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REMEDIAL ACTION REPORT:

KNOX TRAIL GROUNDWATER EXTRACTION SYSTEM EXPANSION

NUCLEAR METALS, INC. SUPERFUND SITE, CONCORD, MASSACHUSETTS

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Geosyntec Project: BR0090E

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LIST OF ABBREVIATIONS AND ACRONYMS

µg/L	microgram(s) per liter
CQA	construction quality assurance
de maximis	de maximis, inc.
DTI	Directional Technologies, Inc.
ft	feet or foot
FSP	field sampling plan
g/d	gram(s) per day
GAC	granular activated carbon
Geosyntec	Geosyntec Consultants, Inc.
gpm	gallons per minute
HDD	horizontal directional drilling
HDPE	high density polyethylene
KM	Kinder Morgan
MassDEP	Massachusetts Department of Environmental Protection
NMI	Nuclear Metals, Inc.
NTU	Nephelometric Turbidity Units
O&M	operation and maintenance
P&ID	piping and instrumentation diagram
PVC	polyvinyl chloride
RA	Remedial Action
RD	Remedial Design
ROD	Record of Decision
SD	Settling Defendants
SWMP	site-wide monitoring plan
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

PROFESSIONAL ENGINEER'S CERTIFICATION

REMEDIAL ACTION REPORT
KNOX TRAIL GROUNDWATER EXTRACTION SYSTEM EXPANSION
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

I certify under penalty of law that the remedial action for expansion of the Knox Trail Groundwater Extraction System at the Nuclear Metals, Inc. Superfund Site in Concord, Massachusetts has been complete in accordance with the 100% remedial design, inclusive of approved changes, and that the system is functioning as designed. Based on data presented herein, the remedial action is achieving the performance as designed, and meets the criteria for "operational and functional".

CARL R.
ELDER
CIVIL
No.46259

8/1/24

Carl
Elder

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by Carl Elder
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Carl R. Elder, Ph.D., P.E.
(Licensed in MA, NH, KS)
Senior Principal, Geosyntec Consultants
Engineer-of-Record

This document has been digitally signed, sealed and locked by Carl R. Elder. Document is not approved unless it contains a digital stamp and signature certification.

Bruce Thompson
de maximis, inc.
Project Coordinator

1 INTRODUCTION AND ORGANIZATION

1.1 Purpose

The 100% Remedial Design (100% RD) for the Knox Trail Groundwater Extraction System Expansion at the Nuclear Metals, Inc. Superfund Site (NMI Site or Site) located in Concord, Massachusetts (USEPA ID MAD062166335) was submitted to the United States Environmental Protection Agency (USEPA) on September 15, 2022 and was subsequently approved by USEPA in a letter dated September 23, 2022. The Remedial Action Work Plan for the project was submitted to USEPA on December 5, 2022 and approved by USEPA in a letter dated February 1, 2023. Coordination with property owners for access occurred during spring 2023 with construction activities occurring between July and November 2023. The expanded groundwater extraction system subsequently underwent shakedown and start-up activities between November 2023 and January 2024 with the treatment system continuing with an optimization program[1] into spring 2024. The location of the Site is shown in **Figure 1** and a layout of the Site is shown in **Figure 2**.

The purpose of this Remedial Action Report is to summarize the construction activities completed during the Knox Trail Groundwater Extraction System Expansion at the NMI Site. The Knox Trail Groundwater Extraction System is a groundwater extraction and treatment system located at 16 Knox Trail in Acton, Massachusetts. Since 2017, the Knox Trail system has extracted groundwater from a deep overburden well, EW-1, and treated the groundwater prior to discharge it to the nearby Assabet River. The objective of the Knox Trail Groundwater Extraction System Expansion remedial action (RA) was to extend hydraulic capture of the dissolved phase plume in overburden and shallow bedrock groundwater by connecting two new extraction wells, EW-2 and BEW-5, to the existing Knox Trail Treatment System. The goal of adding these wells into the system was to capture concentrations of 1,4-dioxane and volatile organic compounds (VOCs)[2] in the area between Main Street and the Assabet River, and potentially in downgradient wells.

This document provides:

1) A chronological summary of construction, start-up and monitoring activities.

2) Data to demonstrate that the system is functioning as designed.

3) Supporting information including as-built drawings for the system, approved submittals, and data from start-up testing.

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[1] The Knox Trail Treatment System Optimization Plan dated February 22, 2024 was approved by USEPA on March 4, 2024.

[2] The VOC plume is within the boundaries of the 1,4-dioxane plume so capturing the extent of the 1,4-dioxane plume will also capture VOC concentrations exceeding clean-up levels.

1.2 Report Organization

The RA Report is organized as follows:

- Section 1 – Introduction and Organization
- Section 2 – Review of Construction Activities
- Section 3 – Results During Start-up
- Section 4 – Operation and Maintenance
- Section 5 – Pre-Final and Final Inspection
- Section 6 – Demonstration of Compliance
- Section 7 – References

1.3 Project Team

The table below lists stakeholders and companies involved in the Knox Trail Groundwater Extraction System Expansion project.

Project Team	
Settling Defendants (SDs)	Textron Inc. and Whittaker Corporation are the SDs named in the 2019 Consent Decree and are responsible for funding construction, operation, and maintenance of the remedy.
Regulatory Agencies	The lead agency responsible for managing the remedial action was USEPA. The USEPA Remedial Project Manager for the Site was Kara Nierenberg. USEPA was supported by the Massachusetts Department of Environmental Protection (MassDEP). Gary Waldeck was MassDEP's Project Manager for this remedial action.
Oversight Contractor	AECOM is the USEPA's oversight contractor providing document review and periodic field oversight related to the remedial action.
Project Coordinator	Bruce Thompson of ***de maximis, inc.*** (de maximis) is the Project Coordinator hired by the SDs and has overall supervisory responsibility for work under this RA and is the lead for communications with USEPA, MassDEP and the SDs.
Engineer of Record	Carl Elder of Geosyntec Consultants, Inc. (Geosyntec) prepared the remedial design and was present throughout the RA to provide clarifications about the design. He also reviewed and approved submittals and any changes to the remedial design.
General Contractor	de maximis served as the general contractor hiring the earthwork contractor, construction quality assurance (CQA) consultant, EW-2 driller O&M, Inc., and the electrician.

Subcontractors	
Treatment System Operator	O&M, Inc.
CQA Consultant	Geosyntec
Earthwork Contractor	Republic Services (Republic; formerly US Ecology, Inc.)
Well Driller	Cascade Drilling
Horizontal Driller	Directional Technologies, Inc. (DTI; DTI was subcontracted to Geosyntec)

Other Parties	
Valley Sports, Inc.	Owner of the property where a much of the construction activities took place
Concord Medical Realty, The Town of Acton	Owners of additional properties where construction activities were completed
Tennessee Gas Pipeline Company, LLC, a Kinder Morgan Company (Kinder Morgan)	Owner of a gas line and easement crossed during construction
Acton Water District	The treatment system and piping for the new wells are located on Acton Water District property (currently leased to de maximis)

2 REVIEW OF CONSTRUCTION ACTIVITIES

The 100% RD and RA Work Plan provide specific information on the goals, scope and methods used to complete the RA. A copy of the design drawings from the 100% RD are included as **Appendix A**.

In summary, the RA consisted of five general components:

1) Preliminary activities
2) Horizontal directional drilling
3) Installation of EW-2
4) Installation of vaults and final connections
5) Shakedown and start-up

The sections below briefly describe these components of work. These descriptions are followed by a chronology of the RA, discussion of construction quality control, and a list of approved deviations from the design. Additional information regarding each component of the RA is provided in appendices referenced within the sections below.

Figure 3 shows the location of the Knox Trail Treatment System, extraction wells EW-2 and BEW-5, the alignment of horizontal conduits under the Assabet River which connect EW-2 and BEW-5 to the treatment system, and associated vaults. As-Built surveys showing the locations of vaults and piping installed as part of this RA are included as **Appendix B.** A piping and instrumentation diagram (P&ID) of the treatment plant showing the changes to incorporate EW-2 and BEW-5 is provided in **Appendix C.**

2.1 Summary of RA Activities

2.1.1 Preliminary Activities

Preliminary activities were generally performed by Republic[3] and consisted of the following:

- Construction of a gravel access road from the parking lot of Valley Sports over the Kinder Morgan (KM) gas line and to BEW-5;
- Removal of approximately 47 cubic yards of surficial soils along the north side of the new access road to compensate for flood storage potentially impacted by fill placed as part of access road construction;

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[3] US Ecology was acquired by Republic during the RA. For consistency, this report refers to US Ecology/Republic as Republic. Despite the name change, US Ecology/Republic management and field personnel involved in the RA remained consistent throughout the project.

- Excavation of an entry pit for horizontal directional drilling (HDD) in the parking lot north of the Knox Trail Treatment System building and HDD exit pits near BEW-5 and at EW-2;
- Installation of a vertical steel plate in the path of the HDD at the western edge of the Kinder Morgan easement to protect the gas pipeline when advancing HDD into the easement; and
- Associated preparation activities such as mobilizing roll-offs and frac tanks to support RA activities and some minor tree trimming in work areas.

All preliminary activities were performed per the design documents. Additional details regarding construction of the access road are provided in **Appendix D**.

2.1.2 Horizontal Directional Drilling

HDD was used to install conduits beneath the Assabet River for conveying extracted groundwater and electrical power from the Knox Trail Treatment System building to/from extraction wells EW-2 and BEW-5. Two separate HDD borings were advanced for this purpose, with the first installed to EW-2 and the second installed to BEW-5. HDD borings were installed by DTI. HDD consisted of first drilling a pilot boring along the entire HDD trajectory. The pilot boring was then reamed to expand the diameter of the boring to sufficient diameter for placement of piping in the boring. Next, DTI pulled a 6-inch diameter high density polyethylene (HDPE) outer pipe sleeve through the reamed hole. Finally, inner 1- and 2-inch HDPE pipes were pulled through the 6-inch pipe sleeve. Per the design, all 1- and 2-inch piping was leak tested after installation. Additional details regarding HDD and the installation of piping between the Knox Trail Treatment System and EW-2 and BEW-5, including a photolog, HDD boring logs, and certification of leak testing, are provided in **Appendix F**.

2.1.3 Installation of Extraction Well EW-2

Drilling and construction of new extraction well, EW-2, was conducted in August and September 2023 by Cascade Drilling. EW-2 is located north of the Valley Sports building approximately 90 feet northeast of the MW-34 well cluster (**Figure 3**). This location coincides with the approximate location where the 1,4-dioxane plume emerges from bedrock into overburden. As described in the 100% Remedial Design (RD), a pilot boring was advanced near the proposed EW-2 location in March 2022 to collect data to support the screen design.

EW-2 is an 8-inch diameter extraction well constructed with a Schedule 40 polyvinyl chloride (PVC) riser pipe and two 10-foot section of stainless-steel screen. One screen is located immediately above till, and another screen is located immediately below till, separated by a blank section of pipe between the screens. This construction allows extraction of groundwater from the deep overburden on top of till and the shallow bedrock groundwater from beneath till.

Following the installation and development of EW-2, step and pump testing was performed in accordance with procedures described in SOP NMI-GW-017 and SOP NMI-GW-018 included in Remedial Design Work Plan Appendix I – Field Sampling Plan (FSP) (Geosyntec, 2020a).

Additional details regarding the installation of EW-2, including a boring log, well construction log, photolog and results of EW-2 hydraulic testing are provided in **Appendix F**.

2.1.4 Installation of Vaults and Final Connections

Following the completion of HDD from the Knox Trail Treatment System to BEW-5 and EW-2 and the installation of EW-2, vaults were installed at EW-2 and final piping connections were made. Republic first set the vault over EW-2 and the nearby HDD transition vault. Both of these vaults were 4-foot by 4-foot. Republic also set a 6-foot by 6-foot vault in the parking lot on the north side of the Knox Trail Treatment System housing HDD transition piping coming from BEW-5 and EW-2. Installed vaults met the design and specification provided in Appendix A.

Republic then trenched and installed piping to connect the Knox Trail Treatment System to the nearby vault in the parking lot and similarly trenched and installed piping between the EW-2 HDD transition vault and the well vault at EW-2.

Other components of this phase of work involved the following tasks:

- Installation of pipe, meters, valves and ports in the Knox Trail Treatment System building by O&M, Inc. to transmit groundwater entering the building from BEW-5 and EW-2 to the influent equalization tank for the treatment system.
- Installation of conduits for electrical power and signal wires in trenches and through vaults by Watjus Electrical The electrician also pulled and made final connections of wires for pumps and signal wires, installed electrical disconnects and switches, and wired/mounted leak detection in vaults.
- Installation of couplings/connections and hoses in the vaults by O&M, Inc. to plumb between pipes entering and exiting vaults.
- Placement of pumps in EW-2 and BEW-5 by Cascade and O&M, Inc. and fabrication of well heads.
- Construction of an enclosure around BEW-5.
- General earthwork such as backfilling and compacting around vaults, grading, and repair of the parking lot north of the Knox Trail Treatment System.
- Not as a component of the design but performed as an in-kind service, Republic also graded and asphalt-paved the north end of the parking lot at Valley Sports including around the HDD transition vault and well vault at EW-2.
- Installation of granite markers on the east and west boundaries of the Kinder Morgan easement where HDD piping from BEW-5 passes below the gas line.

2.1.5 Shakedown and Start-up

Shakedown of the expanded treatment system commenced once system construction was complete. Shakedown consisted of typical tasks such as testing/bumping pumps, adjusting flow control valves, testing leak detection devices, confirming flow meters were operating properly and monitoring piping for leaks.

Start-up of the system occurred in three phases as described in the 100% RD where the response to pumping from each newly connected well was first evaluated individually and then wells were operated together. The purpose of this approach was to gradually introduce new groundwater streams to the Knox Trail Treatment System and test each extraction pump and well individually. Pumping from EW-1 was continued throughout all phases of the start-up program to ensure plume capture of the 1,4-dioxane plume was maintained.

A summary of active extraction wells and pumping rates tested during each phase of start-up is described below. Phases 1 and 2 generally involved operating pumps in wells at the rates as listed below for at least a week followed by operating only EW-1 (at 20 gallons per minute [gpm]) for a week. Flow rates for each phase of start-up were selected based on results from step and pump testing at BEW-5 and EW-2, as well as knowledge about plume capture provided from historical EW-1 performance.

- Phase 1: November 6 to 27, 2023
    - November 6 to 20: EW-1 at 20 gpm, EW-2 at 0 gpm, and BEW-5 at 2.3 gpm
    - November 20 to 27: BEW-5 and EW-2 off, and EW-1 at 20 gpm to allow the aquifer to return to baseline conditions.
- Phase 2: November 27 to December 11, 2023
    - November 27 to December 4: EW-1 at 10 gpm, EW-2 at 11.5 gpm and BEW-5 at 0 gpm
    - December 4 to 11: EW-2 and BEW-5 off, and EW-1 at 20 gpm to allow the aquifer to return to baseline conditions.
- Phase 3: After December 11, 2023
    - EW-1 at 10 gpm, EW-2 at 11.5 gpm and BEW-5 at 2.3 gpm

Water level data were collected from wells listed in the monitoring program described in the 100% RD at the end of each pumping phase after pumps had operated continuously at the target pumping rates for at least one week. Groundwater samples for analytical analysis were also collected from each active well, the combined system influent and the combined system effluent at the end of each pumping phase (at a minimum).

Operations of the Knox Trail Treatment System were adjusted during start-up to accommodate the new groundwater stream(s) and 1,4-dioxane mass loading. Phase 1 pumping revealed that water drawn from BEW-5 required adjustment of the VanOx system to accommodate the higher 1,4-dioxane mass load. System adjustment initially had the negative effect of causing precipitation to form downstream of the VanOx units and clog granular activated carbon (GAC) – this resulted in a maintenance shutdown for GAC cleaning during Phase 1 pumping. More precipitation formed during the initial days of Phase 3 pumping and another maintenance shutdown was needed. O&M, Inc. and the vendor for the VanOx unit (Evoqua) were able to adjust the oxidation system within the initial weeks of Phase 3 pumping and achieve treatment while mitigating precipitation. Such adjustments are considered normal shakedown activities. O&M, Inc. continued refinement of VanOx operations through Spring 2024 as the plant underwent an optimization program. This program is described in the Knox Trail Treatment System Optimization Plan dated February 22, 2024 that was approved by USEPA on March 4, 2024. Optimization activities occurred during March, April and May 2024 and were aimed at achieving the best possible treatment for the combined water from EW-1, EW-2 and BEW-5. Monthly Site progress reports submitted to USEPA for November 2023 through March 2024 contain additional information on adjustments to the system and VanOx unit during these months.

Pumping rates listed above (EW-1 at 10 gpm, EW-2 at 11.5 gpm and BEW-5 at 2.3 gpm) were not changed once initiated during Phase 3. The Phase 3 pumping rates are currently anticipated to be the long-term pumping rates for EW-1, EW-2 and BEW-5.

2.2 Chronology of Field Activities

The table below summarizes the sequence of field activities performed to implement the RA. Additional details regarding construction are included in **Appendices D, E**, and **F**.

Period	RA Activities
Pre-construction (December 2022-May 2023)	Republic performed the following activities per the 100% RD in preparation for RA construction: • Constructed the roadway to BEW-5 (December 2022) • Excavated 47 CY of shallow soils from around trees north of BEW-5 to compensate for flood storage lost from the road (April/May 2023). • Installed a vertical steel road plate under the access road on the western side of the Kinder Morgan easement as a physical barrier to protect the gas line during HDD (May 2023) • Performed some tree trimming and minor brush clean-up around BEW-5 (e.g., removed fallen trees and branches in the way of work) (April/May 2023) • Excavated an HDD entry pit in the north parking lot of the Knox Trail Treatment System (May 2023)
July 24-28, 2023	DTI mobilized HDPE pipe and personnel to the site. DTI welded 6-inch, 2-inch and 1-inch diameter HDPE pipe into approximately 400-foot to 500-foot sections.
July 30-August 5, 2023	No Work

Period	RA Activities
August 7-11, 2023	DTI mobilize an HDD rig and set-up at the entry pit in the parking lot of the Knox Trail Treatment System. Republic excavated an exit pit near EW-2. DTI drilled from the entrance in Knox Trail Treatment System parking lot toward EW-2 emerging in the exit pit. The pilot hole was reamed to enlarge the borehole and then 6-inch HDPE was pulled from EW-2 through the reamed hole back to the Knox Trail Treatment System.
August 14-18, 2023	DTI mobilized a larger HDD rig to drill the boring to BEW-5 since it was a longer distance than to EW-2. One of the rig's metal pins broke prior to initiating drilling; DTI with the assistance of Republic had a new pin fabricated at a local machine shop. Once the rig was fixed, drilling was initiated from the entrance at Knox Trail Treatment System parking lot toward BEW-5. Drilling was suspended just east of the Valley Sports parking lot approximately 30 feet (ft) before approaching the Kinder Morgan gas pipeline in preparation for Kinder Morgan personnel to arrive and observed drilling within the easement on Monday August 21st.
August 21-25, 2023	DTI resumed drilling and advanced HDD beneath the gas pipeline in the presence of Kinder Morgan personnel. Republic excavated an exit pit near BEW-5. The pilot hole was drilled to the exit pit and then reamed to enlarge the borehole. DTI began pulling the 6-inch HDPE casing from BEW-5 through the reamed hole back to Knox Trail until the swivel connecting the HDPE pipe to drilling rods broke after approximately 400 ft of HDPE had been pulled through. For 1.5 days DTI attempted to pull the HDPE out of the boring unsuccessfully.
August 28-September 1, 2023	DTI re-drilled the eastern portion of the HDD boring to BEW-5 from the point where the pipe swivel broke (about 400-feet from the HDD exit point). The new portion of the boring ran parallel and adjacent to the stuck pipe. The western portion of the boring between the entrance in the Knox Trail Treatment System parking lot and where the pipe swivel broke (approximately 450 feet) remained. The portion of the HDPE pipe that remaining stuck in the ground was decommissioned by filling it with bentonite grout, cutting the pipe slightly below ground surface, and capping it.
September 4-8, 2023	DTI installed 1-inch and 2-inch HDPE pipes from EW-2 and BEW-5 to Knox Trail within outer 6-inch HDPE chase pipes. After installation, DTI leak tested lines to EW-2 and BEW-5 on September 8. All lines to EW-2 passed leak testing. One of the 2-inch lines to BEW-5 failed leak testing (the 1-inch lines to BEW-5 passed).
September 11-15, 2023	DTI welded additional 1-inch and 2-inch HDPE pipe at the BEW-5 end of piping and pulled approximately 30 feet of the inner lines towards Knox Trail. This revealed that a rock had become wedge between a 2-inch pipe and the 6-inch outer pipe and that this rock had cut the 2-inch line. After the rock was removed, 1-inch and 2-inch pipes were trimmed to remove

Period	RA Activities
	sections damaged by the rock. Piping to BEW-5 was then retested on September 15. All pipes to BEW-5 past leak testing. DTI demobilized from the Site.
September 18-22, 2023	EW-2 was developed by Cascade using a surge block attached to a 3-inch Grundfos pump. After repeated surging and pumping cycles, turbidity in pumped groundwater was reduced to <1 Nephelometric Turbidity Units (NTU). Well testing demonstrated that EW-2 could yield up to 28 gpm which was the maximum flow for the pump, at approximately 15 feet of water level drawdown. Republic installed the vault in the parking lot of the Knox Trail Treatment System as well as subsurface groundwater conveyance piping and electrical conduit between the vault and treatment building. O&M, Inc. then installed plumbing connections within the vault at the Knox Trail Treatment System. Prior to HDD drilling, O&M, Inc. had constructed plumbing, valves, and gauges inside the treatment building to transmit groundwater entering the building from BEW-5 and EW-2 into the influent tank for the treatment system.
September 25-29, 2023	Republic and O&M, Inc. installed subsurface piping and electrical conduit from the end of the HDD at BEW-5 to the wellhead at BEW-5. This included pouring a small concrete pad around BEW-5 to support the enclosure that was later installed.
October 2-6, 2023	Republic installed the HDD transition vault and the wellhead vault for EW-2. O&M, Inc. then installed piping between vaults and down EW-2 and made connections to the pipes installed by HDD. The electrician connected power from the Knox Trail Treatment System to EW-2 including a knife box in the EW-2 vault. The extraction pump and stiller pipe were installed in EW-2 by O&M, Inc. to prepare EW-2 for step and pump testing week of October 9, 2023. O&M, Inc. also completed piping in the vault located in the parking lot of the Knox Trail Treatment System.
October 9-13, 2023	Republic completed grading around EW-2, installed the top on the vault in the Knox Trail Treatment System parking lot, backfilled and graded around the vault and started to repair the parking lot around the Knox Trail Treatment System building. Geosyntec performed step and pump testing at EW-2 (see Appendix E).
October 16-20, 2023	O&M, Inc. and the electrician continued to connect plumbing and electricity between BEW-5 and the Knox Trail Treatment System. The enclosure was placed atop the concrete pad at BEW-5.
October 23-27, 2023	The electrician continued to install and connect signal wires for leak detection in vaults. Republic rebuilt the parking lot at the Knox Trail

Period	RA Activities
	Treatment System. Republic also paved the parking lot for Valley Sports at the request of the owner. Evoqua visited the site to review the treatment system in preparation for start-up.
October 30-November 3, 2023	The electrician finalized signal wires for the leak detection in vaults and landed them in the plant. Pumps in wells were energized and bumped to ensure proper operation. Transducers were deployed in wells per Table 1 of the 100% RD on 11/2/23.
November 6-10, 2023	Water levels were measured during the morning of 11/6/23 and pumping from BEW-5 was initiated at 11:45 (with ongoing pumping from EW-1). This began the start of Phase 1 of system start-up.
November 13-17, 2023	An alarm on the Knox Trail Treatment System, which could not be resolved by the operator, occurred at 6:45 am on 11/13/23 and the system had to be shutdown. This shutdown preceded the water level gauging planned for later in the day to capture steady-state heads with EW-1 and BEW-5 pumping. The alarm was resolved, and the Knox Trail Treatment System was restarted by early evening on 11/13/23. Transducer data from MW-BS15/BM15 and MW-BS51 were downloaded on 11/15/23 which revealed that water levels had not returned to stable levels prior to the alarm shutdown. It was decided to continue Phase 1 startup pumping until 11/20/23.
November 20-24, 2023	Per the start-up program, water levels were measured, and laboratory samples were collected on the morning of 11/20/23 prior to the shutdown of BEW-5 for the second half of Phase 1 start-up. BEW-5 was shut down around noon on 11/20/23 and remained off until 11/27/23 to allow the aquifer to return to static conditions. EW-1 continued to operate at 20 gpm. The system operated in this mode for one week.
November 27-December 1, 2023	Phase 2 of system start-up began on 11/27/23. This first entailed collecting water level measurements. Additional wells were added to the hydraulic monitoring program to assess water elevations closer to the Town of Acton’s Assabet well field since pumping rates had recently changed at these wells. After collecting water level measurements, EW-1 was turned down to 10 gpm and EW-2 was activated at 11.5 gpm (BEW-5 remained at 0 gpm). These rates were specified by Geosyntec based on capture observed by EW-2 during pump testing.
December 4-8, 2023	The second half of phase 2 start-up began on 12/4/23. This entailed collecting water level measurements in the morning, including additional wells around Acton’s Assabet well field, followed by turning off EW-2 and returning EW-1 to a pumping rate of 20 gpm to allow the aquifer to return to static conditions. The system operated in this mode for one week.
December 11-15, 2023	Phase 3 of system start-up began on 12/11/23. This entailed collecting water level measurements during the morning of 12/11/23 including additional

Period	**RA Activities**
	wells around the Town Assabet wells. Pumping for the Knox Trail Treatment System was then adjusted such that flow rates at EW-1 = 10 gpm, EW-2 = 11.5 gpm, and BEW-5 = 2.3 gpm. These rates were specified by Geosyntec based on plume capture observed during Phase 2 pumping. Phase 3 pumping began around noon on 12/11/23. The Knox Trail Treatment System experiences formation of a fine precipitate that accumulated and eventually clogged on the lead GAC vessel. This clogging required shutdown and cleaning on 12/12/23 for approximately 4 hours and 12/15/23 for approximately 2 hours.
December 18-22, 2023	Water level gauging was planned for 12/18/23 but postponed due to: (1) to system shutdowns on 12/12/23 and 12/15/23, and (2) high groundwater. High groundwater was caused by a storm with ~4 inches of rainfall on 12/18/23 resulting is the Assabet River reaching flood stage and a more than 10-year high.
December 25-31, 2023	The system continued to operate under Phase 3 pumping. Water levels were collected on 12/28/23. These water levels represented steady state under Phase 3 (i.e., long-term) pumping conditions.
January 1, 2024 to present	System continued to operate with the following flow rates: - EW-1 = 10 gpm, - EW-2 = 11.5 gpm, and - BEW-5 = 2.3 gpm
March – May 2024	O&M, Inc. in partnership with de maximis performed parametric adjustments of the Knox Trail Treatment System in order to optimize its treatment of the combined groundwater stream from EW-1, EW-2 and BEW-5. The annual groundwater monitoring event that includes gauging and sampling wells across site occurred during the first two-weeks of April 2024.
April 22-26, 2024	Charter Construction, under subcontract to de maximis for other site construction activities, installed granite markers on the east and west boundaries of the Kinder Morgan Easement where the piping from BEW-5 passes below the gas line.
May 22, 2024	Pre-final inspection conducted by USEPA, MassDEP, de maximis, O&M, Inc., AECOM, and Geosyntec to confirm RA is operating as designed and identify punch list items. Additional details provided in **Section 5.**

2.3 Construction Quality Control

Geosyntec reviewed and approved contractor submittals for conformance with the 100% RD. This included materials specifications, construction and progress schedules, groundwater piping leak test results, and other quality assurance documentation. Copies of approved submittals are included in **Appendix G**; copies of leak test reports for HDD piping are provided in **Appendix F**.

