐
Comments: Parent sample was ND, well below the PSL.

d. Surrogates – Organics Only or Isotope Dilution Analytes (IDA) – Isotope Dilution Methods Only

i. Are surrogate/IDA recoveries reported for organic analyses – field, QC, and laboratory samples?
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

ii. Accuracy – Are all percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable? (AK Petroleum methods 50-150 %R for field samples and 60-120 %R for QC samples; all other analyses see the laboratory report pages)
Yes ☐ No ☒ N/A ☐
Comments: o-TP recovery in V-MW01 (23.2%), and FD V-MW019 (5.24%) below LCL of 50%.

iii. Do the sample results with failed surrogate/IDA recoveries have data flags? If so, are the data flags clearly defined?
Yes ☒ No ☐ N/A ☐
Comments: DRO in V-MW01 is qualified as estimated and flagged QL, and DRO in V-MW019 is flagged X for possible exclusion. However, heavy emulsion was noted for both samples (including the prep bench sheet) and results are historically consistent.

iv. Is the data quality or usability affected?
Yes ☒ No ☐ N/A ☐
Comments: The result for the FD on V-MW01 may be rejected due to low surrogate recovery. However, the result is consistent with V-MW01 and historically ND.

e. Trip Blanks

i. Is one trip blank reported per matrix, analysis, and for each cooler containing volatile samples? Yes ☐ No ☐ N/A ☒
Comments: No volatiles submitted with this SDG.

ii. Are all results less than LoQ or RL?
Yes ☐ No ☐ N/A ☐
Comments: Click or tap here to enter text.

iii. If above LoQ or RL, what samples are affected?
Comments: Click or tap here to enter text.

iv. Is the data quality or usability affected?
Yes ☐ No ☐ N/A ☐
Comments: Click or tap here to enter text.

f. Field Duplicate

i. Are one field duplicate submitted per matrix, analysis, and 10 project samples?
Yes ☒ No ☐ N/A ☐
Comments: V-MW01/V-MW019

ii. Was the duplicate submitted blind to lab?
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

iii. Precision – All relative percent differences (RPD) less than specified project objectives? (Recommended: 30% water or air, 50% soil)

$$RPD\ (\%) = \left| \frac{R_1 - R_2}{\left(\frac{R_1 + R_2}{2}\right)} \right| X\ 100$$

Where R_1 = Sample Concentration

R_2 = Field Duplicate Concentration

Yes ☒ No ☐ N/A ☐
Comments: All results are ND

iv. Is the data quality or usability affected? (Explain)
Yes ☐ No ☒ N/A ☐
Comments: No qualifications were made based on FD precision

g. Decontamination or Equipment Blanks

i. Were decontamination or equipment blanks collected?
Yes ☐ No ☒ N/A ☐
Comments: An equipment blank was not collected due to sampling error.

ii. Are all results less than LOQ or RL?
Yes ☐ No ☐ N/A ☒
Comments: Click or tap here to enter text.

iii. If above LOQ or RL, specify what samples are affected.
Comments: None.

iv. Are data quality or usability affected?
Yes ☐ No ☒ N/A ☐
Comments: Usability is not affected as all sample results were ND.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Are they defined and appropriate?
Yes ☒ No ☐ N/A ☐
Comments: Click or tap here to enter text.

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Attachment D-4
Laboratory Summary Report