During RA construction activities, a Geosyntec representative was on-site full time during major construction components to ensure work was completed in accordance with the 100% RD except for approved deviations (**Section 2.4**). In addition to Geosyntec oversight, de maximis and AECOM, USEPA's oversight contractor, provided periodic field oversight of the RA construction.

During HDD, Geosyntec accompanied and was in constant communication with the HDD driller's helper walking along the path of HDD pilot bit advancement. The driller's helper was in continuous radio communication with the lead driller at the initiation side of HDD in the parking lot of the Knox Trail Treatment System. HDD quality assurance monitoring activities included overseeing that the advancement path of the HDD (as identified by the driller's helper using a handheld instrument receiving a signal from the HDD pilot bit while walking across ground surface) conformed with the design layout and was painted or marked with a pin flag approximately every twenty feet of advancement, overseeing that the drill tip did not advance at a depth shallower than the design depth, discussing any obstructions encountered by the driller, monitoring ground surface for any visible drilling fluid frac-out, monitoring the river for visible drilling fluid frac-out during advancement under the river, monitoring drilling advancement relative to the KM easement to ensure KM presence before advancing, and monitoring any rig breakdown or loss of drilling fluid. Geosyntec also observed 1-inch and 2-inch HDPE pipe leak testing. A certification of groundwater piping leak test results is included in **Appendix F.**

The depth of HDD achieved minimum design depths identified in the 100% RD beneath key features, including the Assabet River (based on depths below ground at the western and eastern banks), the water line on the west side of Knox Trail, and the Kinder Morgan gas pipeline. Additional details of HDD including a photolog and boring logs identifying as-built depths along the HDD trajectories is included in **Appendix F**.

Geosyntec also oversaw Cascade drilling and construction of EW-2 drilling for compliance with the 100% RD, and Geosyntec performed the step and pump testing at EW-2. A detailed description of the drilling and construction of EW-2, as well as details and analysis of subsequent step and pump testing at EW-2, are provided in **Appendix E**.

Pre-final and final inspection are discussed in **Section 5**.

2.4 Deviations from the 100% Remedial Design

Conditions encountered during RA construction required some changes from the remedial design. Deviations were made in consultation with the project team including de maximis and the Engineer of Record, and regulatory agencies as necessary. The table below documents deviations from the 100% RD.

Item	Description of Change from 100%RD
Access road to BEW-5	The access road was extended to the east to and in a 5-foot radius around BEW-5 to improve the drainage and accessibility around the well.
6-inch casing to BEW-5	While the 6-inch HDPE pipe was being drawn from BEW-5 toward the Knox Trail Treatment System, the steel swivel connecting drilling rods to the HDPE pipe broke approximately 400 feet from BEW-5. Multiple attempts were made over 1.5 days to pull the HDPE pipe back to BEW-5 using chains, straps and heavy equipment – all were unsuccessful. Thus, the HDD from the Knox Trail Treatment System to BEW-5 was re-drilled from the point where the pipe swivel broke (about 450 feet from the HDD entry point in the parking lot of the Knox Trail Treatment System) to BEW-5 and a 6-inch HDPE pipe (with 400 feet of new pipe) was pulled through the new boring. The new boring ran parallel to and within a few feet of the original pipe. The 6-inch pipe that was stuck in the ground was decommissioned in-situ by pouring bentonite grout into the pipe through the BEW-5 end. The decommissioned pipe was also capped by the steel pulling head welded on the far end (where the swivel broke below ground) and a cap that was attached at the BEW-5 end after the pipe was filled with bentonite grout.
EW-2 Screen Depths	Till was encountered approximately 6 inches shallower and was slightly thicker at the EW-2 location than at the pilot boring for EW-2 (the two locations are approximately 20 feet apart). As such, and in consultation with the Senior Project Hydrogeologist and Engineer-of-Record, the screen intervals for EW-2 were raised 1 foot from the intervals planned in the 100% RD so that the section of solid casing between the two screens was centered on the till at EW-2.
BEW-5 Concrete Pad and leak sensor	A concrete pad was added around BEW-5. This pad is approximately 4 inches thick and was installed to support the overlying enclosure atop BEW-5.

Item	Description of Change from 100%RD
	Because BEW-5 has a concrete pad and prefabricated enclosure attached to the pad, as opposed to a wooden enclosure on the ground surface, a leak detection sensor (conductivity switch) was added within the enclosure at BEW-5 and connected in series with other sensors in vaults at EW-2 and in the parking lot of the Knox Trail Treatment System. These sensors connect back to the Knox Trail Treatment System and are wired such that a leak detection at any vault or BEW-5 ceases pumping at EW-2 and BEW-5 and signals an alarm. The pumps do not restart until the fault is reset by the operator (after they inspect the system for the source of the alarm).
Phase 1 Start-up Pumping Duration	The pumping portion of Phase 1 start-up was planned to last one week but was extended an extra week (until 11/20/23) due to an unexpected shutdown of the Knox Trail Treatment System on 11/13/23.
Phase 1 and 3 Pumping – Maintenance Shutdowns	Precipitation was observed downstream of the VanOx unit during Phase 1 and early in Phase 3 when BEW-5 was brought on-line. This required a maintenance shutdown during each phase for cleaning. As a result, water level measurements under steady state pumping were delayed a week.

2.5 Soil and Groundwater Disposal

The 100% RD contemplated reuse of soils generated during the RA at the main NMI Property located at 2229 Main Street in Concord, Massachusetts (the NMI Property) but this did not occur. Rather, all soils generated during the RA were disposed of at Wayne Disposal Inc. in Belleville, Michigan, a licensed disposal facility. Soil and drilling fluids/cuttings were handled during the RA in the following manner:

- A small amount of surficial soil was removed from a wooded area adjacent to the new road to BEW-5 to compensate for flood storage volume lost when building the road. This soil was transported by Republic in dump trucks to the NMI Property and stockpiled in the Waste Processing Area. The material was subsequently transported off-site under a Non-Hazardous Manifest to Wayne Disposal Inc.
- Approximately one-third of a roll-off containing soil and drilling mud was generated from HDD. This material was placed into the roll-off by DTI as work progressed and at the end of the HDD program was transported by Republic to the Waste Processing Area at the NMI Property. The material was subsequently transported off-site under a Non-Hazardous Manifest to Wayne Disposal Inc.

- Drilling cuttings generated during the installation of EW-2 were placed in a roll-off by Cascade and staged next to the well within a fenced area. Once drilling was complete, Republic transported the material via a vac truck to the Waste Processing Area at the NMI Property. Drill cuttings were subsequently transported off-site under a Non-Hazardous Manifest to Wayne Disposal Inc.

The development, step testing, and pump testing of EW-2 generated approximately one fractionation tank of groundwater. This groundwater was treated using a temporary system containing bag filters and granular activated carbon filters. Water passed through the system consisting of bag filters followed by GAC, and into a clean fractionation tank where it was tested and subsequently discharged to the Assabet River under Remediation General Permit equivalency. Analytical results of water generated from step and pump testing at EW-2 after treatment are provided in **Table 1**.

3 RESULTS DURING START-UP

The purpose of the Knox Trail Groundwater Extraction System Expansion is to intercept the 1,4-dioxane plume from the NMI Site further upgradient of EW-1 by incorporating wells EW-2 and BEW-5 into the pumping system. An additional benefit of the RA is that more 1,4-dioxane mass is removed since EW-2 and BEW-5 are screened in higher-concentration portions of the plume than EW-1. This section presents results during each phase of start-up but focuses primarily on results observed during Phase 3 of startup since the pumping configuration employed during Phase 3 is anticipated to persist as the long-term operational pumping configuration and that is what will be evaluated when considering if the RA has achieved performance objectives.

3.1 Phase 1

Phase 1 consisted of groundwater extraction from bedrock well, BEW-5, in conjunction with deep overburden well EW-1. EW-2 was not operational during Phase 1. Phase 1 began on November 6, 2023 and ended on November 27, 2023. Phase 1 consisted of a pumping and rebound period as follows:

- Pumping (November 6-20): EW-1 operated at 20 gpm and BEW-5 operated at 2.3 gpm.
- Rebound (November 20-27): EW-1 operated at 20 gpm and BEW-5 was off.

The pumping rate for BEW-5 was selected as the maximum sustainable yield for the well determined from pump testing performed at BEW-5. EW-1 was maintained at 20 gpm to maintain capture of the overburden 1,4-dioxane plume.

Groundwater elevations were collected prior to starting Phase 1, on November 20, 2023 at the end of the pumping portion of the phase, and on November 27 at the end of the rebound phase. The groundwater elevations are provided in **Table 2**. Groundwater analytical samples were also collected at the treatment plant at the beginning and end of Phase 1 pumping; these samples were collected from the system influent (i.e., a mixture of groundwater extracted from both EW-1 and BEW-5 operating at the time), BEW-5, and the system effluent. The 1,4-dioxane results for these samples are provided in **Table 3, Table 4a,** and shown on **Figure 4.** Calculated mass removal rates are reported in **Table 4b**. Full analytical results are provided in **Appendix H**.

The Knox Trail Treatment System experienced some operational challenges during Phase 1 of start-up. As described in **Sections 2.1.5** and **2.2**, a precipitate formed within the system, potentially from excess or unreacted persulfate, and clogged the GAC filters located downstream of the VanOx unit. This clogging increased backpressure and the system had to be shutdown periodically for cleaning as the issue was resolved. O&M, Inc. worked closely with the vendor of the VanOx unit to adjust UV and persulfate dosing for the new influent composition and performed intense cleaning to maintain operation of the plant through the pumping stage of Phase 1. Despite efforts to adjust the system, treatment of 1,4-dioxane to below 0.46 micrograms per liter (µg/L) in effluent[4] was not achieved during Phase 1. Operational challenges associated with the formation of precipitate occurred again during Phase 3 (i.e., when influent contained groundwater from BEW-5), but were managed though an optimization program for the plant as described in **Section 3.3** such that by April 2024, 1,4-dioxane concentrations in effluent were consistently below 0.46 µg/L. Further discussion about this is provided in **Section 3.3**, monthly Site progress reports submitted to USEPA for November 2023 through May 2024, and the Knox Trail Pump and Treatment System Optimization Report included as **Appendix I**.

The 1,4-dioxane mass removal rate during Phase 1 pumping at 22.3 gpm (EW-1 and BEW-5) was calculated to be approximately 1.07 grams per day (g/d). This is an impressive 2.7-times higher than the mass removal rate when pumping from EW-1 (only) at 20 gpm (i.e., prior to the Knox Trail Groundwater Extraction System Expansion RA) and demonstrates the benefit of incorporating BEW-5 into the system. The individual 1,4-dioxane mass removal rates for extraction wells EW-1 and BEW-5 were 0.39 and 0.68 g/d, respectively, with the combination yielding the aforementioned 1.07 g/d in system influent (**Table 4b**).

3.2 Phase 2

Phase 2 consisted of groundwater extraction from new extraction well EW-2 screened in deep overburden and shallow bedrock, in conjunction with deep overburden well EW-1. BEW-5 was not operational during Phase 2. Phase 2 began on November 27, 2023 and ended on December 11, 2023. Phase 2 consisted of a pumping and rebound period as follows:

- Pumping (November 27-December 4): EW-1 operated at 10 gpm and EW-2 operated at 11.5 gpm.
- Rebound (December 4-11): EW-1 operated at 20 gpm and EW-2 was off.

The pumping rate for EW-2 was selected to capture the width of the overburden 1,4-dioxane plume (plus a safety factor) at EW-2 (see **Appendix F**) and the flow at EW-1 was reduced to 10 gpm so that the total flow to capture the overburden 1,4-dioxane plume remained no less than 20 gpm (i.e., the rate that has sufficiently contained the plume for years).

Groundwater elevations were collected prior to starting Phase 2, at the end of the pumping portion of the phase, and at the end of the rebound phase. The groundwater elevations are provided in **Table 2**. Groundwater analytical samples were also collected at the treatment plant at the beginning and end of Phase 2 pumping; these samples were collected from the system influent (i.e., a mixture of groundwater extracted from EW-1 and EW-2 operating at the time), EW-2, and the system effluent. The 1,4-dioxane results for these samples are provided in **Table**

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[4] The Record of Decision (ROD) Groundwater Cleanup Level (Cleanup Level) for 1,4-dioxane is 0.46 µg/L which is also the discharge limit for 1,4-dioxane by the Knox Trail Treatment System when influent concentrations are below 10 µg/L (see de maximis' February 13, 2024 letter to EPA).

3, results averaged by phase are reported in **Table 4a,** and shown on **Figure 4.** Calculated mass removal rates are reported in **Table 4b**. Full analytical results are provided in **Appendix H**.

The Knox Trail Treatment System treated groundwater during Phase 2 with minimal operational challenges. Details regarding system adjustments, cleaning and testing are provided in monthly Site progress reports.

The 1,4-dioxane mass removal rate during Phase 2 pumping at 21.5 gpm (EW-1 and EW-2) was calculated to be approximately 0.56 g/d. This is approximately 1.4 times more mass removal than when pumping from EW-1 (only) at 20 gpm (i.e., prior to the RA). The individual 1,4-dioxane mass removal rates for extraction wells EW-1 and EW-2 were 0.20 and 0.36 g/d respectively, with the combination yielding the aforementioned 0.56 g/d for the system influent (**Table 4b**).

3.3 Phase 3

Phase 3 consisted of groundwater extraction from both new wells, EW-2 and BEW-5, in conjunction with deep overburden well EW-1. Phase 3 began on December 11, 2023 and is expected to remain the pumping program for the foreseeable future (pumping rates may be adjusted over the years as part of optimization as the plume shrinks). Phase 3 consisted of pumping wells as follows:

- EW-1 at 10 gpm, EW-2 at 11.5 gpm and BEW-5 at 2.3 gpm.

These pumping rates were selected as the Phase 2 pumping rates (to achieve plume capture) plus BEW-5 operating at its maximum sustainable yield.

Groundwater elevations were collected on December 28, 2023, approximately 17 days after initiating Phase 3. The groundwater elevations are provided in **Table 2**. Groundwater analytical samples were also collected at the treatment plant during Phase 3 pumping; these samples were collected from the system influent (i.e., a mixture of groundwater extraction from all wells), EW-1, EW-2, BEW-5, and the system effluent. The 1,4-dioxane results for these samples are provided in **Table 3, Table 4a,** and shown on **Figure 4.** Calculated mass removal rates are reported in **Table 4b**. Full analytical results are provided in **Appendix H**.

Groundwater elevations contours based on measurements collected on December 28, 2023, were prepared and are shown in **Figure 5** and **6** to understand capture in deep overburden and bedrock attained by Phase 3 pumping relative to the extent of the 1,4-dioxane plumes. These figures show that the pumping wells capture overburden and bedrock groundwater from beyond the boundaries of the 1,4-dioxane plumes. This analysis indicates that the groundwater extraction system under the new pumping regime is intercepting groundwater containing 1,4-dioxane above 0.46 µg/L and preventing it from migrating downgradient toward the Assabet wellfield. If the Town of Acton significantly modifies the pumping rates and/or configuration for the Assabet wellfield enough to change the historical trajectory of the 1,4-dioxane plume, then capture should be verified (as is done as part of annual site wide sampling) and the extraction rates for EW-1, EW-2 and/or BEW-5 may need to be adjusted.

The Knox Trail Treatment System initially experienced some challenges treating water during Phase 3. Similar to Phase 1, formation of a precipitate occurred and caused clogging in downstream filters and high back pressure. O&M, Inc., in conjunction with the VanOx vendor, made calculated and incremental adjustments to persulfate dosing and UV lamp intensity, along with performing intense system cleaning which allowed near continuous pumping and plant operations to continue. Adjustments to the VanOx system continued to be made into spring 2024 to optimize the plant for treatment of the new influent containing groundwater from EW-1, EW-2 and BEW-5, including systematic adjustments in persulfate dose and lamp intensity, as well as operating a fourth reactor. The result of these adjustments was that by April 2024 the system effluent consistently achieved concentrations less than 0.46 μg/L of 1,4-dioxane. Details regarding system adjustments, cleaning and testing are provided in monthly Site progress reports and the July 2024 Knox Trail Groundwater Pump & Treatment System Optimization Report (**Appendix I**).

The average 1,4-dioxane mass removal rate achieved during the first two months of Phase 3 operation pumping at 23.8 gpm (EW-1, EW-2, and BEW-5) was calculated to be approximately 1.02 g/d (**Table 4b**). This is an approximately 2.6-times higher mass removal rate than prior to the RA when EW-1 (only) was pumping at 20 gpm. In comparison, the mass removal rate for the Knox Trail Treatment System prior to adding EW-2 and BEW-5 was approximately 0.39 g/d. Expanding the Knox Trail Treatment System to include EW-2 and BEW-5 has therefore increased 1,4-dioxane mass removal 260% while total volumetric extraction rate has only increased 114% (from 20 to 22.8 gpm).

3.4 Transducer Data

In addition to groundwater elevation data described above which were manually collected at key times during Phases 1, 2 and 3, transducers were installed in select monitoring wells within the vicinity of pumping wells on November 2, 2023 (prior to Phase 1) and left in wells until January 19, 2024 (more than a month into Phase 3 pumping). A transducer was also placed in the Assabet River. The purpose of deploying transducers was to observe water level changes in the aquifer and Assabet River throughout the phases of start-up, and particularly, verify that a week was sufficiently long for water levels at site wells to stabilize following a change in pumping configuration at EW-1, EW-2 and/or BEW-5 before proceeding to subsequent start-up phases.

Figure 7 provides a plot of groundwater elevations measured using transducers throughout Phases 1, 2 and 3. Solinst LevelLogger pressure transducers with a pressure rating of 100-feet of water were used to measure depth of water (above the transducer) every 30 minutes over a 2-month period in 7 bedrock wells, 3 overburden wells, and the Assabet River. Transducer data were converted to groundwater elevation (or surface water elevation in the case of the Assabet River) using the submerged depth of the transducer relative to a reference elevation when transducers were deployed. Elevations were verified periodically during the two-month deployment period using hand measurements. **Figure 7** also shows rainfall events and their magnitude during the deployment period. Conclusions drawn from transducer data are as follows:

- Phase 1 of start-up was the first data used to assess the lag time between a change in extraction well pumping rates and stabilized groundwater elevations. During Phase 1 pumping, bedrock wells in the system experienced steep drawdown for the first 2 days of pumping (i.e., November 6 and 7, 2023) before beginning to level off.

- Hydraulic stability was perturbed by rainfall events. During Phase 1, this can be seen for the November 10, 2023 rainfall. Larger rainfall events during Phases 2 and 3 of pumping clearly affect river and groundwater levels.

- On November 14, 2023, the Knox Trail Treatment System had to shut down due to high pressure from precipitation accumulating on filters. Increases in groundwater elevation coincide with this event but quickly (within 2 days) after system restart, groundwater elevations return to stable levels.

- The most distinct responses to changes in Phase 1 pumping were observed in BEW-6, MW-BM15, MW-BS15, and MW-BS51.

- MW-SD32, MW-BS32, MW-SD34, MW-BS34, MW-SD-52, and MW-BS-52 appear to be more heavily influenced by precipitation which can be seen by the rain events from November 22 to 23, 2023, where their hydraulic response mirrors the Assabet River.

- After Phase 1 pumping ceased on November 20, 2023, groundwater elevations increased and appear to stabilize after 2-3 days. However, two rainfall events occurred shortly into the rebound period of Phase 1 so response to pumping is most apparent at wells that are less affected by river level.

- Phase 2 began on November 27, 2023 causing groundwater elevations to decrease. After approximately 4 days, groundwater elevations stabilized under Phase 2 pumping; however, the level of the Assabet River was also falling during this period so there was a general lowering of water elevation between November 27, 2023 and a rainfall event on December 3, 2023.

- Phase 2 rebound began on December 4, 2023, however, data during the rebound period are difficult to interpret because the Assabet River level decreased by more than a foot during the initial 5 days and then a large rainfall event occurred on December 10, 2023 which raised the Assabet River by more than 2 feet and groundwater levels at least a foot.

- Data at the beginning of Phase 3, similar to data at the end of Phase 2, are difficult to interpret because several large rainfall events caused large changes in river and groundwater elevation, and in fact, much of the data collected during Phase 3 are overshadowed by three rain events of greater than 2.5-inchs (in addition to 10 smaller events) that occurred between December 10, 2023 and January 8, 2024.

Despite water levels being impacted by many rainfall events, some of which were extraordinarily large, during Phase 1, 2 and 3, inspection of transducer data shows that water levels at monitoring wells generally stabilized under new pumping scenarios within about 4 days. This observation validates that one-week intervals between pumping and rebound periods during Phases 1 and 2 was sufficient for the aquifer to respond to the new pumping configuration. These data also support that water elevations collected on December 28, 2023 (17 days after initiating Phase 3 pumping; **Figures 5** and **6**) provide a representative snapshot of stabilized heads under EW-1, EW-2 and BEW-5 pumping.

4 OPERATION AND MAINTENANCE

4.1 Treatment System Operation and Monitoring

The addition of EW-2 and BEW-5 is an expansion of the existing Knox Trail Treatment System. The operation, maintenance, and monitoring activities for the expanded treatment system, which include system restart, shutdown procedures, and routine maintenance, are generally the same as prior to the system expansion and are included in the Knox Trail Groundwater Treatment System Operation and Maintenance (O&M) Plan (*de maximis*, 2023), that was updated in 2023 as part of the 100%RD to incorporate new maintenance for the expanded system including EW-2 and BEW-5.

4.2 Analytical Monitoring

Routine site-wide groundwater monitoring will continue to be completed in accordance with the Site-Wide Monitoring Plan (SWMP; Geosyntec, 2020). The SWMP includes routine site-wide groundwater monitoring associated with various RA projects at the Site. The annual sampling events to monitor 1,4-dioxane and VOC plume described in the SWMP are considered adequate to evaluate the efficacy of the new extraction wells at reducing the 1,4-dioxane and VOC concentrations in the downgradient plume over time. The first annual sampling event with EW-2 and BEW-5 operational was performed in April 2024. The treatment system itself is also sampled at least monthly as part of routine O&M and these results are submitted to the Agencies in regular monthly progress; these reports are available on the Project Portal.

Discussion regarding the system's demonstration of compliance with performance objectives is included in **Section 6**.

4.3 Annual Monitoring Reports

Groundwater monitoring reports, which are prepared on an annual basis as described in the SWMP, will incorporate results of analytical monitoring. These will include discussion of the effectiveness of the treatment plant and a discussion of the 1,4-dioxane plumes in overburden and bedrock (e.g., equipotential maps), and concentration trends as select wells at the Site.

5 PRE-FINAL AND FINAL INSPECTION

A pre-final inspection was conducted with USEPA, MassDEP, Geosyntec, de maximis, O&M, Inc., and AECOM on May 22, 2024[5]. Punch list items identified during the pre-final inspection were subsequently addressed as follows. Based on the satisfactory inspection and limited punch list items, the USEPA RPM determined that a pre-final inspection also fulfilled the requirement for a final inspection.

Item	Manner Addressed
Insulation to be placed in the enclosure at BEW-5 to cover the bottom vents as these vents are not needed and pose a pathway for potential freezing during winter months.	On June 12, 2024, covers were fabricated and installed over vents on the enclosure atop BEW-5.

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[5] USEPA (Kara Nierenberg and Zanetta Purnell), MassDEP (Garry Waldeck), Geosyntec (Amy DeSantis and Carl Elder), de maximis (Bruce Thompson, Adrian Bilger and Christine Taddonio), O&M, Inc. (Garrett Fuerst and David Pierce), AECOM (Andrew Schkuta and Nicholas Carabillo).

6 DEMONSTRATION OF COMPLIANCE

The performance objectives for the Knox Trail Groundwater Extraction System Expansion RA are provided in Section 1.1 of the 100% RD and restated below:

1) Hydraulic Capture: The primary objective of groundwater extraction from the two new extraction wells is to extend hydraulic capture of the dissolved phase plume in overburden and shallow bedrock groundwater further upgradient and into the areas between the Assabet River and Main Street (Route 62). Hydraulic capture will be achieved by lowering the potentiometric elevation in the vicinity of EW-2 and BEW-5 via pumping so that groundwater hydraulic gradients across the plume width in deep overburden and shallow bedrock are towards pumping wells, thereby intercepting the 1,4-dioxane plume.

2) Decreasing Concentration Trends in Downgradient Wells: The second objective of the expanded groundwater capture and treatment system is to decrease concentrations of 1,4-dioxane and VOCs in the area between Main Street, the Assabet River, and potentially in downgradient wells.

These design objectives are accomplished if the two new extraction wells (EW-2 and BEW-5) can extract groundwater at rates that capture the breadth of the 1,4-dioxane plume upgradient of EW-1, and the treatment plant can treat the combined groundwater stream.

The first performance objective can be measured by mapping groundwater heads in deep overburden and bedrock, which are the lithologies where 1,4-dioxane is migrating, and assessing whether the capture zones for EW-2 and BEW-5 extend beyond the edges of the 1,4-dioxane plume (from north to south) in the area upgradient of EW-1. **Figures 5** and **6** are maps of hydraulic heads in these lithologies under Phase 3 pumping (i.e., expected long-term pumping). These maps show that the combined capture zones of EW-2 and BEW-5 in shallow bedrock and deep overburden extend from north to south beyond the boundaries of the 1,4-dioxane plume (defined by concentrations greater than 0.46 μg/L) upgradient of EW-1. This figure also shows that the capture zone for EW-1 extends from north to south beyond the boundaries of the 1,4-dioxane plume. These figures therefore demonstrate that the expanded Knox Trail Groundwater Extraction System when pumping with EW-1 at 10 gpm, EW-2 at 11.5 gpm and BEW-5 at 2.3 gpm captures 1,4-dioxane plumes in overburden and bedrock. The ongoing annual groundwater monitoring program includes site-wide water elevation measurements that will be used to verify that the Knox Trail Groundwater Extraction System continues to capture 1,4-dioxane plumes throughout system operation.

Demonstrating that concentrations in the downgradient plume are shrinking requires temporal analysis of groundwater concentrations at the downgradient end of the 1,4-dioxane plume (e.g., wells north of Main Street) over time as pumping continues and ongoing analysis of treatment system data over a longer time periods than the existing start-up period. The Site currently has monthly sampling and analysis for the treatment plant and annual groundwater monitoring; data from these programs, especially annual events, are useful for tracking changes in plume size and concentration over time. However, several lines of evidence from start-up of the expanded system support an expectation that the new pumping regime will achieve this objective. These lines of evidence are:

1) Analytical data for combined influent to the system under the new pumping condition (i.e., EW-1 at 10 gpm, EW-2 at 11.5 gpm and BEW-5 at 2.3 gpm) show that the 1,4-dioxane mass load removed from the subsurface (and entering the treatment system) increased by more than 2.6x with EW-2 and BEW-5 incorporated (compared to EW-1 only prior to system expansion). By removing more mass, it is logical to expect the 1,4-dioxane plume to shrink and concentrations in the plume to decrease faster with EW-2 and BEW-5 operating as pumping wells than from pumping EW-1 alone.

2) 1,4-dioxane concentrations in groundwater extracted from EW-1 have demonstrated a decreasing trend since EW-1 began operation in 2017. Since EW-2 is also screened mostly in deep overburden, a similar trend is expected over the next several years.

3) EW-1 has successfully intercepted the 1,4-dioxane plume in deep overburden since EW-1 began operation in 2017 and 1,4-dioxane concentrations between Assabet wells and EW-1 have decreased. It is reasonable to expect the new wells, especially EW-2 since is also extracting groundwater mostly from deep overburden, to have a similar positive impact for the 1,4-dioxane plume immediately east of the Assabet River.

In summary, construction of the Knox Trail Groundwater Extraction System Expansion was completed in conformance with the design and the system is currently operating and functioning as designed The expanded system at its current flow rates is achieving hydraulic capture of the overburden and bedrock 1,4-dioxane plumes, capturing plumes further upgradient than where they were intercepted by EW-1 alone, and preventing the plumes from the NMI Site from migrating to the Assabet wellfield. In addition, mass removal is substantially greater with EW-2 and BEW-5 included as pumping wells which is expected to have a positive impact relative to plume size and/or concentration compared to pumping from EW-1 only.

Finally, effluent data collected from the system through January 2024 (i.e., Phase 1, Phase 2 and initial 2 months of Phase 3) shows that the treatment system was able to destroy >90% of influent 1,4-dioxane, on average, but not achieve the discharge limit of <0.46 ug/L. In spring 2024, once wells were pumping at their expected long-term rates, an optimization program was performed to achieve the best performance possible from the system. As a result of this program, which made systematic adjustments in persulfate dose and lamp intensity, as well as operating a fourth reactor, treatment improved and by April 2024 the system consistently achieved 1,4-dioxane concentrations in effluent below the discharge limit of 0.46 ug/L (see **Appendix I**).

According to the National Contingency Plan (40 Code of Federal Regulations 300.435(f)(2)), a groundwater containment remedy, including measures to control the migration of a groundwater plume, becomes "operational and functional" either one year after construction is complete, or when the remedy is determined by both USEPA and the State to be functioning properly and is performing as designed, whichever is earlier. This RA Report and the Professional Engineer’s Certification prior to Section 1 certify that the Settling Defendants consider that the RA has been constructed, is operational and functional as designed, and is containing 1,4-dioxane in overburden and bedrock north of Main Street (Route 62).

7 REFERENCES

de maximis, 2023. *Knox Trail Groundwater Treatment System Operation & Maintenance Plan, Revision 3*. May 16.

Geosyntec. 2020a. *Remedial Design Work Plan – Appendix I, Field Sampling Plan (FSP).* Nuclear Metals Superfund Site. March.

Geosyntec. 2020b. *Remedial Design Work Plan – Appendix K, Site Wide Monitoring Plan (SWMP).* Nuclear Metals Superfund Site. Revision 1. September.

Geosyntec. 2022. *100% Remedial Design – Knox Trail Groundwater Extraction System Expansion*. Nuclear Metals Inc. Superfund Site, Concord, MA. September.

USEPA. 2022. *Close Out Procedures for National Priorities List Sites*. OLEM Directive 9320.2-23. June.

TABLES

Table 1. Groundwater Results from EW-2 Step and Pump Testing Program
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

			Location	EW-2	EW-2	EW-2	EW-2	EW-2
			Description	Groundwater sample collected at the end of the step test performed at EW-2	Groundwater sample collected half-way through the pump test performed at EW-2	Groundwater collected at the end of the pump test performed at EW-2	Duplicate groundwater sample collected at the end of the pump test performed at EW-2	Sample of treated water from EW-2 step and pump test collected from the post-treatment fractionation tank
			Sample ID	EW-2-STEP-END-10092023	EW-2-CR-MID-10112023	EW-2-CONSTANT-END-10132023	EW-2-CONSTANT-END-10132023 DUP	EW2-EFF-10172023
			Sample Date	10/09/2023	10/11/2023	10/13/2023	10/13/2023	10/17/2023
			Lab Sample ID	L2359602-01	L2360312-01	L2360855-01	L2360855-02	L2361644-01
Parameter	Fraction	Method	TBEL (Daily Max)					
Wet Chemistry (ug/L)								
Alkalinity as CaCO3	T	SM 2320B		--	--	**64700**	**64100**	--
Ammonia (as N)	T	SM 4500-NH3-H		--	--	**57 J**	**43 J**	**1030**
Bicarbonate Ion, as HCO3	T	SM 2320B		--	--	64700	64100	--
Bromide	T	EPA 300.0	0.05	--	--	< 50 U	< 50 U	--
Carbonate (as CO3)	T	SM 2320B		--	--	< 2000 U	< 2000 U	--
Chloride	T	EPA 300.0		--	--	--	--	**52700**
Chloride	T	SM 4500-Cl--E		--	--	**82000**	**84000**	--
Chlorine, Total Residual	T	SM 4500-Cl-D		--	--	--	--	< 20 U
Cyanide	T	SM 4500-CN-E	178000	--	--	--	--	< 5.0 U
Fluoride	T	SM 4500-F-C		--	--	**30 J**	**30 J**	--
Nitrogen, Nitrate as NO3	T	SM 4500-NO3-F		--	--	**867**	**854**	--
Nitrogen, Nitrite as NO2	T	SM 4500-NO3-F		--	--	< 50 U	**14 J**	--
Phosphate	T	SM 4500-P-E MOD		--	--	12 J	25 J	--
Phosphorus	T	SM 4500-P-E		--	--	**4 J**	**8 J**	--
Sulfate	T	SM 4500-SO4-E		--	--	**72000**	**81000**	--
Metals (ug/L)								
Aluminum	T	SW-846 6020B		--	--	< 10 U	< 10 U	--
Aluminum	D	SW-846 6020B		--	--	< 10 U	< 10 U	--
Antimony	T	EPA 200.8	206	--	--	--	--	**9.68**
Antimony	T	SW-846 6020B	206	--	--	**21.5**	< 4.0 U	--
Antimony	D	SW-846 6020B	206	--	--	< 4.0 U	< 4.0 U	--
Arsenic	T	EPA 200.8	104	--	--	--	--	**11.76**
Arsenic	T	SW-846 6020B	104	--	--	**1.0**	< 0.50 U	--
Arsenic	D	SW-846 6020B	104	--	--	< 0.50 U	< 0.50 U	--
Barium	T	SW-846 6020B		--	--	**33.5**	**32.1**	--
Barium	D	SW-846 6020B		--	--	**33.2**	**33.1**	--
Beryllium	T	SW-846 6020B		--	--	< 0.50 U	< 0.50 U	--
Beryllium	D	SW-846 6020B		--	--	< 0.50 U	< 0.50 U	--
Cadmium	T	EPA 200.8	10.2	--	--	--	--	< 0.20 U
Cadmium	T	SW-846 6020B	10.2	--	--	< 0.50 U	< 0.50 U	--
Cadmium	D	SW-846 6020B	10.2	--	--	< 0.50 U	< 0.50 U	--
Calcium	T	SW-846 6020B		--	--	**59700**	**58200**	--
Calcium	D	SW-846 6020B		--	--	**60200**	**60500**	--
Chromium	T	EPA 200.8	323	--	--	--	--	**2.00**
Chromium	T	SW-846 6020B	323	--	--	< 1.0 U	< 1.0 U	--
Chromium	D	SW-846 6020B	323	--	--	< 1.0 U	< 1.0 U	--
Chromium, Hexavalent	D	SW-846 7196A		--	--	--	--	< 10 U
Chromium, Trivalent	T	CALC		--	--	--	--	< 10 U
Cobalt	T	SW-846 6020B		--	--	**0.7**	**0.6**	--
Cobalt	D	SW-846 6020B		--	--	**0.7**	**0.7**	--
Copper	T	EPA 200.8	242	--	--	--	--	**5.26**
Copper	T	SW-846 6020B	242	--	--	< 1.0 U	< 1.0 U	--
Copper	D	SW-846 6020B	242	--	--	< 1.0 U	< 1.0 U	--
Hardness (as CaCO3)	T	SW-846 6020B		--	--	**209800**	**204800**	--
Iron	T	EPA 200.8	5000	--	--	--	--	< 50.00 U
Iron	T	SW-846 6020B	5000	--	--	**1210**	**1190**	--
Iron	D	SW-846 6020B	5000	--	--	**1180**	**1180**	--
Lead	T	EPA 200.8	160	--	--	--	--	**0.56 J**
Lead	T	SW-846 6020B	160	--	--	< 1.0 U	< 1.0 U	--
Lead	D	SW-846 6020B	160	--	--	< 1.0 U	< 1.0 U	--
Magnesium	T	SW-846 6020B		--	--	**14800**	**14400**	--
Magnesium	D	SW-846 6020B		--	--	**15000**	**14900**	--
Manganese	T	SW-846 6020B		--	--	**140.1**	**135.4**	--
Manganese	D	SW-846 6020B		--	--	**135.2**	**135.2**	--
Mercury	T	EPA 245.1	0.74	--	--	--	--	< 0.20 U
Mercury	T	SW-846 7470A	0.74	--	--	< 0.20 U	< 0.20 U	--
Mercury	D	SW-846 7470A	0.74	--	--	< 0.20 U	< 0.20 U	--
Nickel	T	EPA 200.8	1450	--	--	--	--	**0.71 J**

Table 1. Groundwater Results from EW-2 Step and Pump Testing Program
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

			Location	EW-2	EW-2	EW-2	EW-2	EW-2
			Description	Groundwater sample collected at the end of the step test performed at EW-2	Groundwater sample collected half-way through the pump test performed at EW-2	Groundwater collected at the end of the pump test performed at EW-2	Duplicate groundwater sample collected at the end of the pump test performed at EW-2	Sample of treated water from EW-2 step and pump test collected from the post-treatment fractionation tank
			Sample ID	EW-2-STEP-END-10092023	EW-2-CR-MID-10112023	EW-2-CONSTANT-END-10132023	EW-2-CONSTANT-END-10132023 DUP	EW2-EFF-10172023
			Sample Date	10/09/2023	10/11/2023	10/13/2023	10/13/2023	10/17/2023
			Lab Sample ID	L2359602-01	L2360312-01	L2360855-01	L2360855-02	L2361644-01
Parameter	Fraction	Method	TBEL (Daily Max)					
Nickel	T	SW-846 6020B	1450	--	--	**2.8**	**2.8**	--
Nickel	D	SW-846 6020B	1450	--	--	**2.9**	**3.0**	--
Potassium	T	SW-846 6020B		--	--	**5100**	**4880**	--
Potassium	D	SW-846 6020B		--	--	**5060**	**4990**	--
Selenium	T	EPA 200.8	235.8	--	--	--	--	< 5.00 U
Selenium	T	SW-846 6020B	235.8	--	--	< 5.0 U	< 5.0 U	--
Selenium	D	SW-846 6020B	235.8	--	--	< 5.0 U	< 5.0 U	--
Silver	T	EPA 200.8	35.1	--	--	--	--	< 0.40 U
Silver	T	SW-846 6020B	35.1	--	--	< 0.50 U	< 0.50 U	--
Silver	D	SW-846 6020B	35.1	--	--	< 0.50 U	< 0.50 U	--
Sodium	T	SW-846 6020B		--	--	**22200**	**22000**	--
Sodium	D	SW-846 6020B		--	--	**22700**	**23000**	--
Thallium	T	SW-846 6020B		--	--	< 1.0 U	< 1.0 U	--
Thallium	D	SW-846 6020B		--	--	< 1.0 U	< 1.0 U	--
Vanadium	T	SW-846 6020B		--	--	< 5.0 U	< 5.0 U	--
Vanadium	D	SW-846 6020B		--	--	< 5.0 U	< 5.0 U	--
Zinc	T	EPA 200.8	420	--	--	--	--	**9.36**
Zinc	T	SW-846 6020B	420	--	--	< 10.0 U	< 10.0 U	--
Zinc	D	SW-846 6020B	420	--	--	< 10.0 U	< 10.0 U	--
VOCs (ug/L)								
1,1,1,2-Tetrachloroethane	N	SW-846 8260D		< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
1,1,1-Trichloroethane	N	EPA 624.1	200	--	--	--	--	< 2.0 U
1,1,1-Trichloroethane	N	SW-846 8260D	200	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
1,1,2,2-Tetrachloroethane	N	SW-846 8260D		< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
1,1,2-Trichloroethane	N	EPA 624.1	5	--	--	--	--	< 1.5 U
1,1,2-Trichloroethane	N	SW-846 8260D	5	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
1,1-Dichloroethane	N	EPA 624.1	70	--	--	--	--	< 1.5 U
1,1-Dichloroethane	N	SW-846 8260D	70	**0.37 J**	**0.33 J**	**0.29 J**	**0.31 J**	--
1,1-Dichloroethene	N	EPA 624.1	3.2	--	--	--	--	< 1.0 U
1,1-Dichloroethene	N	SW-846 8260D	3.2	< 1.0 U	**0.48 J**	**0.45 J**	**0.48 J**	--
1,1-Dichloropropene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
1,2,3-Trichlorobenzene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
1,2,3-Trichloropropane	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
1,2,4-Trichlorobenzene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
1,2,4-Trichlorobenzene	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
1,2,4-Trimethylbenzene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
1,2-Dibromo-3-chloropropane	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
1,2-Dibromoethane	N	EPA 504.1		--	--	--	--	< 0.010 U
1,2-Dibromoethane	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
1,2-Dichlorobenzene	N	EPA 624.1	600	--	--	--	--	< 5.0 U
1,2-Dichlorobenzene	N	SW-846 8260D	600	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
1,2-Dichlorobenzene	N	SW-846 8270E	600	--	--	< 2.0 U	< 2.0 U	--
1,2-Dichloroethane	N	EPA 624.1	5	--	--	--	--	< 1.5 U
1,2-Dichloroethane	N	SW-846 8260D	5	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
1,2-Dichloroethene	N	SW-846 8260D		**0.34 J**	**0.34 J**	**0.30 J**	**0.31 J**	--
1,2-Dichloropropane	N	SW-846 8260D		< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
1,3,5-Trimethylbenzene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
1,3-Dichlorobenzene	N	EPA 624.1	320	--	--	--	--	< 5.0 U
1,3-Dichlorobenzene	N	SW-846 8260D	320	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
1,3-Dichlorobenzene	N	SW-846 8270E	320	--	--	< 2.0 U	< 2.0 U	--
1,3-Dichloropropane	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
1,3-Dichloropropene, Total	N	SW-846 8260D		< 0.40 U	< 0.40 U	< 0.40 U	< 0.40 U	--
1,4-Dichlorobenzene	N	EPA 624.1	5	--	--	--	--	< 5.0 U
1,4-Dichlorobenzene	N	SW-846 8260D	5	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
1,4-Dichlorobenzene	N	SW-846 8270E	5	--	--	< 2.0 U	< 2.0 U	--
1,4-Dichlorobutane	N	SW-846 8260D		--	--	--	--	--
2,2-Dichloropropane	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
2-Chlorotoluene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
2-Hexanone	N	SW-846 8260D		< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	--
4-Chlorotoluene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--

Table 1. Groundwater Results from EW-2 Step and Pump Testing Program
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

			Location	EW-2	EW-2	EW-2	EW-2	EW-2
			Description	Groundwater sample collected at the end of the step test performed at EW-2	Groundwater sample collected half-way through the pump test performed at EW-2	Groundwater collected at the end of the pump test performed at EW-2	Duplicate groundwater sample collected at the end of the pump test performed at EW-2	Sample of treated water from EW-2 step and pump test collected from the post-treatment fractionation tank
			Sample ID	EW-2-STEP-END-10092023	EW-2-CR-MID-10112023	EW-2-CONSTANT-END-10132023	EW-2-CONSTANT-END-10132023 DUP	EW2-EFF-10172023
			Sample Date	10/09/2023	10/11/2023	10/13/2023	10/13/2023	10/17/2023
			Lab Sample ID	L2359602-01	L2360312-01	L2360855-01	L2360855-02	L2361644-01
Parameter	Fraction	Method	TBEL (Daily Max)					
4-Isopropyltoluene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
4-Methyl-2-Pentanone	N	SW-846 8260D		< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	--
Acetone	N	EPA 624.1	7970	--	--	--	--	< 10 U
Acetone	N	SW-846 8260D	7970	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	--
Acrylonitrile	N	SW-846 8260D		--	--	--	--	--
Benzene	N	EPA 624.1	5	--	--	--	--	< 1.0 U
Benzene	N	SW-846 8260D	5	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	--
Bromobenzene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Bromochloromethane	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Bromodichloromethane	N	SW-846 8260D		< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
Bromoform	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Bromomethane	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Carbon disulfide	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Carbon tetrachloride	N	EPA 624.1	4.4	--	--	--	--	< 1.0 U
Carbon tetrachloride	N	SW-846 8260D	4.4	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
Chlorobenzene	N	SW-846 8260D		< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
Chloroethane	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Chloroform	N	SW-846 8260D		**0.97 J**	**1.0**	**0.86 J**	**0.93 J**	--
Chloromethane	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
cis-1,2-Dichloroethene	N	EPA 624.1	70	--	--	--	--	< 1.0 U
cis-1,2-Dichloroethene	N	SW-846 8260D	70	**0.34 J**	**0.34 J**	**0.30 J**	**0.31 J**	--
cis-1,3-Dichloropropene	N	SW-846 8260D		< 0.40 U	< 0.40 U	< 0.40 U	< 0.40 U	--
Dibromochloromethane	N	SW-846 8260D		< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
Dibromomethane	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Dichlorodifluoromethane	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Diethyl ether	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Ethanol	N	SW-846 8260D		--	--	--	--	--
Ethyl Methacrylate	N	SW-846 8260D		--	--	--	--	--
Ethyl tert-butyl ether	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Ethylbenzene	N	EPA 624.1		--	--	--	--	< 1.0 U
Ethylbenzene	N	SW-846 8260D		< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
Hexachlorobutadiene	N	SW-846 8260D		< 0.60 U	< 0.60 U	< 0.60 U	< 0.60 U	--
Hexachlorobutadiene	N	SW-846 8270E SIM		--	--	< 0.50 U	< 0.50 U	--
Isopropyl Ether	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Isopropylbenzene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
m-&p-Xylenes	N	EPA 624.1		--	--	--	--	< 2.0 U
m-&p-Xylenes	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Methyl Ethyl Ketone	N	SW-846 8260D		< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	--
Methyl tert-butyl ether	N	EPA 624.1	70	--	--	--	--	< 10 U
Methyl tert-butyl ether	N	SW-846 8260D	70	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Methylene Chloride	N	EPA 624.1	4.6	--	--	--	--	< 1.0 U
Methylene Chloride	N	SW-846 8260D	4.6	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Naphthalene	N	EPA 625.1 SIM	20	--	--	--	--	< 0.100 U
Naphthalene	N	SW-846 8260D	20	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Naphthalene	N	SW-846 8270E SIM	20	--	--	**0.37**	**0.06 J**	--
N-Butylbenzene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
N-Propylbenzene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
o-Xylene	N	EPA 624.1		--	--	--	--	< 1.0 U
o-Xylene	N	SW-846 8260D		< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
Sec-Butylbenzene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Styrene	N	SW-846 8260D		< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
tert-Amyl methyl ether	N	EPA 624.1	90	--	--	--	--	< 20 U
tert-Amyl methyl ether	N	SW-846 8260D	90	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
tert-Butyl Alcohol	N	EPA 624.1	120	--	--	--	--	< 100 U
Tert-Butylbenzene	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Tetrachloroethene	N	EPA 624.1	5	--	--	--	--	< 1.0 U
Tetrachloroethene	N	SW-846 8260D	5	**0.42 J**	**0.33 J**	**0.29 J**	**0.30 J**	--
Tetrahydrofuran	N	SW-846 8260D		< 2.0 U	**0.81 J**	< 2.0 U	< 2.0 U	--
Toluene	N	EPA 624.1		--	--	--	--	< 1.0 U
Toluene	N	SW-846 8260D		< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
trans-1,2-Dichloroethene	N	SW-846 8260D		< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--