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ANALYTICAL REPORT

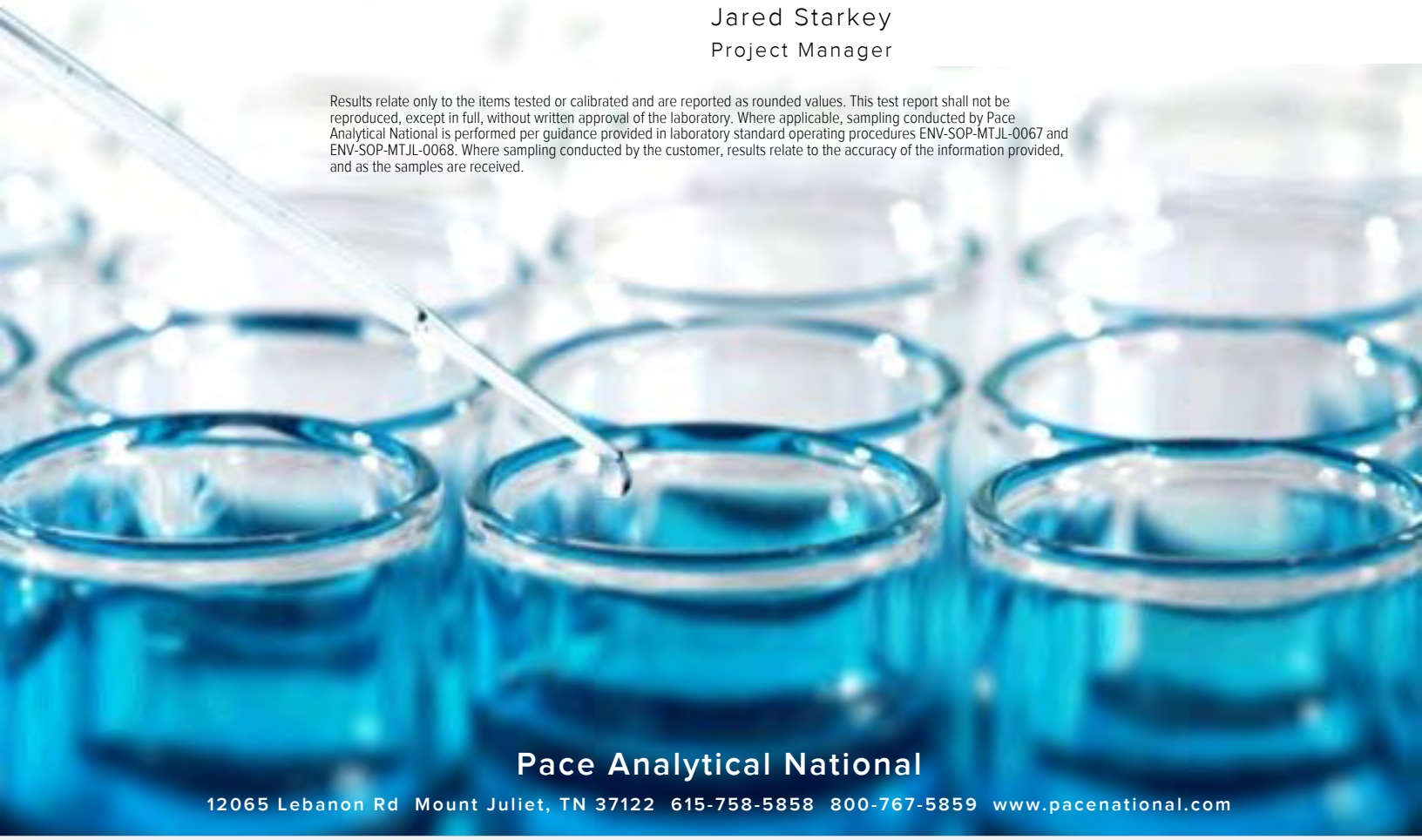
September 19, 2022

Brice Env. Services- Anchorage, AK

Sample Delivery Group:	L1532264
Samples Received:	09/02/2022
Project Number:	W911KB-20-0002
Description:	North ORC/North River RRS/700261 21-025
Site:	V-MW01
Report To:	Victoria Pennick 3700 Centerpoint Dr Suite 800 Anchorage, AK 99503

Entire Report Reviewed By:

Jared Starkey
Project Manager



Pace Analytical National

12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

22NRRS-V-MW01 L1532264-01 GW

Collected by	Collected date/time	Received date/time
	08/31/22 10:45	09/02/22 19:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Semi-Volatile Organic Compounds (GC) by Method AK102	WG1924366	1	09/12/22 04:42	09/13/22 06:30	DMG	Mt. Juliet, TN