Table 1. Groundwater Results from EW-2 Step and Pump Testing Program
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

			Location	EW-2	EW-2	EW-2	EW-2	EW-2
			Description	Groundwater sample collected at the end of the step test performed at EW-2	Groundwater sample collected half-way through the pump test performed at EW-2	Groundwater collected at the end of the pump test performed at EW-2	Duplicate groundwater sample collected at the end of the pump test performed at EW-2	Sample of treated water from EW-2 step and pump test collected from the post-treatment fractionation tank
			Sample ID	EW-2-STEP-END-10092023	EW-2-CR-MID-10112023	EW-2-CONSTANT-END-10132023	EW-2-CONSTANT-END-10132023 DUP	EW2-EFF-10172023
			Sample Date	10/09/2023	10/11/2023	10/13/2023	10/13/2023	10/17/2023
			Lab Sample ID	L2359602-01	L2360312-01	L2360855-01	L2360855-02	L2361644-01
Parameter	Fraction	Method	TBEL (Daily Max)					
trans-1,3-Dichloropropene	N	SW-846 8260D		< 0.40 U	< 0.40 U	< 0.40 U	< 0.40 U	--
trans-1,4-Dichloro-2-butene	N	SW-846 8260D		--	--	--	--	--
Trichloroethene	N	EPA 624.1	5	--	--	--	--	< 1.0 U
Trichloroethene	N	SW-846 8260D	5	**2.2**	**1.9**	**1.7**	**1.7**	--
Trichlorofluoromethane	N	SW-846 8260D		< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	--
Vinyl Acetate	N	SW-846 8260D		--	--	--	--	--
Vinyl Chloride	N	EPA 624.1	2	--	--	--	--	< 1.0 U
Vinyl Chloride	N	SW-846 8260D	2	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
Xylenes (total)	N	EPA 624.1		--	--	--	--	< 1.0 U
Xylenes (total)	N	SW-846 8260D		< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	--
SVOCs (ug/L)								
1,1'-Biphenyl	N	SW-846 8270E		--	--	< 0.73 U	< 0.73 U	--
1,4-Dioxane	N	SW-846 8270E SIM	200	**8.13**	**7.83**	**7.27**	**7.62**	< 0.147 U
2,4,5-Trichlorophenol	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
2,4,6-Trichlorophenol	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
2,4-Dichlorophenol	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
2,4-Dimethylphenol	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
2,4-Dinitrophenol	N	SW-846 8270E		--	--	< 20 U	< 20 U	--
2,4-Dinitrotoluene	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
2,6-Dinitrotoluene	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
2-Chloronaphthalene	N	SW-846 8270E SIM		--	--	< 0.20 U	< 0.20 U	--
2-Chlorophenol	N	SW-846 8270E		--	--	< 2.0 U	< 2.0 U	--
2-Methylnaphthalene	N	SW-846 8270E SIM		--	--	**0.08 J**	< 0.10 U	--
2-Methylphenol	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
2-Nitrophenol	N	SW-846 8270E		--	--	< 10 U	< 10 U	--
3-&4-Methylphenol	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
3,3'-Dichlorobenzidine	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
4-Bromophenyl phenyl ether	N	SW-846 8270E		--	--	< 2.0 U	< 2.0 U	--
4-Chloroaniline	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
4-Nitrophenol	N	SW-846 8270E		--	--	< 10 U	< 10 U	--
Acenaphthene	N	EPA 625.1 SIM		--	--	--	--	< 0.100 U
Acenaphthene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
Acenaphthylene	N	EPA 625.1 SIM		--	--	--	--	< 0.100 U
Acenaphthylene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
Acetophenone	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
Aniline	N	SW-846 8270E		--	--	< 2.0 U	< 2.0 U	--
Anthracene	N	EPA 625.1 SIM		--	--	--	--	< 0.100 U
Anthracene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
Azobenzene	N	SW-846 8270E		--	--	< 2.0 U	< 2.0 U	--
Benzo(a)anthracene	N	EPA 625.1 SIM		--	--	--	--	**0.023 J**
Benzo(a)anthracene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
Benzo(a)pyrene	N	EPA 625.1 SIM		--	--	--	--	< 0.050 U
Benzo(a)pyrene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
Benzo(b)fluoranthene	N	EPA 625.1 SIM		--	--	--	--	< 0.050 U
Benzo(b)fluoranthene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
Benzo(g,h,i)perylene	N	EPA 625.1 SIM		--	--	--	--	< 0.100 U
Benzo(g,h,i)perylene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
Benzo(k)fluoranthene	N	EPA 625.1 SIM		--	--	--	--	< 0.050 U
Benzo(k)fluoranthene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
bis(2-Chloro-1-Methylethyl) Ether	N	SW-846 8270E		--	--	< 2.0 U	< 2.0 U	--
bis(2-Chloroethoxy) Methane	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
bis(2-Chloroethyl) Ether	N	SW-846 8270E		--	--	< 2.0 U	< 2.0 U	--
bis(2-Ethylhexyl) Phthalate	N	EPA 625.1	101	--	--	--	--	< 2.20 U
bis(2-Ethylhexyl) Phthalate	N	SW-846 8270E	101	--	--	< 3.0 U	< 3.0 U	--
Butyl Benzyl Phthalate	N	EPA 625.1		--	--	--	--	< 5.00 U
Butyl Benzyl Phthalate	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
Chrysene	N	EPA 625.1 SIM		--	--	--	--	< 0.050 U
Chrysene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
Dibenzo(a,h)anthracene	N	EPA 625.1 SIM		--	--	--	--	< 0.100 U
Dibenzo(a,h)anthracene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--

Table 1. Groundwater Results from EW-2 Step and Pump Testing Program
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

			Location	EW-2	EW-2	EW-2	EW-2	EW-2
			Description	Groundwater sample collected at the end of the step test performed at EW-2	Groundwater sample collected half-way through the pump test performed at EW-2	Groundwater collected at the end of the pump test performed at EW-2	Duplicate groundwater sample collected at the end of the pump test performed at EW-2	Sample of treated water from EW-2 step and pump test collected from the post-treatment fractionation tank
			Sample ID	EW-2-STEP-END-10092023	EW-2-CR-MID-10112023	EW-2-CONSTANT-END-10132023	EW-2-CONSTANT-END-10132023 DUP	EW2-EFF-10172023
			Sample Date	10/09/2023	10/11/2023	10/13/2023	10/13/2023	10/17/2023
			Lab Sample ID	L2359602-01	L2360312-01	L2360855-01	L2360855-02	L2361644-01
Parameter	Fraction	Method	TBEL (Daily Max)					
Dibenzofuran	N	SW-846 8270E		--	--	< 2.0 U	< 2.0 U	--
Diethyl Phthalate	N	EPA 625.1		--	--	--	--	< 5.00 U
Diethyl Phthalate	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
Dimethyl Phthalate	N	EPA 625.1	190	--	--	--	--	< 5.00 U
Dimethyl Phthalate	N	SW-846 8270E	190	--	--	< 5.0 U	< 5.0 U	--
Di-n-butyl Phthalate	N	EPA 625.1		--	--	--	--	< 5.00 U
Di-n-butyl Phthalate	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
Di-n-octyl Phthalate	N	EPA 625.1		--	--	--	--	< 5.00 U
Di-n-octyl Phthalate	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
Fluoranthene	N	EPA 625.1 SIM		--	--	--	--	< 0.100 U
Fluoranthene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
Fluorene	N	EPA 625.1 SIM		--	--	--	--	< 0.100 U
Fluorene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
Hexachlorobenzene	N	SW-846 8270E SIM		--	--	< 0.80 U	< 0.80 U	--
Hexachloroethane	N	SW-846 8270E SIM		--	--	< 0.80 U	< 0.80 U	--
Indeno(1,2,3-cd)pyrene	N	EPA 625.1 SIM		--	--	--	--	< 0.100 U
Indeno(1,2,3-cd)pyrene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
Isophorone	N	SW-846 8270E		--	--	< 5.0 U	< 5.0 U	--
Nitrobenzene	N	SW-846 8270E		--	--	< 2.0 U	< 2.0 U	--
Pentachlorophenol	N	EPA 625.1 SIM	1	--	--	--	--	< 1.00 U
Pentachlorophenol	N	SW-846 8270E SIM	1	--	--	< 0.80 U	< 0.80 U	--
Phenanthrene	N	EPA 625.1 SIM		--	--	--	--	< 0.100 U
Phenanthrene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
Phenol	N	SW-846 8270E	1080	--	--	< 5.0 U	< 5.0 U	--
Phenols, Total	T	EPA 420.1		--	--	--	--	< 30 U
Pyrene	N	EPA 625.1 SIM		--	--	--	--	< 0.100 U
Pyrene	N	SW-846 8270E SIM		--	--	< 0.10 U	< 0.10 U	--
General Chemistry (ug/L)								
Chemical Oxygen Demand	T	SM 5220D		--	--	< 20000 U	< 20000 U	--
Petroleum Hydrocarbons C10-C36	T	EPA 1664B		--	--	--	--	< 4000 U
Total Dissolved Solids	D	SM 2540C		--	--	390000	410000	--
Total Organic Carbon	T	SM 5310C		--	--	**394 J**	**375 J**	--
Total Suspended Solids (TSS)	T	SM 2540D		--	--	< 5000 U	< 5000 U	< 5000 U
PCBs (ug/L)								
Aroclor 1016	N	EPA 608.3		--	--	--	--	< 0.250 U
Aroclor 1221	N	EPA 608.3		--	--	--	--	< 0.250 U
Aroclor 1232	N	EPA 608.3		--	--	--	--	< 0.250 U
Aroclor 1242	N	EPA 608.3		--	--	--	--	< 0.250 U
Aroclor 1248	N	EPA 608.3		--	--	--	--	< 0.250 U
Aroclor 1254	N	EPA 608.3		--	--	--	--	< 0.250 U
Aroclor 1260	N	EPA 608.3		--	--	--	--	< 0.200 U

Notes:
1. Data is not validated.

-- = Not analyzed
J = Estimated value. Analyte detected at a level less than the reporting limit and greater than or
U = Analyte not detected at or above the reporting
< = less than the laboratory reporting limit
Bold = Detected above the reporting limit

VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
PCBs = polychlorinated biphenyls
ug/L = micrograms per liter
TBEL = Technology-based effluent limitation

Definitions for fractions:
T Total analysis (for metals)
D Dissolved fraction (for metals)
N Not applicable

Table 2: Groundwater Elevation Measurements Collected During Phase 1, 2 and 3
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

			November 6, 2023 Baseline (EW-1 @ 20 gpm) and Prior to Phase 1 Pumping (BEW-5 & EW-1)			November 20, 2023 After 1 Week of Phase 1 Pumping** (EW-1 @ 20 gpm & BEW-5 @ 2.3 gpm)			November 27, 2023 After 1 Week of Phase 1 Rebound (EW-1 @ 20 gpm) and Baseline Prior to Phase 2 (EW-2 & EW-1)			December 4, 2023 After 1 Week of Phase 2 Pumping (EW-1 @ 10 gpm & EW-2 @ 11.5 gpm)			December 11, 2023 After 1 Week of Phase 2 Rebound (EW-1 @ 20 gpm) and Baseline Prior to Phase 3 (EW-1, EW-2 & BEW-5)			December 28, 2023 After 2.5 Weeks of Phase 3 Pumping (EW-1 @ 10 gpm, EW-2 @ 11.5 gpm & BEW-5 @ 2.3 gpm)		
Monitoring Location	Measuring Point Elevations (TOR; ft NGVD)	Transducer Location	Time	Depth to Water (ft NGVD)	Groundwater Elevation (ft NGVD)	Time	Depth to Water (ft NGVD)	Groundwater Elevation (ft NGVD)	Time	Depth to Water (ft NGVD)	Groundwater Elevation (ft NGVD)	Time	Depth to Water (ft NGVD)	Groundwater Elevation (ft NGVD)	Time	Depth to Water (ft NGVD)	Groundwater Elevation (ft NGVD)	Time	Depth to Water (ft NGVD)	Groundwater Elevation (ft NGVD)
EW-1	137.28		9:32 AM	29.18	108.10	6:30 AM	29.20	108.08	8:24 AM	29.14	108.14	9:30 AM	18.95	118.33	1:50 PM	28.71	108.57	10:15 AM	18.27	119.01
EW-2	131.99		10:48 AM	6.38	125.61	8:42 AM	6.85	125.14	9:00 AM	6.58	125.41	11:35 AM	11.83	120.16	2:20 PM	5.66	126.33	8:02 AM	10.53	121.46
BEW-4	169.60		1:04 PM	54.06	115.54	9:50 AM	54.20	115.40	NM	NM	NM	NM	NM	NM	10:45 AM	38.55	131.05	9:35 AM	53.79	115.81
BEW-5	132.75		10:57 AM	5.86	126.89	9:00 AM	19.53	113.22	8:34 AM	6.00	126.75	11:06 AM	6.05	126.70	11:18 AM	6.82	125.93	8:12 AM	19.85	112.90
BEW-6	132.91	X	1:45 PM	6.25	126.66	9:15 AM	8.00	124.91	8:49 AM	6.18	126.73	11:08 AM	6.35	126.56	11:15 AM	6.11	126.80	8:25 AM	6.32	126.59
ASBRV-D2	131.10		1:14 PM	1.92	129.18	9:35 AM	2.91	128.19	NM	NM	NM	NM	NM	NM	NM	NM	*	9:00 AM	1.02	130.08
ASBRV-U2	140.85		8:27 AM	12.64	128.21	8:25 AM	13.05	127.80	9:30 AM	12.89	127.96	12:08 PM	12.47	128.38	11:25 AM	11.48	129.37	8:38 AM	11.76	129.09
AR-PHS	138.48	X	9:55 AM	3.60	134.88	8:02 AM	4.00	134.48	10:20 AM	3.76	134.72	10:25 AM	3.50	134.98	NM	NM	*	10:38 AM	2.75	135.73
9-78	138.96		NM	NM	NM	NM	NM	NM	10:00 AM	12.36	126.60	10:50 AM	12.76	126.20	1:30 PM	12.24	126.72	9:27 AM	11.54	127.42
GZW-8-1	127.57		1:03 PM	7.07	120.50	9:35 AM	7.52	120.05	NM	NM	NM	NM	NM	NM	1:01 PM	5.97	121.60	9:00 AM	6.27	121.30
GZW-8-2	127.10		1:00 PM	3.98	123.12	9:35 AM	21.52	105.58	NM	NM	NM	NM	NM	NM	1:00 PM	17.76	109.34	9:00 AM	18.25	108.85
GZW-11-2	195.45		8:34 AM	66.83	128.62	10:20 AM	67.50	127.95	NM	NM	NM	NM	NM	NM	8:50 AM	66.48	128.97	8:57 AM	66.28	129.17
LF-20D	150.16		NM	NM	NM	NM	NM	NM	9:55 AM	25.05	125.11	10:44 AM	24.91	125.25	1:22 PM	24.03	126.13	9:20 AM	23.9	126.26
LF-20DBR	150.46		NM	NM	NM	NM	NM	NM	9:55 AM	23.87	126.59	10:46 AM	23.96	126.50	1:20 PM	24.46	126.00	9:20 AM	22.85	127.61
LF-20SBR	150.16		NM	NM	NM	NM	NM	NM	9:55 AM	24.49	125.67	10:45 AM	24.57	125.59	1:21 PM	23.71	126.45	9:20 AM	23.09	127.07
ML-1-1	175.49		10:25 AM	48.17	127.32	9:55 AM	45.1	130.39	NM	NM	NM	NM	NM	NM	7:30 AM	45.07	130.42	8:15 AM	44.16	131.33
ML-1-2	175.35		11:29 AM	44.80	130.55	9:55 AM	44.55	130.80	NM	NM	NM	NM	NM	NM	7:31 AM	44.98	130.37	8:16 AM	43.44	131.91
ML-1-3	175.40		10:25 PM	44.89	130.51	9:55 AM	49.97	125.43	NM	NM	NM	NM	NM	NM	7:32 AM	44.96	130.44	8:16 AM	44.4	131.00
MW-1	155.60		11:45 AM	26.22	129.38	9:42 AM	26.58	129.02	NM	NM	NM	NM	NM	NM	NM	NM	#	9:05 AM	25.52	130.08
MW-S01	193.37		8:36 AM	63.52	129.85	10:10 AM	63.95	129.42	NM	NM	NM	NM	NM	NM	7:40 AM	63.79	129.58	9:15 AM	67.92	125.45
MW-SD01	193.54		8:37 AM	63.84	129.70	10:05 AM	64.10	129.44	NM	NM	NM	NM	NM	NM	7:41 AM	64.00	129.54	9:12 AM	63.29	130.25
MW-BS01	194.03		8:38 AM	67.84	126.19	10:10 AM	67.94	126.09	NM	NM	NM	NM	NM	NM	7:42 AM	66.76	127.27	9:10 AM	66.98	127.05
MW-S14	194.90		8:10 AM	64.06	130.84	10:25 AM	64.59	130.31	NM	NM	NM	NM	NM	NM	7:50 AM	64.83	130.07	8:32 AM	65.78	129.12
MW-BS14	193.84		8:11 AM	64.96	128.88	10:25 AM	65.45	128.39	NM	NM	NM	NM	NM	NM	7:51 AM	64.71	129.13	8:31 AM	65.34	128.50
MW-S15	134.14		10:58 AM	6.96	127.18	9:01 AM	7.26	126.88	8:35 AM	7.00	127.14	11:05 AM	6.98	127.16	8:01 AM	6.23	127.91	8:13 AM	6.07	128.07
MW-SD15	136.44		11:00 AM	9.55	126.89	9:10 AM	9.94	126.50	8:39 AM	9.67	126.77	11:02 AM	9.60	126.84	8:02 AM	8.90	127.54	8:15 AM	8.72	127.72
MW-BM15	135.61	X	11:00 AM	8.85	126.76	9:10 AM	10.85	124.76	8:39 AM	8.88	126.73	11:04 AM	8.99	126.62	8:03 AM	8.66	126.95	8:15 AM	9.27	126.34
MW-BS15	135.28	X	11:00 AM	8.58	126.70	9:08 AM	9.74	125.54	8:39 AM	9.77	125.51	11:03 AM	8.81	126.47	8:04 AM	8.29	126.99	8:15 AM	8.21	127.07
MW-BS25	152.95		11:31 AM	24.65	128.30	10:00 AM	25.16	127.79	NM	NM	NM	NM	NM	NM	10:08 AM	23.31	129.64	8:21 AM	24.24	128.71
MW-S26	130.65		11:20 AM	4.45	126.20	9:05 AM	4.97	125.68	8:37 AM	4.65	126.00	11:31 AM	4.50	126.15	12:00 PM	3.51	127.14	8:20 AM	3.79	126.86
MW-SD26	130.56		11:20 AM	5.25	125.31	9:05 AM	5.57	124.99	8:37 AM	5.31	125.25	11:32 AM	5.13	125.43	12:01 PM	4.22	126.34	8:20 AM	4.29	126.27
MW-BS26	131.84		11:20 AM	5.15	126.69	9:05 AM	7.21	124.63	8:37 AM	5.14	126.70	11:30 AM	5.34	126.50	12:02 PM	5.03	126.81	8:20 AM	5.45	126.39
MW-S28	196.94		8:22 AM	66.19	130.75	10:21 AM	66.71	130.23	NM	NM	NM	NM	NM	NM	7:10 AM	66.71	130.23	8:40 AM	65.78	131.16
MW-BS28	197.35		8:20 AM	68.54	128.81	10:21 AM	69.10	128.25	NM	NM	NM	NM	NM	NM	7:11 AM	68.48	128.87	8:37 AM	67.94	129.41
MW-B1D28	197.25		8:25 AM	68.53	128.72	10:22 AM	69.22	128.03	NM	NM	NM	NM	NM	NM	7:12 AM	68.44	128.81	8:35 AM	67.80	129.45
MW-B2D28	197.25		8:23 AM	68.29	128.96	10:22 AM	69.11	128.14	NM	NM	NM	NM	NM	NM	7:13 AM	68.11	129.14	8:33 AM	67.73	129.52
MW-S29	194.74		10:11 AM	64.76	129.98	10:15 AM	65.14	129.60	NM	NM	NM	NM	NM	NM	7:15 AM	65.14	129.60	8:53 AM	64.21	130.53
MW-SD29	195.56		10:10 AM	66.4	129.16	10:15 AM	98.95	96.61	NM	NM	NM	NM	NM	NM	7:16 AM	66.4	129.16	8:50 AM	65.79	129.77
MW-BS31	139.40		10:31 AM	12.35	127.05	8:29 AM	13.02	126.38	9:17 AM	12.55	126.85	10:56 AM	12.48	126.92	12:09 PM	11.89	127.51	8:30 AM	11.71	127.69
MW-S32	131.23		10:40 AM	5.90	125.33	8:31 AM	6.63	124.60	8:52 AM	6.06	125.17	11:11 AM	5.88	125.35	12:12 PM	4.81	126.42	8:05 AM	4.93	126.30
MW-SD32	131.37	X	10:38 AM	6.00	125.37	8:31 AM	6.42	124.95	8:52 AM	6.15	125.22	11:10 AM	6.04	125.33	12:13 PM	5.05	126.32	8:05 AM	5.10	126.27
MW-BS32	131.36	X	10:38 AM	6.00	125.36	8:31 AM	6.48	124.88	8:52 AM	6.14	125.22	11:09 AM	6.09	125.27	12:14 PM	5.28	126.08	8:05 AM	5.13	126.23
MW-SD34	133.56	X	10:50 AM	8.30	125.26	8:40 AM	8.68	124.88	9:02 AM	8.42	125.14	11:37 AM	8.48	125.08	11:29 AM	7.67	125.89	8:00 AM	7.40	126.16
MW-BS34	133.60	X	10:50 AM	8.34	125.26	8:40 AM	8.68	124.92	9:02 AM	8.40	125.20	11:38 AM	8.55	125.05	11:28 AM	8.16	125.44	8:00 AM	7.36	126.24
MW-S35	138.95		10:20 AM	12.96	125.99	8:20 AM	20.73	118.22	9:25 AM	13.18	125.77	12:03 PM	12.97	125.98	11:20 AM	20.49	118.46	8:35 AM	12.04	126.91
MW-SD35	138.79		10:20 AM	10.82	127.97	8:20 AM	12.29	126.50	9:25 AM	11.03	127.76	12:06 PM	10.93	127.86	11:19 AM	15.40	123.39	8:35 AM	9.92	128.87
MW-BS35	138.80		10:20 AM	10.57	128.23	8:20 AM	16.51	122.29	9:25 AM	10.70	128.10	12:05 PM	10.71	128.09	11:18 AM	17.03	121.77	8:35 AM	17.03	121.77
MW-S36	135.09		9:40 AM	9.65	125.44	7:52 AM	10.00	125.09	8:48 AM	9.77	125.32	9:42 AM	9.70	125.39	1:35 PM	8.98	126.11	10:30 AM	8.34	126.75
MW-SD36	134.78		9:40 AM	9.03	125.75	7:52 AM	9.29	125.49	8:46 AM	9.13	125.65	9:44 AM	9.00	125.78	1:36 PM	8.54	126.24	10:31 AM	7.60	127.18
MW-BS36	134.76		9:40 AM	9.06	125.70	7:52 AM	9.36	125.40	8:44 AM	9.15	125.61	9:43 AM	9.05	125.71	1:37 PM	8.61	126.15	10:32 AM	7.63	127.13

Table 2: Groundwater Elevation Measurements Collected During Phase 1, 2 and 3
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

			November 6, 2023 Baseline (EW-1 @ 20 gpm) and Prior to Phase 1 Pumping (BEW-5 & EW-1)			November 20, 2023 After 1 Week of Phase 1 Pumping** (EW-1 @ 20 gpm & BEW-5 @ 2.3 gpm)			November 27, 2023 After 1 Week of Phase 1 Rebound (EW-1 @ 20 gpm) and Baseline Prior to Phase 2 (EW-2 & EW-1)			December 4, 2023 After 1 Week of Phase 2 Pumping (EW-1 @ 10 gpm & EW-2 @ 11.5 gpm)			December 11, 2023 After 1 Week of Phase 2 Rebound (EW-1 @ 20 gpm) and Baseline Prior to Phase 3 (EW-1, EW-2 & BEW-5)			December 28, 2023 After 2.5 Weeks of Phase 3 Pumping (EW-1 @ 10 gpm, EW-2 @ 11.5 gpm & BEW-5 @ 2.3 gpm)		
Monitoring Location	**Measuring Point Elevations (TOR; ft NGVD)**	**Transducer Location**	**Time**	**Depth to Water (ft NGVD)**	**Groundwater Elevation (ft NGVD)**	**Time**	**Depth to Water (ft NGVD)**	**Groundwater Elevation (ft NGVD)**	**Time**	**Depth to Water (ft NGVD)**	**Groundwater Elevation (ft NGVD)**	**Time**	**Depth to Water (ft NGVD)**	**Groundwater Elevation (ft NGVD)**	**Time**	**Depth to Water (ft NGVD)**	**Groundwater Elevation (ft NGVD)**	**Time**	**Depth to Water (ft NGVD)**	**Groundwater Elevation (ft NGVD)**
MW-S40	138.71		9:30 AM	13.65	125.06	7:50 AM	13.90	124.81	8:30 AM	13.74	124.97	9:35 AM	13.62	125.09	1:40 PM	12.90	125.81	10:18 AM	12.41	126.30
MW-SD40	138.67		9:30 AM	14.46	124.21	7:50 AM	15.67	123.00	8:32 AM	15.47	123.20	9:37 AM	14.33	124.34	1:41 PM	14.65	124.02	10:19 AM	13.24	125.43
MW-BS40	138.76		9:30 AM	14.01	124.75	7:50 AM	14.41	124.35	8:34 AM	14.13	124.63	9:36 AM	13.76	125.00	1:41 PM	13.48	125.28	10:20 AM	12.62	126.14
MW-SD41	136.60		NM	NM	NM	NM	NM	NM	8:52 AM	12.16	124.44	10:04 AM	11.97	124.63	1:44 PM	11.71	124.89	10:30 AM	10.44	126.16
MW-SD42A	137.70		NM	NM	NM	NM	NM	NM	9:02 AM	13.20	124.50	10:00 AM	12.95	124.75	1:48 PM	12.73	124.97	10:29 AM	11.45	126.25
MW-SD43	137.78		NM	NM	NM	NM	NM	NM	9:50 AM	12.88	124.90	10:02 AM	12.47	125.31	1:52 PM	12.46	125.32	10:25 AM	11.16	126.62
MW-SD44	137.01		NM	NM	NM	NM	NM	NM	9:05 AM	12.35	124.66	9:55 AM	12.78	124.23	1:55 PM	12.10	124.91	10:28 AM	10.85	126.16
MW-SD45	140.15		9:25 AM	15.52	124.63	7:45 AM	15.80	124.35	8:37 AM	15.61	124.54	9:40 AM	15.17	124.98	1:58 PM	14.84	125.31	10:22 AM	14.04	126.11
MW-BS51	140.90	X	11:40 AM	13.63	127.27	9:30 AM	14.03	126.87	NM	NM	NM	NM	NM	NM	9:05 AM	13.48	127.42	8:50 AM	13.13	127.77
MW-SD52	132.57	X	10:35 AM	6.53	126.04	8:30 AM	6.92	125.65	9:14 AM	6.66	125.91	11:44 AM	6.62	125.95	11:38 AM	5.79	126.78	8:10 AM	5.72	126.85
MW-BS52	132.58	X	10:35 AM	6.73	125.85	8:30 AM	7.16	125.42	9:14 AM	6.89	125.69	11:43 AM	6.83	125.75	11:39 AM	6.01	126.57	8:10 AM	5.92	126.66
MW-BS53	140.36		10:30 AM	16.33	124.03	8:28 AM	27.67	112.69	9:20 AM	5.63	134.73	12:00 PM	0.75	139.61	11:16 AM	0.25	140.11	8:30 AM	overflow	--
OW-2	151.90		11:42 AM	21.15	130.75	9:45 AM	21.72	130.18	NM	NM	NM	NM	NM	NM	9:10 AM	23.22	128.68	9:05 AM	20.91	130.99
OW-3	147.30		10:32 AM	18.66	128.64	9:30 AM	18.99	128.31	NM	NM	NM	NM	NM	NM	9:12 AM	18.52	128.78	8:53 AM	17.96	129.34
P-1	127.80		1:20 PM	7.15	120.65	9:35 AM	7.58	120.22	NM	NM	NM	NM	NM	NM	1:03 PM	6.09	121.71	9:02 AM	6.02	121.78
P-1A	128.80		1:22 PM	6.85	121.95	9:35 AM	7.30	121.50	NM	NM	NM	NM	NM	NM	1:04 PM	5.81	122.99	9:02 AM	6.32	122.48
P-3	130.34		10:35 AM	3.88	126.46	9:32 AM	4.14	126.20	NM	NM	NM	NM	NM	NM	9:18 AM	3.11	127.23	8:55 AM	3.1	127.24
P-3A	129.7		10:35 AM	4.22	125.48	9:32 AM	4.38	125.32	NM	NM	NM	NM	NM	NM	9:19 AM	3.91	NM	8:55 AM	4.03	126.31
P-4	159.14		10:30 AM	28.82	130.32	10:00 AM	29.14	130.00	NM	NM	NM	NM	NM	NM	8:30 AM	29.08	130.06	8:25 AM	28.14	131.00
PT-09	133.83		9:50 AM	8.74	125.09	8:00 AM	9.07	124.76	10:20 AM	8.88	124.95	10:27 AM	8.49	125.34	1:28 PM	7.94	125.89	10:36 AM	7.38	126.45
PT-10	135.23		9:50 AM	10.07	125.16	8:00 AM	10.34	124.89	10:20 AM	10.12	125.11	10:33 AM	9.98	125.25	1:29 PM	9.12	126.11	10:36 AM	8.85	126.38
PT-11P	133.42		10:48 AM	7.92	125.50	8:40 AM	8.34	125.08	9:03 AM	8.06	125.36	11:39 AM	7.90	125.52	11:30 AM	6.94	126.48	8:01 AM	7.00	126.42
Total		**11**																		

Notes
1) TOR - Top Of Riser
2) ft NGVD - feet relative to the National Geodetic Vertical Datum of 1929
3) * - Water Level too high to get measurement safely
4) # - unable to locate well due to recent landscaping
5) See section 2.1.5 for the beginning and end dates for phases and flow rates from wells during each phase.
6) ** indicates that the Phase I pumping duration of 1 week is considered to begin after the system was restarted on November 13, 2023 after a shutdown.

Table 3. 1,4-Dioxane Concentration in Influent, Effluent and Extraction Wells During Phases 1, 2 and 3

Nuclear Metals Inc. Superfund Site
Concord, Massachusetts

Sampling date		1,4-Dioxane Concentrations (µg/L)				
		Influent	Effluent	EW-1	BEW-5	EW-2
Phase 1	11/6/2023	-	0.62	-	59.9	-
	11/15/2023	8.75	1.06^	-	-	-
	11/17/2023	-	0.65	-	-	-
	11/20/2023	-	1.16	-	48.2	-
Phase 2	11/27/2023	5.27	0.32	-	-	6.37
	12/4/2023	4.78	0.63	-	-	5.08
	12/8/2023	4.22	0.26	-	-	-
Phase 3	12/12/2023	8.20	<0.14 U	4.40	53.2	4.69
	12/20/2023	7.91	0.60	4.52	48.3	4.68
	1/8/2024	-	1.13	-	-	-
	1/17/2024	7.70	0.885	4.34	43.8	4.86
	1/24/2024	-	0.595^	-	-	-
	1/30/2024	-	0.577	-	-	-
	1/31/2024	-	0.567	-	-	-
	02/06/2024	-	0.386 ^	-	-	-
	02/28/2024	5.96	0.670	-	-	-
	03/14/2024	-	0.425	-	-	-
	03/27/2024	6.26	0.337	-	-	-
	04/08/2024	-	-	2.35	35.4	3.86
	04/16/2024	-	0.202	-	-	-
	04/29/2024	5.93	0.105 J	-	-	-
	05/10/2024	5.59	0.160	-	-	-
	05/30/2024	5.27	0.308	-	-	-
	06/26/2024	5.77	0.108 J	-	-	-

Notes:

1) "-" denotes that the location was not sampled on this date.
2) "^" denotes the average of parent and duplicate samples collected on this date.
3) µg/L denotes micrograms per liter.
4) Influent samples represent a mixture of groundwater extracted from all extraction wells operating at the time of sampling.
5) <0.14 U denotes that the analyte was not detected at or above the laboratory reporting limit (listed).
6) J denotes that the analyte was detected at a level between the method detection limit and laboratory reporting limit. Results is estimated.

Table 4a. Average 1,4-Dioxane Concentration in Influent and Effluent for the Knox Tail System and from Extraction Wells During System Start-up

Nuclear Metals Inc. Superfund Site
Concord, Massachusetts

Phases	**Average 1,4-dioxane Concentrations (µg/L)**				
	Influent	Effluent	EW-1	BEW5	EW-2
Phase 1 (EW-1 & BEW-5)	8.75	0.87	3.54*	54.05	-
Phase 2 (EW-1 & EW-2)	4.76	0.40	3.64*	-	5.73
Phase 3 - Month 1 (EW-1, EW-2, and BEW-5)	8.06	0.60	4.46	50.75	4.69
Phase 3 - Month 2 (EW-1, EW-2, and BEW-5)	7.70	0.60	4.34	43.80	4.86
Phase 3 - Month 3 (EW-1, EW-2, and BEW-5)	5.96	0.67	-	-	-
Phase 3 - Month 4 (EW-1, EW-2, and BEW-5)	6.26	0.38	2.35	35.40	3.86
Phase 3 - Month 5 (EW-1, EW-2, and BEW-5)	5.76	0.16	-	-	-
Phase 3 - Month 6 (EW-1, EW-2, and BEW-5)	5.27	0.31	-	-	-
Phase 3 - Month 7 (EW-1, EW-2, and BEW-5)	5.77	0.11	-	-	-

Notes:

1) "*" denotes a calculated concentration using the equation: $C_{EW1} = \frac{C_{Inf}Q_{Inf} - C_{BEW5}Q_{BEW5} - C_{EW2}Q_{EW2}}{Q_{EW1}}$, where C and Q denote concentrations (µg/L) and flow rates (gpm) respectively at EW-1, EW-2 and BEW-5.
2)
3) "-" denotes that a well was not operational or not sampled.
4) µg/L denotes micrograms per liter.
5) Monthly averages presented for Phase 3 represent the arithmetic average of concentration data collected during successive one-month periods starting when Phase 3 initiated on December 11, 2023. For example, Month 1 is the average concentration for samples collected between December 11, 2023 to January 10, 2024; Month 2 represents the average concentration for samples collected between January 11 and February 10, 2024; etc.

Table 4b. Average 1,4-Dioxane Mass Removal Rate in Influent and Effluent of the Knox Tail System and for Extraction Wells During System Start-up

Nuclear Metals Inc. Superfund Site
Concord, Massachusetts

	Average 1,4-Dioxane Mass Removal Rate (g/day)			
Phases	Influent	EW-1	BEW5	EW-2
Phase 1 (EW-1 & BEW-5)	1.07	0.39*	0.68	-
Phase 2 (EW-1 & EW-2)	0.56	0.20*	-	0.36
Phase 3 - Month 1 (EW-1, EW-2, and BEW-5)	1.04	0.24	0.64	0.29
Phase 3 - Month 2 (EW-1, EW-2, and BEW-5)	1.00	0.24	0.55	0.30
Phase 3 - Month 3 (EW-1, EW-2, and BEW-5)	0.77	-	-	-
Phase 3 - Month 4 (EW-1, EW-2, and BEW-5)	0.81	0.13	0.44	0.24
Phase 3 - Month 5 (EW-1, EW-2, and BEW-5)	0.75	-	-	-
Phase 3 - Month 6 (EW-1, EW-2, and BEW-5)	0.68	-	-	-
Phase 3 - Month 7 (EW-1, EW-2, and BEW-5)	0.75	-	-	-

Notes:

1) "*" denotes that mass removal rate is based on a calculated concentration (see Table 4a).
2) "-" denotes that a well was not operational or not sampled.
3) g/day denotes grams per day.
4) Monthly averages presented for Phase 3 represent the arithmetic average of concentration data collected during successive one-month periods starting when Phase 3 initiated on December 11, 2023. For example, Month 1 is the average concentration for samples collected between December 11, 2023 to January 10, 2024; Month 2 represents the average concentration for samples collected between January 11 and February 10, 2024; etc.

FIGURES

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Figure 1

Site Locus

Nuclear Metals, Inc. Site
Remedial Design Work Plan

Concord, Massachusetts

Description:

2229 Main Street Property

Map Legend:

🟥 Site Boundary

Spatial Projection:

N

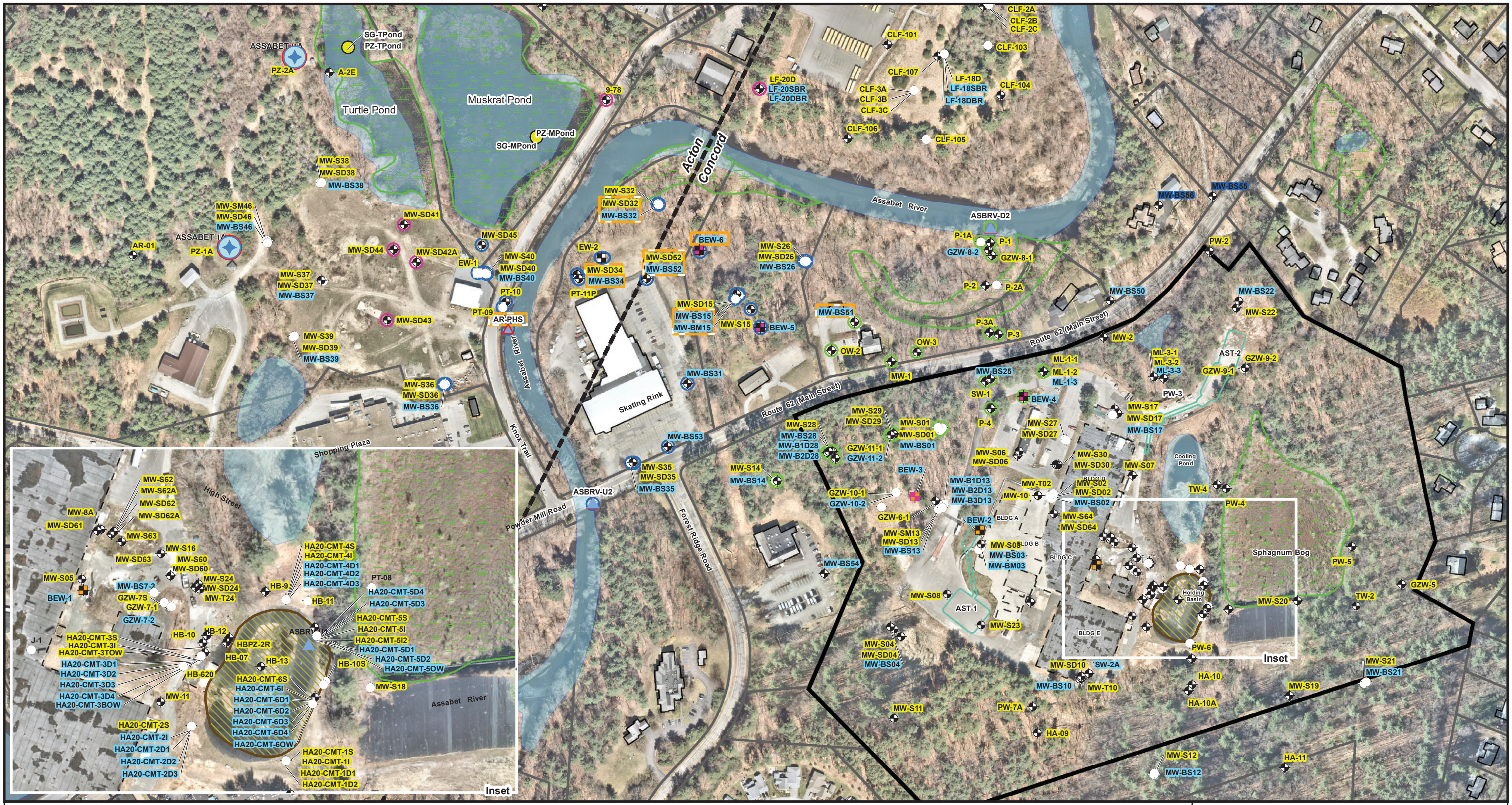
Coordinate System:
MA State Plane Mainland
FIPS Zone: 2001
Units: US Survey Feet
Datum: NAD83

Plot Info:

File: Fig01_SiteLoc.mxd
Project No.: 3252
Plot Date: 11/19/2019
Arc Operator: LS
Reviewed by: HG

ddms
www.ddmsinc.com

de maximis, inc.



Legend

- Bedrock Extraction Well for Uranium Plume
- Bedrock Extraction Well for Uranium and 1,4-Dioxane Plumes
- Bedrock Extraction Well for 1,4-Dioxane Plume
- Extraction Well
- Monitoring Well
- ● Staff Gauge and Drive Point Piezometer Locations
- Assabet River Stage Elevation
- Active Public Water Supply Well
- MW-S32 Overburden Monitoring Well
- MW-BS32 Bedrock Monitoring Well
- MW-BS32 Proposed Bedrock Monitoring Well
- NMI Property
- Parcel Boundaries
- Surface Water
- Wetlands
- Holding Basin Source Control
- Septic Fields
- Building Outline
- Former Building Concrete Foundation
- Town Boundary
- ○ Phase I and III Groundwater Level Monitoring Location
- ○ Phase II and III Groundwater Level Monitoring Location
- ○ Phase I, II, and III Groundwater Level Monitoring Location
- Transducer Monitoring Location

N

0 260 Feet

Site Layout

Nuclear Metals Inc. Superfund Site
Concord, MA

Geosyntec consultants

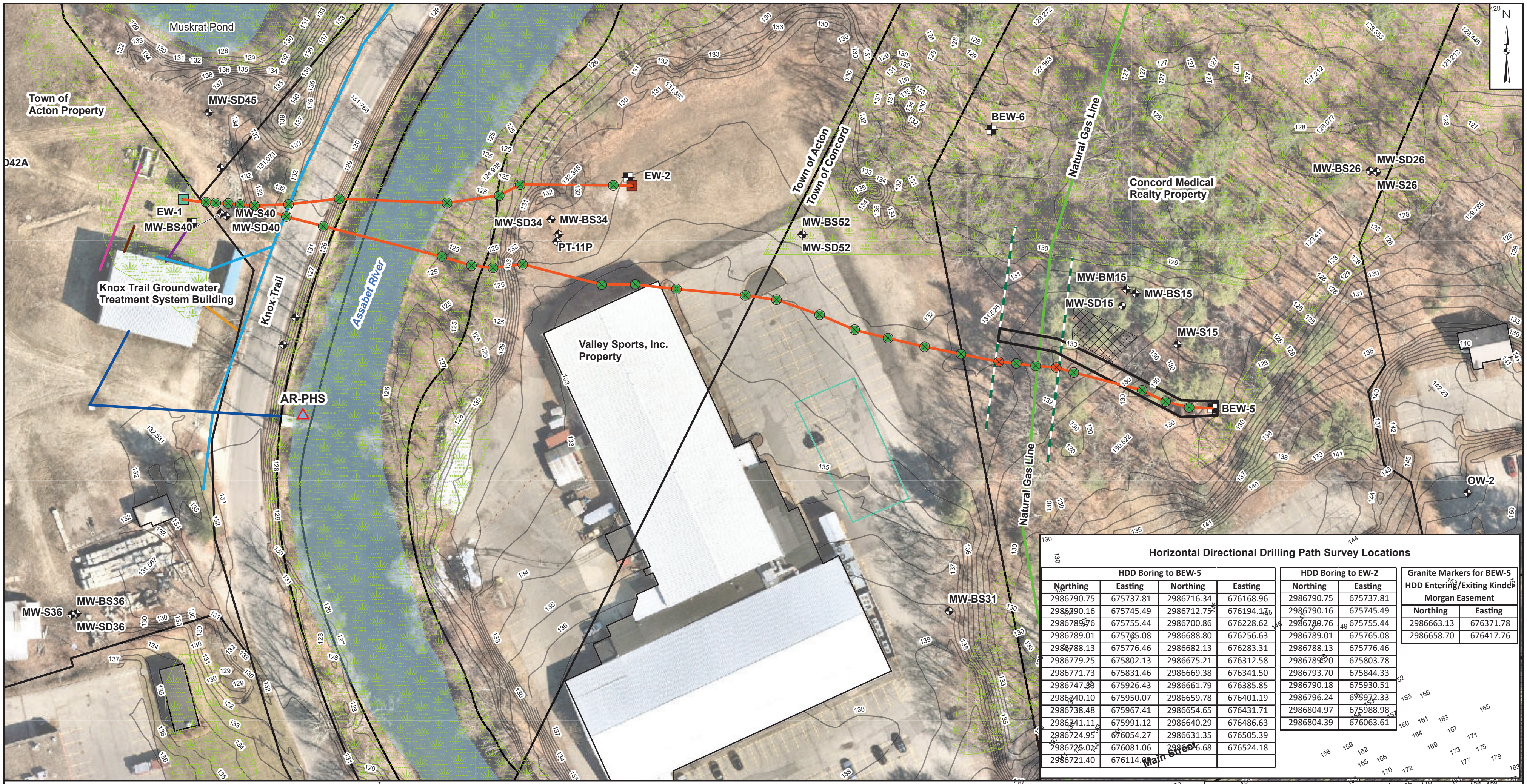
de maximis, inc.