22NRRS-V-MW019 L1532264-02 GW

Collected by	Collected date/time	Received date/time
	08/31/22 10:46	09/02/22 19:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Semi-Volatile Organic Compounds (GC) by Method AK102	WG1924366	1.05	09/12/22 04:42	09/13/22 06:51	DMG	Mt. Juliet, TN

22NRRS-V-MW03 L1532264-03 GW

Collected by	Collected date/time	Received date/time
	08/31/22 11:35	09/02/22 19:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Semi-Volatile Organic Compounds (GC) by Method AK102	WG1924366	1	09/12/22 04:42	09/13/22 15:42	TJD	Mt. Juliet, TN

22NRRS-V-MW06 L1532264-04 GW

Collected by	Collected date/time	Received date/time
	08/31/22 12:10	09/02/22 19:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Semi-Volatile Organic Compounds (GC) by Method AK102	WG1924366	1	09/12/22 04:42	09/13/22 16:53	TJD	Mt. Juliet, TN

CASE NARRATIVE

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Jared Starkey
Project Manager

Semi-Volatile Organic Compounds (GC) by Method AK102

Surrogate recovery limits have been exceeded; values are outside lower control limits.

Batch	Analyte	Lab Sample ID
WG1924366	o-Terphenyl	L1532264-01, 02

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG1924366	(MS) R3836359-8, (MS) R3836359-6, (MSD) R3836359-7, L1532264-03	AK102 DRO C10-C25

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG1924366	(MSD) R3836359-9	AK102 DRO C10-C25

The remainder of this page intentionally left blank, there are no detections to report for this SDG.

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Cooler#	UNK-01	
Cooler Temperature	3	Deg. C

Semi-Volatile Organic Compounds (GC) by Method AK102

Analyte	CAS #	Result	Qualifier	DL	LOD	LOQ	Dilution	Analysis	Batch
		ug/l		ug/l	ug/l	ug/l		date / time	
AK102 DRO C10-C25	C10-C25	400	U	170	400	800	1	09/13/2022 06:30	WG1924366
(S) o-Terphenyl	*84-15-1*	*23.2*	J2			*50.0-150*		*09/13/2022 06:30*	WG1924366

Sample Narrative:

L1532264-01 WG1924366: Sample produced emulsion during Extraction process, low surr/spike recoveries due to matrix.

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Cooler#	UNK-01	
Cooler Temperature	3	Deg. C

Semi-Volatile Organic Compounds (GC) by Method AK102

Analyte	CAS #	Result	Qualifier	DL	LOD	LOQ	Dilution	Analysis	Batch
		ug/l		ug/l	ug/l	ug/l		date / time	
AK102 DRO C10-C25	C10-C25	420	U	179	420	840	1.05	09/13/2022 06:51	WG1924366
(S) o-Terphenyl	*84-15-1*	*5.24*	J2			*50.0-150*		*09/13/2022 06:51*	WG1924366

Sample Narrative:

L1532264-02 WG1924366: Sample produced emulsion during Extraction process, low surr/spike recoveries due to matrix.

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Cooler#	UNK-01	
Cooler Temperature	3	Deg. C

Semi-Volatile Organic Compounds (GC) by Method AK102

Analyte	CAS #	Result	Qualifier	DL	LOD	LOQ	Dilution	Analysis	Batch
		ug/l		ug/l	ug/l	ug/l		date / time	
AK102 DRO C10-C25	C10-C25	400	J6 U	170	400	800	1	09/13/2022 15:42	WG1924366
(S) o-Terphenyl	*84-15-1*	*59.2*				*50.0-150*		*09/13/2022 15:42*	WG1924366

1 Cp
2 Tc
3 Ss
4 Cn
5 Ds
6 Sr
7 Qc
8 Gl
9 Al
10 Sc

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Cooler#	UNK-01	
Cooler Temperature	3	Deg. C