Figure 2

Acton, MA

May 2024

Q:\GISProjects\BR0090-NMISite\Projects\Updates_2022\Figure 8 - Startup GWE Monitoring Locations.mxd 9/9/2022 8:12:34 PM



Horizontal Directional Drilling Path Survey Locations

HDD Boring to BEW-5			
Northing	Easting	Northing	Easting
2986790.75	675737.81	2986716.34	676168.96
2986790.16	675745.49	2986712.75	676194.17
2986789.76	675755.44	2986700.86	676228.62
2986789.01	675765.08	2986688.80	676256.63
2986788.13	675776.46	2986682.13	676283.31
2986779.25	675802.13	2986675.21	676312.58
2986771.73	675831.46	2986669.38	676341.50
2986747.33	675926.43	2986661.79	676385.85
2986740.10	675950.07	2986659.78	676401.19
2986738.48	675967.41	2986654.65	676431.71
2986741.11	675991.12	2986640.29	676486.63
2986724.95	676054.27	2986631.35	676505.39
2986725.01	676081.06	2986626.68	676524.18
2986721.40	676114.09		

HDD Boring to EW-2	
Northing	Easting
2986790.75	675737.81
2986790.16	675745.49
2986789.76	675755.44
2986789.01	675765.08
2986788.13	675776.46
2986789.20	675803.78
2986793.70	675844.33
2986790.18	675930.51
2986796.24	675972.33
2986804.97	675988.98
2986804.39	676063.61

Granite Markers for BEW-5 HDD Entering/Exiting Kinder Morgan Easement	
Northing	Easting
2986663.13	676371.78
2986658.70	676417.76

Legend

- ✚ Extraction Well
- ⊕ Monitoring Well
- △ Assabet River Stage Elevation

Remedial Action Construction

- 🟩 HDD Vault (Entrance Side)
- 🟥 HDD Transition/Vault (Exit Side)
- — HDD Boring Installation Path
- ⊗ Granite Marker for BEW-5 HDD Entering or Exiting Kinder Morgan Easement
- ⊗ HDD As-Built Survey Location
- ▭ Gravel Access Road

Subsurface Utilities

- — Natural Gas Line
- – · Kinder Morgan Utility Easement Boundary
- — Electric Utility and Data
- — Propane Line
- — Groundwater Influent
- — Septic Line
- — Town of Acton Potable Water
- — Treated Groundwater Effluent

- ▨ Wetlands (Town of Acton, Town of Concord)
- ▭ Surface Water
- ☒ General Area of Soil Excavation for Flood Storage Mitigation
- ▭ Valley Sports Septic System
- ▭ Site Boundary
- — Building Outline
- — 1-foot Topographic Contours

Notes:
1. Aerial image dated March 27, 2021.
2. Property boundaries obtained from MassGIS.
3. Topographic Contours (2001) created by SANBORN. Topography in the vicinity of the groundwater treatment system is known to have been altered since 2001 and contours are omitted in this area.
4. Elevations are presented relative to the National Geodetic Vertical Datum of 1929.
5. HDD indicates horizontal directional drilling.
6. Location of underground Kinder Morgan natural gas pipe and utility easement are approximate based on above-ground markings (bollards and temporary flagging) made by Kinder Morgan and information provided by Kinder Morgan regarding utility easement width.
7. Wetlands areas obtained from Town of Acton and Town of Concord, accessed: 02/24/2022 and updated in the vicinity of BEW-5 based on wetland survey completed by Feldman Land Surveyors in June 2022.
8. Valley Sports, Inc. septic system location and extent are approximate and based on a sketch developed in consultation with the property operator.
9. The HDD entrance vault, HDD exit vault at EW-2, and EW-2 wellhead were surveyed by A-Plus Construction Services Corp. in October 2023.
10. Coordinates for the horizontal directional drilling path and granite markers were surveyed by Geosyntec on August 28, 2023 with an EOS Arrow Gold RTK GPS unit.

Knox Trail Groundwater Extraction System Expansion As-Built

Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

Geosyntec consultants
de maximis, inc.

Acton, Massachusetts
June 2024

Figure
3

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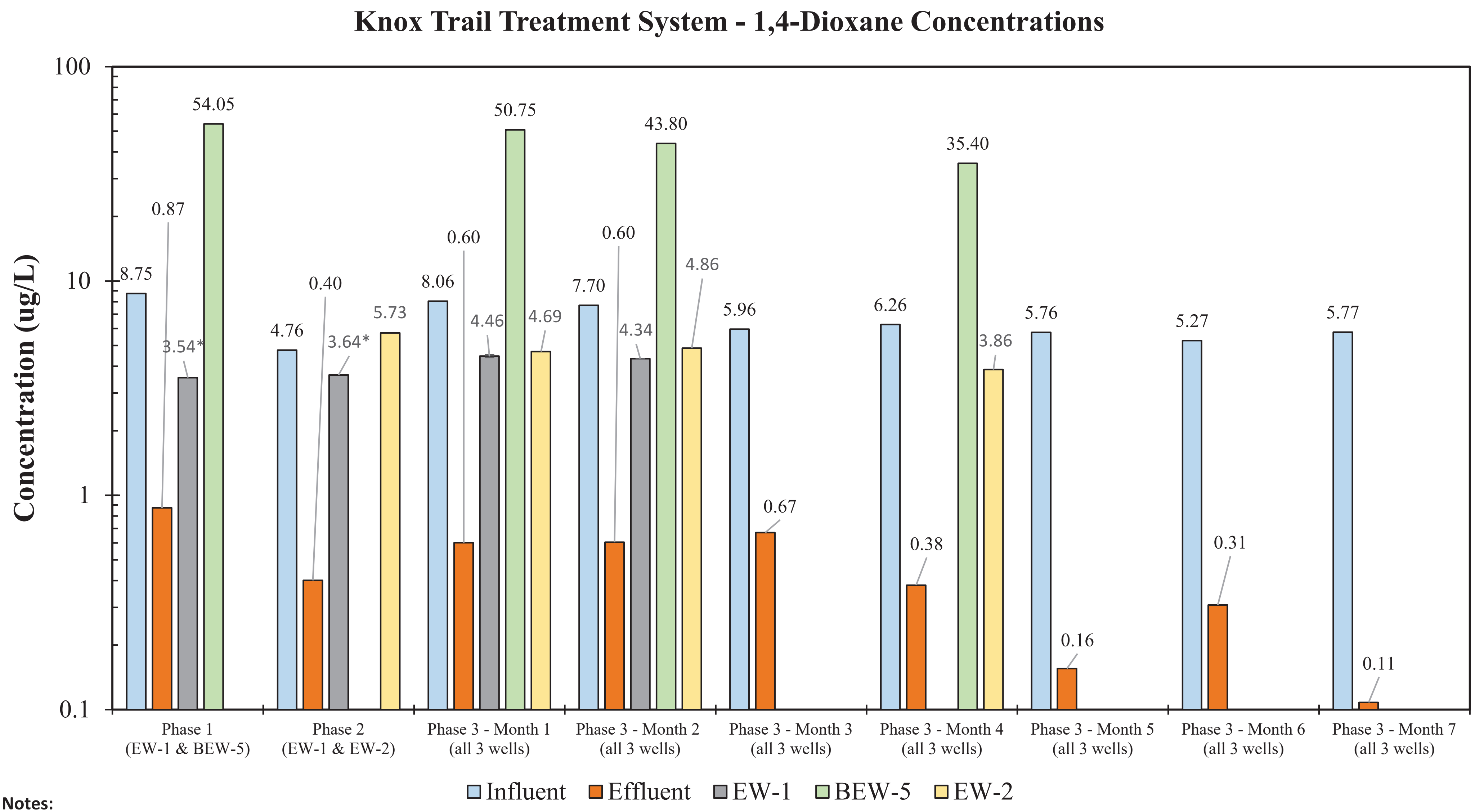


Notes:

1. µg/L denotes micrograms per liter.
2. * denotes a calculated concentration. See footnotes on Table 4a for details on the calculation.
3. Report concentrations represent the arithmetic average for samples collected from the listed locations during each phase of startup. Monthly averages presented for Phase 3 represent the average of concentration data collected during successive one-month periods starting when Phase 3 initiated on December 11, 2023. For example, Month 1 is the average concentration for samples collected between December 11, 2023 and January 10, 2024; Month 2 represents the average concentration for samples collected between January 11 and February 10, 2024; etc.
4. Months without data bars for certain well(s) indicate samples were not collected for the individual extraction wells or the well was not operational.

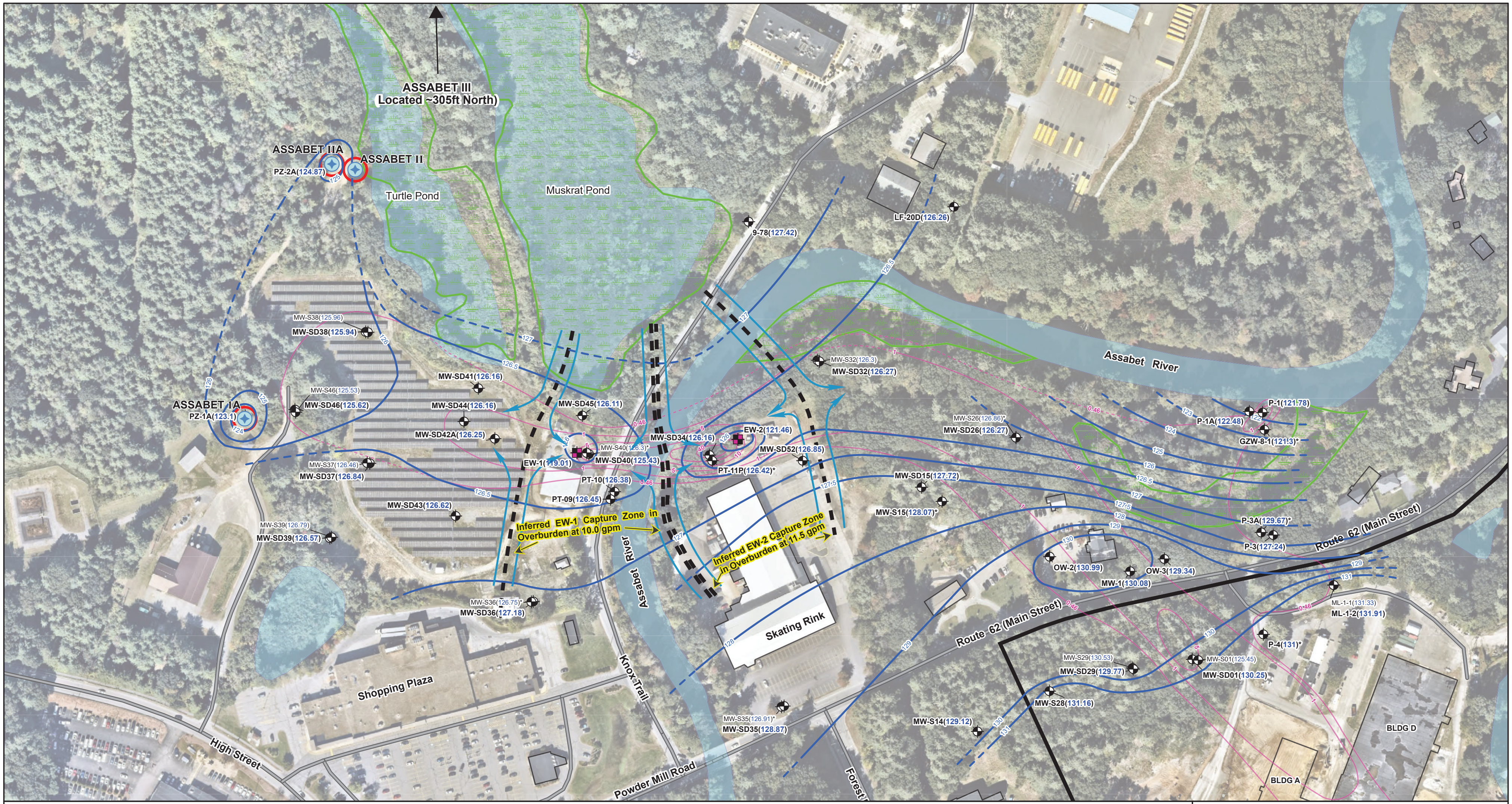
1,4-Dioxane Concentrations During Startup of the Knox Trail Expansion
Nuclear Metals, inc. Superfund Site
Concord, MA

Geosyntec
consultants

Acton, Massachusetts

July 2024

Figure
4



Legend

- ▣ Active Extraction Well
- ▣ Extraction Well
- ⊕ Monitoring Well
- ⊙ Active Public Water Supply Well
- — Building Outline
- 🟩 Wetlands
- ▭ Surface Water
- ▭ Site Boundary
- — Pumping Contours (ft) - December 28, 2023
- - - Estimated Pumping Contours (ft) - December 28, 2023
- → Inferred Groundwater Flow Direction
- ■ ■ Estimated Capture Zone
- — 1,4-Dioxane Isoconcentration Contour in Overburden Through April 2023 (µg/L)
- - - Estimated 1,4-Dioxane Isoconcentration Contour in Overburden Through April 2023 (µg/L)

Notes:
1. The water level round was completed on 28 December 2023 over a 3.5 hour period as part of Startup for Phase 3 of Knox Trail System Expansion.
2. Phase 3 began on 11 December 2023, at the following extraction rates: EW-1 = 10 gallons per minute (gpm); EW-2 =11.5 gpm; BEW-5 = 2.3 gpm.
3. During the water level round, the Acton Water District Assabet Wellfield municipal wells were pumping at the following rates: Assabet 1A = 200 gpm; Assabet 2 = 100 gpm; Assabet 2A = 130 gpm; Assabet 3 = 200 gpm.
4. Where multi-level wells are co-located at a single location, data from the deeper overburden well was typically used in drafting contours. Data used for contouring are bolded. Assabet River Stage at AR-PHS, and groundwater elevations with an asterisk were not used for contouring. The potentiometric contours are interpreted and may not represent actual flow directions or gradient.
5. The 1,4-dioxane distribution contours in overburden were inferred from data collected through April 2023.

Potentiometric Map and 1,4-Dioxane Distribution in Deep Overburden Downgradient of the NMI Property

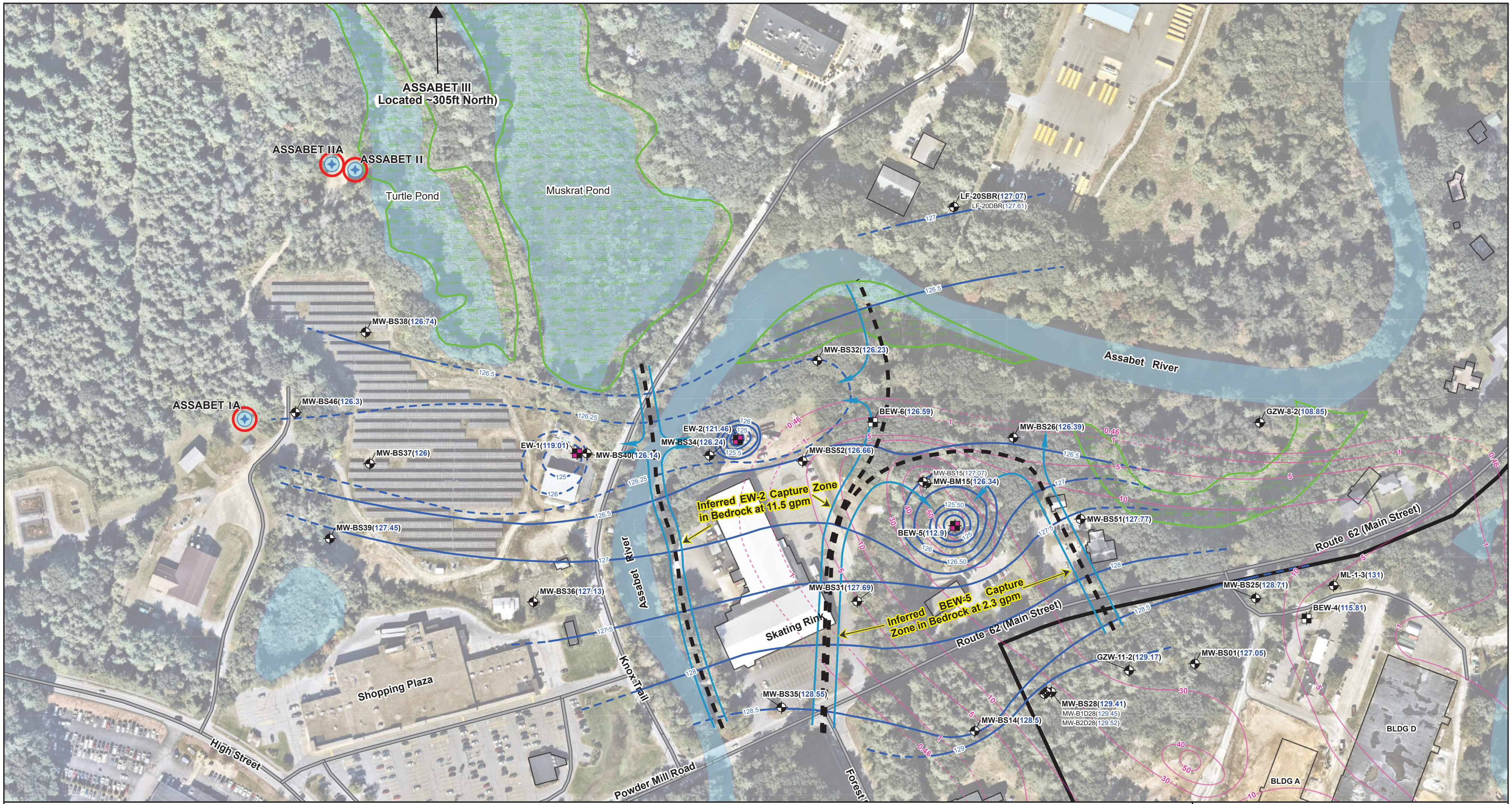
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

Geosyntec consultants
de maximis, inc.

Acton, Massachusetts
July 2024

Figure 5

Q:\GISProjects\BR0090-NMISite\Projects\APRX\EW2_PumpingTest.aprx\GWE_Dec2028_OB 7/17/2024 9:57 AM (finnian.ofarrell)



Legend

- ■ Active Extraction Well
- ■ Extraction Well
- ⊕ Monitoring Well
- ◉ Active Public Water Supply Well
- — Building Outline
- 🟩 Wetlands
- ▭ Surface Water
- ▬ Site Boundary
- — Pumping Contours (ft) - December 28, 2023
- - - Estimated Pumping Contours (ft) - December 28, 2023
- → Inferred Groundwater Flow Direction
- ■ ■ Estimated Capture Zone
- — 1,4-Dioxane Isoconcentration Contour in Bedrock Through April 2023 (µg/L)
- - - Estimated 1,4-Dioxane Isoconcentration Contour in Overburden Through April 2023 (µg/L)

Notes:
1. The EW-1 wellscreen extends from approximately 23 feet above the rock to 1 foot below the top of rock. The EW-2 is constructed with dual screens in overburden and bedrock separated by a 5-foot solid riser. The overburden screen extends from approximately 3 to 13 feet above the the top of rock. The bedrock wellscreen extends from approximately 2 to 12 feet below the top of rock. Although the bulk of water extracted from these wells is from the overburden, there is some water extracted from the bedrock and thus capture zones within the bedrock for these wells have been inferred from the water level data.
2. The water level round was completed on 28 December 2023 over a 3.5 hour period as part of Startup for Phase 3 of Knox Trail System Expansion.
3. Phase 3 began on 11 December 2023, at the following extraction rates: EW-1 = 10 gallons per minute (gpm); EW-2 = 11.5 gpm; BEW-5 = 2.3 gpm.
4. During the water level round, the Acton Water District Assabet Wellfield municipal wells were pumping at the following rates: Assabet 1A = 200 gpm; Assabet 2 = 100 gpm; Assabet 2A = 130 gpm; Assabet 3 = 200 gpm.
5. The potentiometric elevation contours are interpreted and may not represent actual flow directions or gradients.
6. The groundwater elevation at BarCad Well GZW-8-2 is unreliable and because BEW-6 is a 42-ft open bedrock borehole, water levels at these locations were not honored in drafting contours. In addition, potentiometric contours were not inferred near an operating open borehole extraction well BEW-4, and nearby wells MW-BS01, and ML-1-3 because of a limited dataset on the NMI property.
7. The 1,4-dioxane distribution contours in bedrock were inferred from data collected through April 2023.
8. Where multi-level bedrock wells exist at a single location, data from the most appropriate well was prioritized in drafting contours as noted with bold groundwater elevation posting. In general, contours represent the shallower bedrock.

N

0 200
Feet

Potentiometric Map and 1,4-Dioxane Distribution in Shallow Bedrock Downgradient of the NMI Property

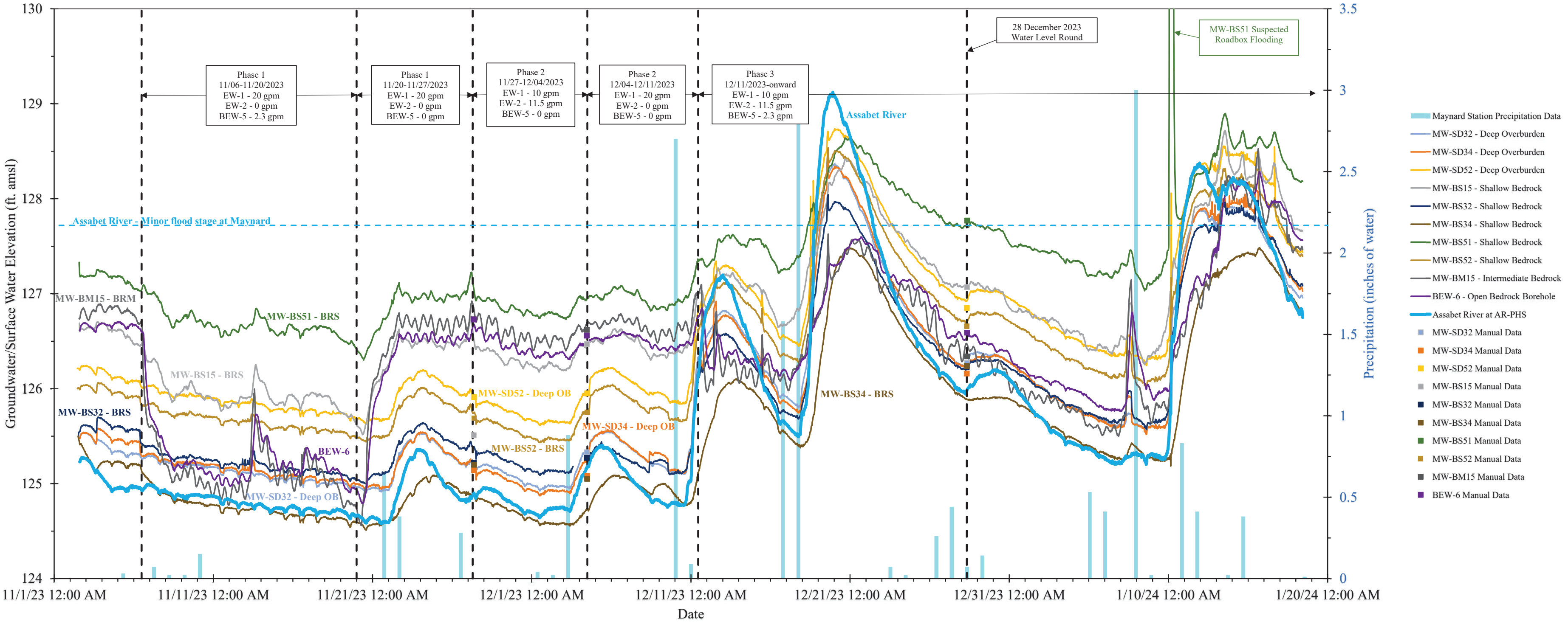
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

Geosyntec consultants
de maximis, inc.

Acton, Massachusetts	July 2024	Figure 6

Q:\GISProjects\BR0090-NMISite\Projects\APRX\EW2_PumpingTest.aprx\GWE_Dec2028_Bedrock 7/17/2024 9:57 AM (finnian.ofarrell)

Figure 7
Water Elevations During Shakedown Measured by Transducers in Select Wells
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts



Notes:

1. The EW-1 wellscreen extends from approximately 23 feet above the rock to 1 foot below the top of rock. The EW-2 is constructed with dual screens in overburden and bedrock separated by a 5-foot solid riser. The overburden screen extends from approximately 3 to 13 feet above the the top of rock. The bedrock wellscreen extends from approximately 2 to 12 feet below the top of rock.Although the bulk of water extracted from these wells is from the overburden, there is some water extracted from the bedrock and therefore the bedrock potentiometric levels are affected by pumping. BEW-5 is screened between 6 and 26 feet below the top of rock.
2. Precipitation data from station GNHCD: US1MAMD0051 in Maynard, Massachusetts. Precipitation is in units of inches of water and includes rain and snow, as rainfall equivalent.
3. A discrepancy in manual water level and transducer measurements at MW-BS32 was identified, to compensate for this, a 1.392-foot correction was applied to transducer measurements at and following the 4 December 2023 manual waterlevel measurement. The correction value represents the difference in groundwater elevation between the correlated pressure transducer data and manual measurement on December 4, 2023.
4. The minor flood stage or the gage height at which the discharge exceeds 50-percent annual exceedence probability for the Assabet River USGS Station 01097000 at Maynard is equal to 5 feet and discharge of 1,200 cubic feet per second.
5. gpm - gallons per minute. ft. asml - feet above mean sea level relative to National Geodetic Vertical Datum of 1929. Deep OB - Deep Overburden, BRS - Shallow Bedrock, BRM - Intermediate Bedrock. BEW - Open Borehole Bedrock Well.