Semi-Volatile Organic Compounds (GC) by Method AK102

Analyte	CAS #	Result	Qualifier	DL	LOD	LOQ	Dilution	Analysis	Batch
		ug/l		ug/l	ug/l	ug/l		date / time	
AK102 DRO C10-C25	C10-C25	400	U	170	400	800	1	09/13/2022 16:53	WG1924366
(S) o-Terphenyl	*84-15-1*	*72.2*				*50.0-150*		*09/13/2022 16:53*	WG1924366

Method Blank (MB)

(MB) R3836359-1 09/13/22 05:29

Analyte	MB Result ug/l	MB Qualifier	MB DL ug/l	MB LOD ug/l	MB LOQ ug/l
AK102 DRO C10-C25	400	U	170	400	800
(S) o-Terphenyl	*66.2*				*60.0-120*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3836359-2 09/13/22 05:50 • (LCSD) R3836359-3 09/13/22 06:10

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
AK102 DRO C10-C25	6000	5340	5340	89.0	89.0	75.0-125			0.000	20
(S) o-Terphenyl				*76.3*	*79.4*	*60.0-120*				

L1531629-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1531629-01 09/13/22 10:10 • (MS) R3836359-4 09/13/22 10:39 • (MSD) R3836359-5 09/13/22 10:59

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
AK102 DRO C10-C25	6660	444	5730	5800	86.0	87.1	1.11	75.0-125			1.21	20
(S) o-Terphenyl					*77.2*	*78.7*		*50.0-150*				

L1532264-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1532264-03 09/13/22 15:42 • (MS) R3836359-6 09/13/22 16:02 • (MSD) R3836359-7 09/13/22 16:22

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
AK102 DRO C10-C25	6000	400	4170	3710	69.5	61.8	1	75.0-125	J6	J6	11.7	20
(S) o-Terphenyl					*65.4*	*62.7*		*50.0-150*				

L1532271-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1532271-02 09/13/22 17:20 • (MS) R3836359-8 09/13/22 18:00 • (MSD) R3836359-9 09/13/22 18:48

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
AK102 DRO C10-C25	6320	531	549	6040	0.285	87.2	1.05	75.0-125	J6	J3	167	20
(S) o-Terphenyl					*75.5*	*79.9*		*50.0-150*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

DL	Detection Limit.
LOD	Limit of Detection.
LOQ	Limit of Quantitation.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J2	Surrogate recovery limits have been exceeded; values are outside lower control limits.
J3	The associated batch QC was outside the established quality control range for precision.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
U	Below Detectable Limits: Indicates that the analyte was not detected.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

E110

BRICE ENGINEERING, LLC.
CHAIN OF CUSTODY RECORD

Section 1

CLIENT: **Brice Engineering, LLC**
3700 Centerpoint Drive, Suite 8223, Anchorage, AK 99503

COC number: 22NRRS-01

Page 1 of 1

CONTACT: Victoria Pennick PHONE #: 907-205-9892

PROJECT: North ORC/North River RRS/700261 Project numbers: NPDL WO#: 21-025; Contract #: W911KB-20-D-0002; Task Order #: 0135

REPORTS TO: Victoria Pennick E-MAIL: vpennick@briceenvironmental.com

INVOICE TO: accountspayable@calistacorp.com QUOTE #: W.O. #: 700200-006/700261

LIS 32261

Section 2

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yyyy	TIME HHMM	MATRIX CODE	# CONTAINERS	TYPE	Preservative: HCL	Analysis: DRO (AK102)									Analysis: MS/MSD	Location
	22NRRS-V-MW01	08/31/2022	1045	WG	2 ~~6~~	grab		X									~~X~~	-01
	22NRRS-V-MW019	"	1046	WG	2	"		X										-02
	22NRRS-V-MW03	"	1135	WG	6	"		X									X	-03
	22NRRS-V-MW06	"	1210	WG	2	"		X										-04