APPENDICES

APPENDIX A

Design Drawings From the 100% Remedial Design

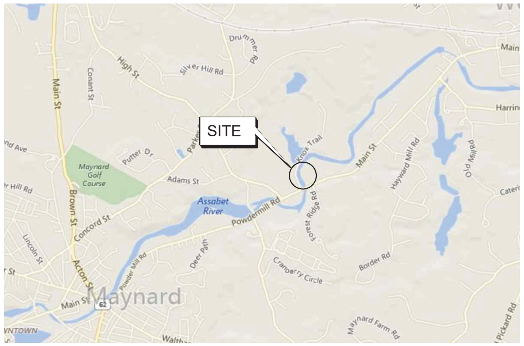
100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER EXTRACTION SYSTEM EXPANSION

NUCLEAR METALS, INC

SUPERFUND SITE

CONCORD, MASSACHUSETTS

SEPTEMBER 2022

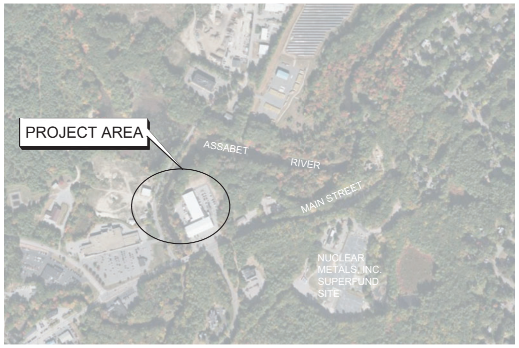


SOURCE: BY BING MAPS.

VICINITY MAP
NOT TO SCALE

Sheet List Table

Sheet Number	Sheet Title	Revision
G-01	COVER SHEET	A
G-02	GENERAL NOTES AND SPECIFICATIONS I	A
G-03	GENERAL NOTES,SPECIFICATIONS II & BASE PLAN LEGEND	A
C-01	SITE PLAN AND EXISTING CONDITIONS	A
C-02	PIPING AND VAULT LAYOUT	A
C-03	PLAN AND PROFILE FOR HDD TO BEW-5	A
C-04	PLAN AND PROFILE FOR HDD TO EW-2	A
C-05	PROCESS AND INSTRUMENTATION DIAGRAM	A
C-06	EXTRACTION WELLHEAD DETAILS	A
C-07	HDD VAULT DETAILS	A
C-08	EW-2 PROPOSED CONSTRUCTION DETAIL	A
C-09	SYSTEM DETAILS	A



SOURCE: MA GIS

LOCATION MAP
NOT TO SCALE

PREPARED FOR:
de maximis, inc.
200 DAY HILL ROAD, SUITE 200
WINDSOR, CONNECTICUT 06095

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588, FL CERT #4321

TITLE: COVER SHEET

PROJECT: 100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER EXTRACTION SYSTEM EXPANSION

SITE: NUCLEAR METALS INC. SUPERFUND SITE
CONCORD, MASSACHUSETTS

DESIGN BY:	AD, CE	DATE:	SEPTEMBER 2022
DRAWN BY:	RMK	PROJECT NO.:	BR0090C
CHECKED BY:	AD	FILE:	
REVIEWED BY:	CE	DRAWING NO.:	G-01 OF 12
APPROVED BY:	CE		

(1in) (2in) (3in) (4in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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GENERAL NOTES

1. REFERENCE: NUCLEAR METALS, INC SUPERFUND SITE
   2229 MAIN STREET,
   CONCORD, MASSACHUSETTS
2. PROJECT TEAM
   a. OWNER – NUCLEAR METALS INC. (NMI) SUPERFUND SITE OR DE MAXIMIS, INC
   b. ENGINEER – GEOSYNTEC CONSULTANTS
   c. CONTRACTOR – US ECOLOGY
   d. WELL DRILLER – TO BE DETERMINED (SUBCONTRACTOR TO DE MAXIMIS)
   e. HORIZONTAL DIRECTION DRILLING (HDD) DRILLER – TO BE DETERMINED (SUBCONTRACTOR STATUS TBD)
3. THE SITE IS LOCATED AT A GROUNDWATER TREATMENT BUILDING LOCATED ON KNOX TRAIL, ACTON MASSACHUSETTS NEAR THE INTERSECTION WITH MAIN STREET. OTHER PORTIONS OF THE SITE ARE LOCATED BEHIND THE BUILDING LOCATED AT 2320 MAIN STREET, CONCORD, MA 01742
4. NORMAL WORK HOURS ARE FROM 7:00 AM TO 5:00 PM MONDAY THROUGH FRIDAY. APPROVAL FROM THE ENGINEER IS REQUIRED FOR CONSTRUCTION OUTSIDE OF NORMAL WORK HOURS.
5. WORK SHALL REFER TO ALL ACTIVITIES, EQUIPMENT AND MATERIALS TO COMPLETE THE CONSTRUCTION AS SHOWN IN DRAWINGS INCLUDING BUT NOT LIMITED TO ALL PREPARATORY (E.G., SUBMITTALS) ACTIVITIES, LABOR, CONSTRUCTION ACTIVITIES, AND PROCURMENT OF EQUIPMENT AND MATERIALS UNLESS NOTED OTHERWISE IN THE DESIGN.
6. EXISTING UTILITIES SHOWN ON THE DRAWINGS ARE APPROXIMATE.
7. CONVENTIONAL INDUSTRY STANDARD DETAILS SHALL APPLY WHERE NO SPECIAL DETAIL IS SHOWN. SUCH DETAILS SHALL BE APPROVED BY THE ENGINEER.
8. CONTRACTOR AND DRILLERS SHALL PERFORM ALL WORK WITHIN THE DESIGNATED LIMITS OF WORK SHOWN ON THE DRAWINGS, UNLESS OTHERWISE APPROVED.
9. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS SHOWN ON THESE DRAWINGS. SCALES, SHOWN ON THE DRAWINGS, IF PROVIDED, ARE FOR GUIDANCE ONLY.
10. ALL EXISTING UTILITY LOCATIONS MAY NOT BE SHOWN ON THE DRAWINGS
    a. THE CONTRACTOR SHALL COORDINATE WITH THE UTILITY COMPANIES, TOWNS OF CONCORD AND ACTON, DE MAXIMIS, AND ENGINEER TO VERIFY UTILITY LOCATIONS PRIOR TO SUBSURFACE WORK. THE CONTRACTOR SHALL VERIFY ALL UTILITY DEPTHS AND LOCATIONS PRIOR TO CONSTRUCTION AND COORDINATE ANY NECESSARY RELOCATIONS. UTITLITIES DAMAGED BY THE CONTRACTOR SHALL BE REPAIRED AND REPLACED BY THE CONTRACTOR AT NO ADDITIONAL EXPENSE TO THE OWNER OR ENGINEER.
    b. LOCATION AND DEPTH OF THE KINDER MORGAN GAS PIPE AT THE HDD CROSSING LOCATION HAS BEEN CONFIRMED VIA TEST PIT. THIS LOCATION IS ACCURATELY DEPICTED ON DRAWINGS AND CAN BE PROVIDED BY GEOSYNTEC.
11. RELOCATION OF ANY WATER LINE, SEWER LINE, OR SERVICE LINE THEREOF REQUIRED FOR THE CONSTRUCTION OF THIS PROJECT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND INCORPORATED INTO CONTRACTOR'S COST TO PERFORM THE WORK.
12. NO CHANGES ARE TO BE MADE ON THESE PLANS WITHOUT THE KNOWLEDGE AND CONSENT OF THE ENGINEER.
13. THE CONTRACTOR SHALL COORDINATE ALL WORK AND MATERIALS PROVIDED BY THEIR SUBCONTRACTORS.
14. ALL MATERIALS USED FOR CONSTRUCTION SHALL BE NEW EXCEPT WHERE SITE SOILS ARE SPECIFIED.
15. UNLESS SPECIFICALLY NOTED ON THE DRAWINGS, ALL MATERIAL SHALL BE PROVIDED BY THE CONTRACTOR. THE WELL DRILLER AND HDD DRILLER SHALL PROVIDE ALL MATERIALS REQUIRED FOR INDIVIDUAL SCOPES. WELL DRILLER SHALL PROVIDE ALL EQUIPMENT AND MATERIALS TO INSTALL AND DEVELOP EW-2 . HDD DRILLER SHALLOW PROVIDE ALL EQUIPMENT AND MATERIALS TO FULLY INSTALL TWO HORIZONTAL WELLS, EACH CONSISTING OF A 6-INCH OUTER HDPE PIPE AND INNER 1- AND 2-INCH HDPE PIPES TO BE INSTALLED VIA HDD AS SHOWN IN DRAWINGS. VAULTS AND PIPING BETWEEN THE TREATMENT SYSTEM BUILDING AND HDD ENTRANCE VAULT AND BETWEEN THE HDD TRANSITION LOCATIONS/VAULTS NEAR BEW-5 AND EW-2 AND THE EXTRACTION WELLS TO BE PROVIDED BY CONTRACTOR.
16. THE CONTRACTOR SHALL FREQUENTLY INSPECT THE SITE ROADS USED BY CONSTRUCTION VEHICLES FOR MATERIAL THAT MAY HAVE SPILLED DURING TRANSPORT. SPILLED MATERIAL SHALL BE CLEANED UP IMMEDIATELY AND AS APPROPRIATE BASED ON THE MATERIAL.
17. THE CONTRACTOR SHALL COORDINATE WITH THE ENGINEER PRIOR TO PERFORMING CONSTRUCTION ACTIVITIES.
18. ALL NECESSARY CONSTRUCTION PERMITS AND INSPECTIONS SHALL BE OBTAINED AND PAID FOR BY THE CONTRACTOR, INCLUDING BUT NOT LIMITED TO PERMITS FOR ELECTRICAL, MECHANICAL, PLUMBING, AND CIVIL CONSTRUCTION.
19. THE CONTRACTOR AND DRILLER SHALL HAVE CURRENT AND APPLICABLE LICENSES AS REQUIRED BY THE WORK PERFORMED.
20. THE CONTRACTOR SHALL RESTORE OR REPLACE ALL EXCAVATED OR DISTURBED AREAS TO PRE-CONSTRUCTION CONDITIONS EXCEPT FOR REPLACING TREES. THE CONTRACTOR IS RESPONSIBLE FOR KEEPING THE SITE VISUALLY CLEAN AND REMOVING ALL TRASH, DEBRIS, AND WASTES ACCORDING TO THE TRASH, DEBRIS AND WASTE TYPES, CLASSIFICATIONS, AND HANDLING PROCEDURES.
21. THE CONTRACTOR IS RESPONSIBLE FOR PROTECTING FROM DAMAGE ALL EXISTING IMPROVEMENTS THAT ARE TO REMAIN. SUCH IMPROVEMENTS THAT ARE DAMAGED BY THE CONTRACTOR SHALL BE REPLACED AT THE EXPENSE OF THE CONTRACTOR. THIS INCLUDE, BUT IS NOT LIMITED TO, MONITORING WELLS, ROADS, GRASS.
22. CONTRACTORS SHALL WARRANTEE ALL MATERIAL AND CONSTRUCTION FOR A PERIOD OF ONE YEAR. THE WARRANTEE PERIOD BEGINS FOLLOWING FINAL CONNECTION OF EXTRACTION WELLS TO THE TREATMENT SYSTEM. ALL DEFECTS SHALL BE CORRECTED AT THE SOLE EXPENSE OF THE CONTRACTOR.
23. THE CONTRACTOR (AND WELL DRILLER AND HDD DRILLER FOR WORK AREAS UNDER THEIR CONTROL) AGREES THAT THEY SHALL ASSUME SOLE RESPONSIBILITY OF THE JOB SITE DURING THE COURSE OF THE CONSTRUCTION OF THIS PROJECT, INCLUDING SECURITY AND SAFETY OF ALL PERSONS AND PROPERTY, THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND THAT THE CONTRACTOR (AND WELL DRILLER AND HDD DRILLER) SHALL DEFEND, INDEMNIFY, AND HOLD THE OWNER AND GEOSYNTEC, INC. HARMLESS FROM ANY AN ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF THE WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER.
24. THE CONTRACTOR SHALL MAINTAIN DRAINAGE DURING CONSTUCTION AND IS RESPONSIBLE FOR ANY DEWATERING NECESSARY DURING CONSTRUCTION.
25. ALL SIGNING, BARRICADES, AND DRUMS UTILIZED IN TRAFFIC CONTROL SHALL BE PROVIDED, ERECTED, AND MAINTAINED BY THE CONTRACTOR. TRAFFIC CONTROL SHALL BE IN CONFORMANCE WITH THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), LATEST EDITION.
26. CONSTRUCTION STAKING IS TO BE PROVIDED BY THE CONTRACTOR. SURVEY STAKES, BENCHMARKS, AND PROPERTY PINS DESTROYED BY THE CONTRACTOR SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE.
27. THE CONTRACTOR'S SUPERVISOR/SITE MANAGER AND DRILLERS' SUPERVISOR/LEAD DRILLER SHALL ATTEND A TAILGATE MEETING WITH THE PROJECT MANAGER AND ENGINEER REPRESENTATIVES AT THE BEGINNING OF THE PROJECT. ALL CONTRACTOR, WELL DRILLER, AND HDD DRILLER EMPLOYEES SHALL ALSO ATTEND DAILY TAILGATE MEETINGS WITH REPRESENTATIVE OF THE ENGINEER AND/OR OWNER. DURING THESE DAILY MEETINGS, CONTRACTOR'S SUPERVISOR/SITE MANAGER/LEAD DRILLER SHALL REPORT ON (1) SAFETY PERFORMANCE AND STATISTICS, (2) SITE MANPOWER, (3) DAILY EQUIPMENT COUNT AND DESCRIPTION, (4) SCHEDULE STATUS AND (5) WORK PLANNED FOR THE DAY ONCE PER WEEK DURING THE TAILGATE MEETING, THE CONTRACTOR SHALL PROVIDE THE ENGINEER REPRESENTATIVES WITH AN UPDATED SCHEDULE, IN WRITING AND CONTAINING THE INFORMATION SPECIFIED UNDER THE CONSTRUCTION SCHEDULE SPECIFICATION, AND DISCUSS WORK PROGRESS, DELAYS AND SCHEDULE PROJECTIONS.

SCHEDULE

1. THE CONTRACTOR, HDD DRILLER AND WELL DRILLER SHALL PREPARE AND SUBMIT A CONSTRUCTION SCHEDULE TO DE MAXIMIS AT LEAST TWO WEEKS PRIOR TO ANY WORK AT THE SITE SO THAT DE MAXIMIS CAN INTEGRATE THE SUBCONTRACTORS SCHEDULES AND INFORM PROPERTY OWNERS.
2. CONTRACTOR AND SUBCONTRACTOR SCHEDULES ARE SUBJECT TO APPROVAL BY DE MAXIMIS AND THE ENGINEER.
3. PROPOSED SCHEDULES SHALL BE PRESENTED IN GANTT CHART FORMAT SHOWING ESTIMATED START DATE, DURATION, AND COMPLETION TIMES FOR EACH ACTIVITY.
4. CONTRACTOR SHALL CONTINUOUSLY MAINTAIN A CONSTRUCTION SCHEDULE WITH A DETAILED TWO-WEEK LOOK-AHEAD. THIS SCHEDULE WILL BE PROVIDED TO DE MAXIMIS WEEKLY AND WHENEVER REQUESTED.

SURVEY BASE PLAN NOTES

1. TOPOGRAPHIC CONTOURS CREATED BY SANBORN (2001). TOPOGRAPHY IN THE VICINITY OF THE GROUNDWATER TREATMENT SYSTEM BUILDING IS KNOWN TO HAVE BEEN ALTERED SINCE 2001. TOPOGRAPHIC CONTOURS ARE OMITTED IN THIS AREA.
2. BENCHMARK INFORMATION:

   TEMPORARY BENCHMARKS SET:

   TGS-1: MAGNETIC NAIL SET UP 1' ON THE SOUTHERLY SIDE OF UTILITY POLE AT THE INTERSECTION OF MAIN STREET AND THE DRIVEWAY TO #2228 MAIN STREET. ELEVATION=151.79'

   TGS-2: MAGNETIC NAIL SET UP 1' IN UTILITY POLE. ELEVATION=167.98'

   TBM PS-1: CHISEL SQUARE SET IN NORTHWEST CORNER OF LIGHT POLE BASE ELEVATION=172.60'

   TBM PS-2: CHISEL SQUARE SET IN NORTHWEST CORNER OF LIGHT POLE BASE. ELEVATION=193.53'
3. PLANIMETRIC SITE FEATURES WERE OBTAINED BY AERIAL MAPPING AND CONTOURS FROM LIDAR PREPARED BY BLUE SKY GEOSPATIAL, LTD. RECEIVED ON JUNE 3, 2020. ADDITIONAL FEATURES WERE VERIFIED BY INSTRUMENT SURVEYS BY FELDMAN LAND SURVEYORS BETWEEN APRIL 14 TO JUNE 16, 2020.
4. ALL UNDERGROUND ULITITIES (ELECTRIC, GAS, TEL, WATER, SEWER DRAIN SERVICES) INCLUDING UTILITIES AT THE TREATMENT SYSTEM BUILDING ARE SHOWN IN SCHEMATIC FASHION, THEIR LOCATIONS ARE NOT PRECISE OR NECESSARILY ACCURATE. NO WORK WHATSOEVER SHALL BE UNDERTAKEN UNTIL CONTRACTOR LOCATES UNDERGROUND SERVICES BY CONSULTING WITH THE PROPER AUTHORITIES CONCERNED WITH THE SUBJECT SERVICE LOCATIONS AND BY USING SOFT DIG TECHNIQUES.
5. CONTRACTOR AND SUBCONTRACTORS SHALL CALL DIG-SAFE AT 1-888-DIG-SAFE AT LEAST 72 HOURS PRIOR TO PERFORMING ANY INVASIVE WORK.
6. THE LOCATION AND DEPTH OF THE KINDER MORGAN GAS LINE AT THE HDD CROSSING LOCATION IS BASED ON A TEST BORING. DEPTH INFORMATION IS PROVIDED ON SHEET C-03.

SAFETY/CLEAN-UP

1. ALL CONSTRUCTION AREAS SHALL BE CLEARLY MARKED WITH BARRICADES, CONES, PLATES OR OTHER APPROVED SAFETY MARKERS TO RESTRICT ACCESS AND PROVIDE A SAFE WORK ENVIRONMENT.
2. PRIOR TO BEGINNING FIELD ACTIVITIES, THE CONTRACTOR, HDD DRILLER, AND WELL DRILLER MUST EACH PROVIDE THE ENGINEER WITH A SITE-SPECIFIC HEALTH AND SAFETY PLAN (HASP) WRITTEN SPECIFICALLY FOR THEIR TASKS AND PERSONNEL . THE HASP MUST COMPLY WITH THE OWNER HASP AND BE DEEMED ADEQUATE IN WRITING BY THE ENGINEER AND DE MAXIMIS BEFORE WORK CAN BEGIN.
3. THE CONTRACTOR, HDD DRILLER, AND WELL DRILLER SHALL MAINTAIN A CLEAN AND ORDERLY SITE, CONTAIN LOOSE DEBRIS, AND STORE CONSTRUCTION MATERIALS ON A DAILY BASIS PRIOR TO LEAVING THEIR WORK AREA(S).
4. THE CONTRACTOR, HDD DRILLER, AND WELL DRILLER SHALL EACH BE FULLY RESPONSIBLE FOR MANAGEMENT, CONTAINMENT, LABELING, STORAGE, AND DISPOSAL OF ALL CONSTRUCTION DEBRIS AND NON-SOIL AND NON-WATER DEBRIS THEY GENERATE AS PART OF THE CONSTRUCTION ACTIVITIES.
5. THE CONTRACTOR, HDD DRILLER, AND WELL DRILLER SHALL BE RESPONSIBLE FOR MANAGEMENT, CONTAINMENT, LABELING, AND TRANSPORTATION OF ALL SOIL AND WATER, NON-HAZARDOUS AND HAZARDOUS WASTE GENERATED BY THEIR WORK. DRILLERS SHALL REPORT QUANTITIES OF WASTE GENERATED BY THEIR WORK TO DE MAXIMIS DURING DAILY TAILGATE MEETINGS. MANAGEMENT OF INVESTIGATIVE DERIVED WASTE FOR VARIOUS ACTIVITIES IS DESCRIBED BELOW. THE COST FOR DISPOSAL OF NON-HAZARDOUS AND HAZARDOUS SOIL AND WATER WASTE, IF ANY, SHALL BE THE RESPONSIBILITY OF DE MAXIMIS.
6. REQUIRED PERSONAL PROTECTIVE EQUIPMENT (PPE) INCLUDING BUT NOT LIMITED TO STEEL-TOED BOOTS, SAFETY GLASSES, HARD HATS, AND SAFETY VESTS SHALL BE WORN BY ALL CONTRACTOR PERSONNEL AND SUBCONTRACTORS AT ALL TIMES WHILE ON SITE. HEARING PROTECTION SHALL BE WORN AS NECESSARY. FAILURE TO WEAR REQUIRED PPE MAY RESULT IN TERMINATION OF SUBCONTRACTOR OR EMPLOYEE. ANY AND ALL HEALTH AND SAFETY NEAR MISSES, INCIDENTS, OR CONCERNS SHALL BE IMMEDIATELY CONVEYED TO DE MAXIMIS. FAILURE TO DO SO MAY RESULT IN TERMINATION OF THE DRILLER/CONTRACTOR/SUBCONTRACTOR. ALTERATIONS IN SCHEDULE DUE TO HEALTH AND SAFETY NONCOMPLIANCE SHALL BE SOLEY AT THE CONTRACTOR AND/OR DRILLER'S EXPENSE.
7. ALL WORKERS AT THE SITE SHALL HAVE CURRENT 40-HOUR OSHA TRAINING AND MAY BE REQUIRED TO TAKE SITE-SPECIFIC RADIATION TRAINING PROVIDED BY DE MAXIMIS.

INVESTIGATION-DERIVED WASTE FROM HDD AND GENERAL EARTHWORK

1. IDW FROM THE HDD AND GENERAL EARTHWORK WILL BE CONTAINERIZED IN A LINED, OPEN-TOP ROLL-OFF STAGED ON TOWN OF ACTON PROPERTY NEAR THE TREATMENT SYSTEM BUILDING ON KNOX TRAIL AND WILL BE ALLOWED TO DECANT.
2. THE SUPERNATANT WILL BE REMOVED FROM THE ROLL-OFF, DRUMMED AND TESTED FOR DISPOSAL PARAMETERS. HDD DRILLING AND EARTHWORK ARE NOT INTERCEPTING CONTAMINATED GROUNDWATER, SO GROUNDWATER WHICH TESTS BELOW SITE CLEAN-UP CONCENTRATIONS MAY BE DISCHARGED TO THE GROUND SURFACE.
3. CONTRACTOR SHALL TRANSPORT THE REMAINING SOLID WASTE WITHIN ROLL-OFF TO THE NMI PROPERTY.
4. DE MAXMIS WILL COLLECT A COMPOSITE SAMPLE OF RESIDUAL SOIL GENERATED FROM HDD DRILLING AND GENERAL EARTHWORK AND TEST THE SOIL FOR PARAMETERS LISTED IN TABLE L-2 OF THE RECORD OF DECISION (ROD). SOILS MEETING CRITERION LISTED IN TABLE L-2 OF THE ROD MAY BE REUSED AS GENERAL FILL AT THE NMI PROPERTY.
5. IDW NOT MEETING CRITERION LISTED IN TABLE L-2 OF THE ROD WILL BE TRANSPORTED TO A DISPOSAL FACILITY APPROVED BY DE MAXIMIS.

INVESTIGATION-DERIVED WASTE FROM EW-2 DRILLING

1. IDW FROM EW-2 DRILLING WILL BE CONTAINERIZED IN 55-GALLON DRUMS AND TRANSPORTED TO THE NMI PROPERTY BY THE WELL DRILLER AND STAGED AT A LOCATION DESIGNATED BY DE MAXIMIS. DRUMS WILL BE ALLOWED TO DECANT.
2. SUPERNATANT WILL BE REMOVED FROM DRUMMED SOIL AND PUT INTO DRUMS WITH IDW GROUNDWATER.
3. DRUMS OF SOIL AND GROUNDWATER FROM EW-2 DRILLING WILL BE SAMPLED FOR WASTE CHARACTERIZATION AND THEN TRANSPORTED TO A DISPOSAL FACILITY APPROVED BY DE MAXIMIS. TESTING, TRANSPORTATION AND DISPOSAL WILL BE COORDINATED BY DE MAXIMIS.