Section 3

Data Deliverables: Level II/IV, AK_SEDD 5.2a (POA instructional set), ERPIMS EDD, and Brice EQEDD

Relinquished By:	Date	Time	Received By:
(1) Amended COC 9/20/2021 VLP	9/1/22	0900	
(2)			
(3)			
(4)			Received For Laboratory By: 9/2/22 1400

Section 4

DOD Project? Yes

Cooler ID: UNK-01

☐ check if multi-cooler shipment

LAB: If multi-cooler shipment is checked, please log all coolers as one SDG.

Requested Turnaround Time and/or Special Instructions:
Standard TAT
Send confirmation of receipt to Victoria Pennick and receipt.cooler@usace.army.mil within 24 hours of sample receipt. Please communicate any issues immediately.

Temp Blank °C: _____ or Ambient [ ]

Chain of Custody Seal: (Circle) INTACT BROKEN #_____

Hand Delivery [ ] FedEx [ ] Goldstreak [ ]

COOLER RECEIPT FORM
(ONE PER COOLER)

ANC 8(a) Brice

Please email this form and the completed CoC records to the Brice Project Chemist within 24 hours of sample receipt.

COC Number	22NRRS-01
Cooler Number/Name on COC	Unk-01
Temperature (temp blank, °C)	
Temperature (cooler, °C)	3.0
Thermometer type/ID	A2
Laboratory/Location	Mt. Juliet Pace
Laboratory SDG	L15 32264

1.	Were custody seals present and intact?	N/A	(Yes)	No
	If yes, how many and where? Front 1 Back 1			
	Signature/date present on custody seals?		(Yes)	No
2.	Were custody papers taped to lid inside cooler?		(Yes)	No
3.	Were custody papers properly filled out (ink, signed, etc.)?		(Yes)	No
4.	Custody forms signed/dated and properly accepted/relinquished?		(Yes)	No
5.	Has the shipper/tracking number been documented on the paperwork?		(Yes)	No
6.	Was sufficient ice used (if appropriate)?	N/A	(Yes)	No
	Type used: [✓] Wet [✓] Gel Still frozen? Yes (No)			
7.	Were all samples/bottles sealed in separate plastic bags?	N/A	(Yes)	No
8.	Did all bottles arrive in good condition? (intact, not leaking, etc.)		(Yes)	No
9.	Were all bottle labels complete (sample ID, date, analysis, preservative, etc.) ?		(Yes)	No
10.	Did all bottle labels agree with the custody papers?		(Yes)	No
11.	Were the appropriate containers used for the analyses?		(Yes)	No
12.	Are all VOA vials free of headspace > 6mm in diameter?	(N/A)	Yes	No
	If no, note samples and number of vials affected below.			
	If no, are there vials without headspace to perform the analysis?	(N/A)	Yes	No
13.	Was sufficient volume sent in each bottle to perform analysis?	N/A	(Yes)	No
14.	If there are volatiles present, is there a trip blank present in this cooler?	(N/A)	Yes	No
15.	Is the temperature within 0-6°C?	N/A	(Yes)	No
16.	Were labels correctly associated with pre-tared containers (not placed directly on jars for methanol-preserved volatiles)?	(N/A)	Yes	No
17.	Were non-volatile sample checked for appropriate preservation?	N/A	(Yes)	No
18.	Were methanol-preserved soil containers accompanied by an unpreserved aliquot for percent moisture content?	(N/A)	Yes	No

(If checked at the bench, include prep logs or narrative with final report.)

Explain any discrepancies/deficiencies (attach additional sheets if required):

If discrepancies/deficiencies are noted, was the Brice chemist contacted*?

Chemist: _____ Date/Time: _____ Contact Method: phone email

Email or phone notes should be included with final report, if applicable, or at a minimum documented in the case narrative.

APPENDIX E
RESPONSE TO COMMENTS

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THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Environmental Conservation

DIVISION OF SPILL PREVENTION AND RESPONSE
Contaminated Sites Program

610 University Ave
Fairbanks, Alaska, 99709-3643
Main: 907.451.2156
Fax: 907.451.2155
www.dec.alaska.gov

File: 630.38.001

April 14, 2023

Electronic Delivery Only
Mr. Robert Johnston
611 CES/CEVR
10471 20th Street, Suite 347
JBER, AK, 99506-2201

RE: DEC Approval of the *2022 Final 2022 Remedial Action-Operation and Long-Term Management Report North River Radio Relay Site, Sites SO001, SS001, SS003,* April 2023

Dear Mr. Johnston:

The Alaska Department of Environmental Conservation (DEC) has completed a review of the above referenced document and response to comments (RTCs), received April 14, 2023. This report presents the 2022 annual remedial action-operation and long-term management (LTM) activities conducted between 30 August and 31 August 2022 at the North River Radio Relay Station (RRS). This work included groundwater monitoring at site SO001 and LTM activities at sites SS001, SO001, and SS003.

All DEC comments were addressed by the response to comments and included in the red-line strike out version of the document. Therefore, the document is approved. Please provide a finalized version of the report with this letter attached. If you have any questions, please do not hesitate to contact the DEC project manager at (907) 451-2156, or by email at axl.levan@alaska.gov.

Sincerely,

Axl LeVan
Environmental Program Specialist

cc via email: Dennis Shepard, DEC

DEC review comments for the
2022 Draft-Final Remedial Action-Operation and Long-Term Management Report, North River Radio Relay Station, Sites SO001, SS001, SS003, Alaska

April 4, 2023

Comment No.	Page	Section	Comment / Recommendation	Response
1.	1-3	1.2.1	Both SO001 and SS003 should be updated with information from the 2021 inspection. Additionally, DEC recommends adding any relevant information from the 2021 Five Year Review to the backgrounds.	Agree. Information from the 2021 inspections will be added to Sections 2.1.1, 2.1.2, and 2.1.3. Also, information from the 2021 Five Year Review will be added to the SS001 and SS03 backgrounds in Sections 2.1.2 and 2.1.3. The following text will be added to the end of Section 1.2.1, "*In 2021, field observations were similar to 2020. Groundwater wells V-MW03 and V-MW06 were sampled for DRO. Results were either non-detect or below the ADEC Table C cleanup level (1.5 mg/L). Well V-MW01 was dry and not sampled. An open excavation was still present as SO001 (AFCEC 2022).*" The following text will be added to the end of Section 1.2.2, "*Also in 2021, Site SS001 was visually inspected. At the time of inspection, the site was covered with land-farmed soils. Orange construction fencing and silt fencing were observed; however, the fencing appeared to be fallen and torn in multiple areas. No IC/LUC signs were in place; however, a "Danger – Keep Out" sign was secured to the construction fencing on the north side of the site. No signs of stained or stressed vegetation, evidence of trespass, unauthorized excavation, or groundwater use were observed (AFCEC 2022).* *In 2021, the first Five-Year Review for Site SS001 was prepared. A protectiveness determination on the remedy at Site SS001 could not be made until further information is*

Comment No.	Page	Section	Comment / Recommendation	Response
				obtained, including evaluation of human health and ecological risk associated with the presence of five VOCs (bromodichloromethane, cis-1,2-dichloroethene, tetrachloroethene, 1,1,2-trichloroethane, and trichloroethylene) in groundwater; additional site characterization through replacement of the monitoring well C-MW15, monitoring groundwater from all site wells, and conducting an assessment of the risk associated with the VOCs. Additionally, the USAF LUC Management Plan requires updating to reflect LUC management as outlined in the 2020 ROD Amendment; signs need to be installed at SS001 that inform the public of potential risks and limit human exposure; and a NAUL filed for Site SS001 (USAF 2021b).” The following text will be added to the end of Section 1.2.3, “*During the 2021 inspection, no stressed vegetation was observed. Access to the site was not controlled, and signs of site trespassing (tire marks) were observed. (AFCEC 2022). In 2021, the second Five-Year Review for Site SS003 was prepared. No issues were identified, and the selected remedies met the remedial action objectives for the short-term. In order for the remedy to be protective in the long-term, the USAF LUC Management Plan requires updating to reflect LUC management as outlined in the ROD Amendment and signs need to be installed at Site SS003 that inform the public of potential risks and limit human exposure. An environmental covenant for Site SS003 should be filed, and stakeholders should concur with LUCs and deed restrictions for the site (USAF 2021b).”* **DEC Accepts Response 4/14/2023**

Comment No.	Page	Section	Comment / Recommendation	Response
2.	2-1	2.1.1	Why was an IC/LUC sign not installed at SO001? The site was identified in the recommendations of the 2021 report for installation of signs like SS001 and SS003. Consider clarifying that the "previously open excavation" was filled under an approved work plan to return landfarmed soil to the excavation.	Prior to the 2022 inspection, it was unknown if heavy equipment would still be working at this site to perform the site restoration activities so signs were not installed. Two signs will be installed during the 2023 inspection. Agree. The first sentence of Section 2.1.1 will be revised to, "At the time of the inspection, the previously open excavation had been filled *under an approved Work Plan to return landfarmed soil to the excavation. The site was* graded and grass was observed." **DEC Accepts Response 4/14/2023**
3.	2-1	2.1.2	"freshly churned soil." For clarity was the soil churned in a way that suggests further disturbance occurred after the hydroseeding?	No, the term "churned" was used to describe the condition of the ground surface that was imprinted with equipment tracks resulting from the removal of the landfarmed soil. No evidence of disturbance following hydroseeding was observed. **DEC Accepts Response 4/14/2023**
4.	2-2	2.4	Since some of the samples were specifically collected following drawdown and removal, please provide additional detail to the sampling methodology in this section.	Agree. The following text will be added to Section 2.4, "*Water levels in V-MW03 and V-MW06 exceeded the minimum drawdown (<0.3 feet) during purging, and water quality parameters did not stabilize, so groundwater samples were collected after three well volumes were purged*." **DEC Accepts Response 4/14/2023**
5.	2-2	2.7	Oversites that lead to anticipated work not occurring should be captured in the deviation section of the report for clarity.	Agree. Section 2.7 will be revised to the following, "*The following deviations from the Work Plan occurred:* *• An equipment blank was not collected due to an oversight; however, all DRO results were non-detect and usability was not impacted*." **DEC Accepts Response 4/14/2023**

Comment No.	Page	Section	Comment / Recommendation	Response
6.	3-1	3.0	"An equipment blank was not collected due to an oversight; however, all DRO results were ND and usability was not impacted." DEC agrees that the usability of data was not affected but this information should be added to the deviations.	Agree. The deviation will be added to Section 2.7. **DEC Accepts Response 4/14/2023**
7.	4-2	Table 3	All tables containing qualified results should reflect them. Update the 2022 results for V-MW01 and V-MW03 and review past site date for accuracy. Qualifiers to data are relevant to future site reviews and should be included in all instances of the reported data.	Agree. Data flags will be added to Table 3. **DEC Accepts Response 4/14/2023**
8.	5-1	5.2	Based on review of the monitoring well checklists should V-MW06 also be recommended for a trimming? It appears that the lockable cap or lid "Does not fit on though due to jacking..." DEC recommends adding the recommendation or clarifying that the well will be assessed and trimmed if necessary. DEC notes that V-MW03 may also require the trimming in 2023 if any additional soil jacking occurs.	Agree. A recommendation to trim the inner casing of V-MW06 will be added to Section 5.2. **DEC Accepts Response 4/14/2023**
9.	5-1	5.2	Note both recommendations being made were recommendations made in the 2021 LTM report. Update the language in the final sentence to reflect this. Additionally, please clarify what steps will be taken to ensure that	Agree. Text will be added to denote that both recommendations were made in the 2021 report. To ensure the wells are properly trimmed and signs installed in 2023, the field crew has been identified and is already preparing to bring the inner casing trimming tool, extra

Comment No.	Page	Section	Comment / Recommendation	Response
			the planned activities occur during the 2023 monitoring event?	replacement locks, and sign materials, and a surveyor will be mobilized to resurvey the wells after the repairs are made. **DEC Accepts Response 4/14/2023**
10.	6-1	6.0	Please reference DEC 2022 Field Sampling Guidance. The 18 AAC 75 reference was updated in February 2023.	Agree. Reference to the Field Sampling Guidance will be added, and the reference to 18 AAC 75 will be updated in Section 6.0 and the text references. **DEC Accepts Response 4/14/2023**
11.	Figure 3		Please update the figure to reflect the current condition of excavations.	Agree. Figures 3 and 4 will be updated to reflect current condition of the excavations. **DEC Accepts Response 4/14/2023**
12.	Appendix B		Road erosion was brought up in the checklists. DEC recommends USAF add this detail to the report and consider marking the location on a figure.	Agree. The following text will be added to the first paragraph in Section 2.0, "*The access road to the sites, North River Road, was observed to be eroding near the bridge where the road is adjacent to the river. The approximate location of the erosion is shown on Figure 1*." **DEC Accepts Response 4/14/2023**
13.	Groundwater Sampling Form V-MW03		The well stabilization data appears to be reported in reverse order. Was the data backfilled from the Low-Flow Test Report?	Yes, the low-flow test reports list the data from bottom up, which was copied on the groundwater form in that order. **DEC Accepts Response 4/14/2023**
14.	Low-Flow Test Reports		Consider adding a note that the date/time on the Low-Flow Test Reports are inaccurate (they all appear to be in July 2021).	Agree. A note will be added to the low-flow text reports. **DEC Accepts Response 4/14/2023**
15.	Appendix D		Section 3.5.1.4: DEC agrees with the decision to qualify result as QL based on review of the 2021 work plan and the logic	Agree. Qualifiers will be added.

Comment No.	Page	Section	Comment / Recommendation	Response
			presented. However, this qualifier should be carried into all tables and presentations (see comment 7). V-MW01 has only had one historical sampling. DEC recommends clarifying whether historical results refers to all the SO001 wells when considering the history of ND or low detections at the site. If the emulsion effect occurs in future years the potential factors contributing to emulsion and the effects on DRO results should be further examined.	Agree. The second paragraph in Appendix D, Section 3.5.1.4 will be revised to, "…however, as the results are consistent between the two samples and with *low or non-detect* historical results *in this well and the other two nearby wells* and can be used for project decisions." This will be noted for the 2023 sampling event discussion. **DEC Accepts Response 4/14/2023**
16	Appendix D		"ADEC. 2019. Minimum Quality Assurance Requirements for Sample Handling, Reports, and Laboratory Data. October." The above guidance has been replaced with the following technical memorandum: "ADEC. 2022 Guidelines for data reporting"	Agree. Reference will be updated. **DEC Accepts Response 4/14/2023**
17	Mann-Kendall Tests		How were the values used in the Mann-Kendall Trend Analysis determined? The original reporting reflects the LOD of the methods and this should be reflected in the analysis of the results. Additionally, capture all data flags in the data flag section. For	Agree. For the Mann-Kendall Trend Analysis, the ND results are assigned a common value lower than the lowest detected concentration unless there's justification to do it otherwise. The spreadsheet is set up to assign all results with a "U" data flag a value of 0.05 in the "M-K Concentration" column. The data flags will be added to Table 3. **DEC Accepts Response 4/14/2023**

Comment No.	Page	Section	Comment / Recommendation	Response
			example, the most recent data from V-MW03 was flagged QL.	
End of comments				