SITE RESTORATION

1. CONTRACTOR SHALL RESTORE DISTURBED AREAS TO PRE-CONSTRUCTION CONDITIONS, EXCEPT FOR THE NEW ACCESS ROAD. RESTORATION INCLUDES REPLACING PAVEMENT IN KIND WITH ASPHALT, CONCRETE OR GRAVEL TO MATCH ADJACENT SURFACES AND GRADES, OR PLANTING GRASS.
2. WHERE SURFACE RESTORATION IS GRASS, CONTRACTOR SHALL WARRANTEE GRASS FOR 1 YEAR FOLLOWING GERMINATION. RESEEDING OR ADDITIONAL RESTORATION WORK NESCESSARY TO ACHIEVE THIS WARRANTEE SHALL BE PERFORMED AT THE SOLE EXPENSE OF THE CONTRACTOR.
3. CONTRACTOR SHALL MAINTAIN AND LEAVE EROSION AND CONTROL MEASURES IN PLACE UNTIL VEGETATION HAS BEEN RESTORED AND AS DIRECTED BY THE ENGINEER OR DE MAXIMIS. ONCE VEGETATION IS RESTORED, CONTRACTOR SHALL REMOVE EROSION AND CONTROL MEASURES.

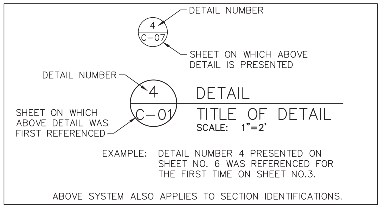
EXCAVATION SECURITY

1. IF EXCAVATIONS ARE TO REMAIN OPEN AFTER NORMAL WORKING HOURS, THEY SHALL BE:
   a. COVERED WITH STEEL PLATES PER MASSACHUSETTS DOT SPECIFICATIONS WHICH ARE PLATES CAPABLE OF SUPPORTING HS20 VEHICLE TRAFFIC IF THE EXCAVATION IS IN A ROADWAY OR WALKWAY.
   b. BE FULLY SURROUNDED BY SNOW FENCE IF NOT IN A ROADWAY OR WALKWAY.
2. EXCAVATIONS SHALL NOT REMAIN OPEN OVER WEEKENDS.
3. ALL EXCAVATED SOIL SHALL BE STOCKPILED OR CONTAINERIZED IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL LAWS, AND AS DIRECTED BY DE MAXIMIS.
4. TRENCHES WILL BE BACKFILLED WITH EXCAVATED SOIL TO THE EXTENT POSSIBLE. SOIL THAT CANNOT BE RETURNED INTO TRENCHES WILL BE MANAGED AS DESCRIBED ABOVE FOR IDW PRODUCED DURING GENERAL EARTHWORK.
5. ASPHALT AND CONCRETE SHALL BE SEGREGATED FROM EXCAVATED SOILS AND SHALL BE TRANSPORTED TO AN APPROVED RECYCLING OR DISPOSAL FACILITY AS DIRECTED BY DE MAXIMIS.
6. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OR DE MAXIMIS OF UNEXPECTED SUBSURFACE CONDITIONS AND DISCONTINUE WORK IN AFFECTED AREA UNTIL RECEIVING NOTIFICATION TO RESUME WORK.

SURVEY AND BACKFILL

1. SURVEYING SHALL BE PERFORMED BY A SURVEYOR LICENSED IN MASSACHUSETTS WORKING FOR THE CONTRACTOR. MINIMUM SURVEY PRECISION SHALL BE ONE TENTHS OF A FOOT VERTICALLY AND ONE FOOT LATERALLY.
2. DEPTH AND POSITION OF SUBSURFACE PIPING SHALL BE DOCUMENTED PRIOR TO BACKFILLING. CONTRACTOR SHALL PROVIDE THE ENGINEER AND DE MAXIMIS WITH AS-BUILT DRAWINGS SHOWING, AT A MINIMUM, ALL SUBSURFACE PIPING, VAULTS, FOUNDATIONS. TRENCH AND PIPE DEPTHS AND LOCATIONS SHALL BE MEASURED EVERY 10 LATERAL FEET AND AT CHANGES OF DIRECTION. VAULTS' ELEVATION AND LOCATION SHALL BE SURVEYED ON ALL CORNERS.
3. THE TOP OF CASING FOR BEW-5 AND EW-2 SHALL BE SURVEYED.
4. THE POSITION OF SURVEY MARKERS INSTALLED IN THE KINDER MORGAN EASEMENT ATOP THE HDD TRAJECTORY SHALL BE SURVEYED.
5. ALL TRENCHES SHALL BE INSPECTED BY THE ENGINEER PRIOR TO PIPE PLACEMENT AND AFTER PIPE PLACEMENT BUT BEFORE BACKFILLING.
6. TRENCHES SHALL INCLUDE BEDDING SAND, A LAYER OF STYROFOAM AND METALLIC INDICATOR TAPE AS SHOWN ON THE DRAWINGS.
7. BEDDING SAND SHALL BE FREE OF ICE, CLAY, EXCESSIVE ORGANIC MATTER AND OTHER DELETERIOUS MATERIAL. BEDDING SAND SHALL HAVE 100% PARTICLES PASSING THE #4 SIEVE AND <5% OF PARTICLES PASSING THE #200 SIEVE.
8. METAL INDICATOR TAPE SHALL BE SAFETY SUPPLY WAREHOUSE DETECTABLE "CAUTION BURIED ELECTRICAL LINE BELOW" UNDERGROUND TAPE OR SIMILAR APPROVED PRODUCT.
9. SOIL EXCAVATED FROM TRENCHS SHALL BE USED TO BACKFILL TRENCHES FOLLOWING PLACEMENT OF PIPE AND BEDING SAND. ROCKS LARGER THAN 6-INCH DIAMETER SHALL BE REMOVED PRIOR TO PLACING EXCAVATED SOIL INTO TRENCHES AS BACKFILL. PIECES OF CONCRETE, ASPHALT, WOOD, WOOD CHIPS OR ANY MATERIAL OTHER THAN SOIL IS PROHIBITED FROM TRENCH BACKFILL.
10. TRENCH BACKFILL SHALL BE PLACED IN LIFTS NO THICKER THAN 1-FOOT AND EACH LIFT SHALL BE COMPACTED BY NO FEWER THAN 4 PASSES OF A VIBRATORY COMPACTOR.
11. CONTRACTOR SHALL CONSTRUCT SURFACE COMPLETIONS FOR TRENCHES TO MATCH EXISTING ADJACENT SURFACES.

WATER PIPING AND HOSE



DETAIL IDENTIFICATION LEGEND

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
289 GREAT ROAD, SUITE 202
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TITLE: GENERAL NOTES AND SPECIFICATIONS I

PROJECT: 100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER EXTRACTION SYSTEM EXPANSION

SITE: NUCLEAR METALS INC. SUPERFUND SITE
CONCORD, MASSACHUSETTS

DESIGN BY:	AD, CE	DATE:	SEPTEMBER 2022
DRAWN BY:	RMK	PROJECT NO.:	BR0090C
CHECKED BY:	AD	FILE:	
REVIEWED BY:	CE	DRAWING NO.:	
APPROVED BY:	CE	G-02 OF 12	

(1in) (2in) (3in) (4in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

T:\Projects_CADD\N\NMI (Nuclear Metals Superfund Site)\DRAWINGS\OFF SITE SYS EXPAND\BR0090C 4301 G-02_03 (GEN NOTES).dwg Last Edited By:RKOHLSTROM

1. PIPING SHALL MATCH THE SIZE, MATERIAL AND WEIGHT NOTED IN THE DRAWINGS. WHEREVER THIS INFORMATION IS NOT EXPLICIT IN THE DRAWINGS, THE CONTRACTOR SHALL ASK ENGINEER FOR CLARIFICATION.
2. HDPE PIPE SHALL BE FUSION WELDED. PVC PIPE SHALL BE SOLVENT WELDED. ALL PIPE CONNECTIONS SHALL COMPLY WITH MANUFACTURER'S SPECIFICATIONS.
3. ALL WATER PIPE AND HOSE ABOVE THE GROUND SURFACE AND TO A DEPTH OF 3 FEET BELOW GROUND SURFACE SHALL BE WRAPPED IN INSULATION WITH PVC JACKET RATED FOR OUTDOOR USE.
4. ALL CAMLOCKS SHALL BE STAINLESS STEEL CONSTRUCTION AND LOCKABLE.
5. UNLESS STATED OTHERWISE ON THE DRAWINGS, ALL PIPING VALVES SHALL BE BRASS.
6. PRIOR TO PIPE INSTALLATION, THE CONTRACTOR SHALL VERIFY THE PIPING ROUTES AND ADJUST FOR OBSTRUCTIONS.
7. PIPING SHALL BE LEAK FREE FOLLOWING INSTALLATION. ANY REPAIRS NEEDED TO REPAIR LEAKS SHALL BE AT THE SOLE EXPENSE OF CONTRACTOR OR HDD DRILLER.
8. GROUNDWATER PIPING SHALL BE PRESSURE TESTED WITH CLEAN WATER AT THE MAXIMUM WORKING PRESSURE OF THE PIPE FOR A PERIOD OF ONE HOUR. IF PRESSURE DROPS MORE THAN 3 PSI WITHIN ONE HOUR, CONTRACTOR OR HDD DRILLER SHALL IDENTIFY THE LOCATION OF LEAK(S), REPAIR THE LEAK AND RETEST THE PIPE; LEAK REPAIR AND RETESTING SHALL BE AT CONTRACTOR'S OR HDD DRILLER'S EXPENSE. LEAK TESTING SHALL BE PERFORMED IN THE PRESENCE OF THE ENGINEER AND OWNER REPRESENTATIVE. FOR TRENCHED PIPE, LEAK TESTING SHALL OCCUR PRIOR TO BACKFILLING ABOVE THE PIPE AND AFTER THE TRENCH IS BACKFILLED. FOR HDD PIPE, LEAK TESTING SHALL BE PERFORMED AFTER THE PIPE IS INSTALLED AND BEFORE IT IS CONNECTED TO OTHER PIPING WITHIN VAULTS OR TO EXTRACTION WELLS. THE CONTRACTOR AND HDD DRILLER SHALL PROVIDE WRITTEN AND SIGNED DOCUMENTATION ON COMPANY LETTERHEAD OF ALL PIPE TESTING THAT INCLUDES DATE, PIPE, TEST PRESSURE, PRESSURE DROP AND TEST DURATION.

ELECTRICAL CONDUIT (AND BEDDING FOR ELECTRICAL CONDUIT)

1. ALL ELECTRICAL WORK SHALL BE PERFORMED BY AN ELECTRICIAN LICENCED IN THE STATE OF MASSACHUSETTS (THE ELECTRICIAN).
2. ALL UNDERGROUND WIRING SHALL BE IN CONDUIT. ELECTRICIAN SHALL SELECT CONDUIT TYPE AND SIZE WITHIN VAULTS AND TRENCHES.
3. WIRE SIZE SHALL BE SELECTED BY THE ELECTRICIAN TO BE APPROPRIATE FOR THE LENGTH AND POWER LOAD.
4. CONDUIT SHALL BE SIZED BY THE ELECTRICIAN BASED ON WIRE SIZE AND RUN LENGTH.
5. PVC SHALL BE USED ON ALL UNDERGROUND CONDUIT RUNS 20 FEET OR LONGER.
6. BENDS OF NO MORE THAN 30-DEGREES SHALL BE PERMITTED. NO OFFSET BENDS SHALL BE ALLOWED.
7. ALL ELBOWS AND VERTICAL CONDUIT SHALL BE RIGID GALVANIZED.

EXTRACTION WELL VAULTS AND HDD TRANSITION VAULTS

1. CONTRACTOR SHALL PROVIDE SHOP DRAWINGS OF VAULTS AND LIDS TO THE ENGINEER AND FOR REVIEW. SHOP DRAWING MUST BE STAMPED BY A STRUCTURAL ENGINEER REGISTERED IN THE STATE OF MASSACHUSETTS. THE CONTRACTOR SHALL ALLOW A MINIMUM OF 2 WEEKS FOR ENGINEER REVIEW OF SHOP DRAWINGS.
2. VAULTS SHALL COMPLY WITH LOADING SPECIFIED IN DRAWINGS.
3. PIPING SHALL ENTER THE VAULTS A MINIMUM OF 4 FEET BELOW THE FINISHED GRADE.
4. THE VAULTS SHALL BE UNDERLAIN BY A MINIMUM OF 1 FOOT STRUCTURAL FILL COMPACTED USING VIBRATION TO A MINIMUM 90% OF THE MAXIMUM DENSITY BY MODIFIED PROCTOR EFFORT.
5. THE EXTRACTION WELL VAULT FOR EW-2 SHALL HAVE THE FOLLOWING:
    a. TOP DIMENSIONS = 3 FEET X 3 FEET SQUARE (MINIMUM)
    b. BOTTOM DIMENSION = 4 FEET x 4 FEET' OR 5.5 FEET' DIAMETER (SEE DRAWINGS)
    c. MINIMUM HEIGHT = 4.5 FEET
    d. SOLID BOTTOM WITH AN 8 INCH DIAMETER HOLE (FOR THE WELL) OFFSET 1 FOOT FROM CENTER
6. THE HDD TRANSITION VAULT NEAR EW-2 SHALL HAVE THE FOLLOWING:
    a. TOP DIMENSIONS = 3 FEET X 3 FEET SQUARE (MINIMUM)
    b. BOTTOM DIMENSION = 4 FEET x 4 FEET' OR 5.5 FEET' DIAMETER (SEE DRAWINGS)
    c. MINIMUM HEIGHT = 4.5 FEET
    d. SOLID BOTTOM
7. THE HDD TRANSITION VAULT NEAR THE TREATMENT SYSTEM BUILDING SHALL HAVE THE FOLLOWING:
    a. TOP AND BOTTOM DIMENSIONS = 6 FEET X 6 FEET SQUARE (MINIMUM, SEE DRAWINGS)
    b. MINIMUM HEIGHT = 4.5 FEET
    c. SOLID BOTTOM
8. PENETRATIONS FOR GROUNDWATER PIPING SHALL BE LOCATED A MINIMUM 4 FEET BELOW TOP OF THE VAULT. PENETRATIONS MAY BE CORED ON-SITE DURING CONSTRUCTION AND VAULT INSTALLATION.
9. CONNECTIONS FOR HOOK AND ELECTRICAL JUNCTION AS SHOWN IN DRAWINGS
10. THE TOP RIMS AND LIDS SHALL:
    a. BE RATED FOR WHEEL LOAD SPECIFIED IN DRAWINGS
    b. 36 INCH X 36 INCH OPENING
    c. BE SECURED BY LOCK AND BOLT
    d. HAVE A WATER-RESISTANT GASKET
    e. HAVE WELDED OR ETCHED LETTERING "REMEDIATION WELL" ON THE LID
11. WELL VAULT RIMS AND LIDS SHALL BE DESIGNED FOR H-20 WHEEL LOADS.

SEQUENCE OF WORK

THIS SEQUENCE OF WORK IS INTENDED TO DESCRIBE THE OVERALL CONSTRUCTION PROJECT AND A GENERAL SEQUENCE OF ACTIVITIES. UNLESS OTHERWISE NOTED, IT IS NOT INTENDED TO ESTABLISH A RIGID OR REQUIRED CONSTRUCTION SEQUENCE.

EW-2 INSTALLATION

1. AT LEAST 48 HOURS PRIOR TO COMMENCING ANY SUBSURFACE ACTIVITIES, IT IS THE RESPONSIBILITY OF THE WELL DRILLER TO NOTIFY UNDERGROUND SERVICES ALERT AND LOCATED UNDERGROUND UTILITIES. IF WELL DRILLER CANNOT ASCERTAIN THE PRECISE LOCATION OF UNDERGROUND UTILITIES, THEN THEY SHALL HIRE A PRIVATE UTILITY LOCATING SERVICE. THE WELL DRILLER SHALL ALSO CLEAR LOCATIONS WITH DE MAXIMIS.
2. WELL DRILLER SHALL INSTALL EXTRACTION WELL EW-2 IN ACCORDANCE WITH THE DESIGN DRAWINGS AND SOIL AND ROCK DRILLING SOP NMI-S-004 USING ROTOSONIC TECHNOLOGY. WELL DRILLER SHALL COMPLETE THE WELL AS A STICKUP.
3. WELL DRILLER SHALL DEVELOP THE WELL IN ACCORDANCE WITH SOP NMI-GW-002 UNTIL THE GROUNDWATER TURBIDITY IS LESS THAN OR EQUAL TO 5 NTU AND AT LEAST 5 SCREENED INTERVAL VOLUMES TOTAL OF PURGE WATER HAVE BEEN REMOVED IN ADDITION TO WATER LOST TO THE FORMATION DURING DRILLING.
4. IDW FROM DRILLING AND DEVELOPMENT ACTIVITIES SHALL BE CONTAINERIZED AND STAGED NEXT TO EW-2. WELL DRILLER WILL TRANSPORT IDW TO THE PROPERTY LOCATED AT 2229 MAIN STREET FOR TESTING AND DISPSOSAL.
5. WELL DRILLER SHALL INSTALL THE SUBMERSIBLE PUMP AND OTHER IN-WELL INFRASTRUCTURE, SUCH AS STILLER PIPE, AS SHOWN ON THE DRAWINGS.

EROSION AND SEDIMENT CONTROL

1. THE CONTRACTOR SHALL PREPARE AN EROSION AND SEDIMENT CONTROL PLAN AND SUBMIT THIS PLAN TO THE ENGINEER AND DE MAXIMIS FOR REVIEW AT LEAST TWO WEEKS PRIOR TO COMMENCING CONSTRUCTION.
2. THE STANDARD EROSION AND SEDIMENT CONTROL DETAILS AND BEST MANAGEMENT PRACTICES ARE PROVIDED HEREIN AS EXAMPLES. THE CONTRACTOR SHALL CONSTRUCT EROSION AND SEDIMENT CONTROLS IN GENERAL ACCORDANCE WITH THE MASSACHUSETTS STORMWATER HANDBOOK.
3. ALL EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCES, INCLUDING DRILLING, OR IN THEIR PROPER SEQUENCE AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED.
4. COMPOST FILTER SOCKS WILL BE MAINTAINED AROUND THE STOCKPILES.
5. INACTIVE STOCKPILES SHALL BE COVERED WITH ANCHORED TARPS OR PROTECTED WITH SOIL STABILIZATION MEASURES.
6. WHEN A STORM EVENT IS PREDICTED, STOCKPILES SHOULD BE PROTECTED WITH AN ANCHORED PROTECTIVE COVERING.
7. [illegible] THAT EROSION AND SEDIMENT CONTROL MEASURES ARE IN PLACE AND FUNCTIONING PROPERLY.
8. ANY CHANGES TO THE EROSION AND SEDIMENT CONTROL PLAN WILL REQUIRE SUBMISSION OF REVISED EROSION AND SEDIMENT CONTROL PLANS TO THE ENGINEER AND DE MAXIMIS FOR APPROVAL.
9. THE CONTRACTOR, WELL DRILLER, AND HDD DRILLER SHALL BE RESPONSIBLE FOR KEEPING ALL ROADS TRAVERSED BY THEIR EQUIPMENT CLEAN FROM SOIL AND SEDIMENT TRACKED-OUT DURING THE LIFE OF THE CONSTRUCTION PROJECT.
10. EROSION AND SEDIMENT CONTROL SHALL BE INSPECTED BY THE CONTRACTOR FOR POOR PERFORMANCE AND DAMAGE AT A MINIMUM OF WEEKLY AND AFTER ANY STORM YIELDING ½" OR MORE RAINFALL. DEFICIENCIES IN THE EROSION AND SEDIMENT CONTROL, IDENTIFIED BY THE CONTRACTOR, ENGINEER, OR OWNER SHALL BE REPAIRED BY THE CONTRACTOR WITHIN 8 HOURS AFTER BEING OBSERVED.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMEDIATING ANY EROSION OR SEDIMENT PROBLEMS THAT ARISE AS A RESULT OF ONGOING CONSTRUCTION AT THE REQUEST OF THE ENGINEER OR OWNER.
12. THE SILT FENCE SHALL CONFORM TO AASHTO M288 05 SILT FENCE SPECIFICATIONS.
13. THE POSTS USED TO SUPPORT THE SILT FENCE SHALL BE A HARDWOOD MATERIAL THAT ARE 2" SQUARE (NOMINAL) BY 4' LONG.
14. SILT FENCE FABRIC SHALL BE ATTACHED TO THE WOOD POSTS WITH STAPLES, WIRE, ZIP TIES OR NAILS.

SITE PREPARATION

1. CONTRACTOR, WELL DRILLER AND, HDD DRILLER SHALL EACH VERIFY THE TYPE AND LOCATION OF ALL UTILITIES WITHIN THEIR LIMITS OF WORK PRIOR TO THE START OF WORK, ESTABLISH SURVEY CONTROL, AND VERIFY EXISTING CONDITIONS SHOWN ON THE PLANS ARE ACCURATE. AT LEAST 72 HOURS PRIOR TO COMMENCING ANY SUBSURFACE ACTIVITIES, IT IS THE RESPONSIBILITY OF THE CONTRACTOR PERFORMING SUBSURFACE WORK TO NOTIFY UNDERGROUND SERVICES ALERT AND LOCATED UNDERGROUND UTILITIES. IF CONTRACTOR CANNOT ASCERTAIN THE PRECISE LOCATION OF UNDERGROUND UTILITIES, THEN THEY SHALL HIRE A PRIVATE UTILITY LOCATING SERVICE. THE CONTRACTOR SHALL ALSO CLEAR LOCATIONS WITH DE MAXIMIS. LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE.
2. DE MAXIMIS WILL COORDINATE WITH KINDER-MORGAN TO HAVE A REPRESENTATIVE ON-SITE PRIOR TO CONDUCTING WORK IN THE KINDER-MORGAN EASEMENT. WORK IN THE KINDER-MORGAN EASEMENT REQUIRING A KINDER-MORGAN REPRESENTATIVE INCLUDES, BUT MAY NOT BE LIMITED TO, ACCESS ROAD CONSTRUCTION, STEEL PLATE INSTALLATION, AND HDD ADVANCEMENT. CONTRACTOR AND HDD DRILLER MUST PROVIDE A MINIMUM OF TWO-WEEK NOTICE TO DE MAXIMIS PRIOR TO INITIATING ANY WORK IN OR REQUIRING EQUIPMENT TO PASS THROUGH THE KINDER MORGAN EASEMENT.
3. CONTRACTOR AND DRILLERS SHALL PERFORM CLEARING AND GRUBBING ACTIVITIES WHERE NECESSARY WITHIN THEIR LIMIT OF WORK. VEGETATION REMOVED AS PART OF THE CLEARING AND GRUBBING WILL BE CHIPPED AND TRANSPORTED TO THE NMI PROPERTY LOCATED AT 2229 MAIN STREET, CONCORD, MA.
4. CONTRACTOR AND DRILLERS SHALL CREATE STOCKPILE/LAYDOWN AREAS FOR MATERIALS SUCH AS TUBING AND GRAVEL.
5. CONTRACTOR AND DRILLERS SHALL USE SANITATION SERVICES LOCATED ON THE NMI PROPERTY OR IN THE KNOX TRAIL TREATMENT BUILDING.
6. CONTRACTOR SHALL CONSTRUCT ACCESS ROAD FROM VALLEY SPORT, INC. PARKING AREA TO BEW-5 THROUGH THE KINDER-MORGAN EASEMENT AS SHOWN IN THE DRAWINGS.
7. CONTRACTOR SHALL EXCAVATE 47 CUBIC YARDS OF SURFICIAL SOILS IN THE WOODS TO THE EAST OF THE KINDER MORGAN EASEMENT TO MITIGATE FLOOD STORAGE LOSS RESULTING FROM THE RAISED ACCESS ROAD AT THE KINDER MORGAN EASEMENT. NO REMOVAL OF TREES SHALL BE CONDUCTED TO EXCAVATE THIS VOLUME. EXCAVATION AND GRADING TO BE CONDUCTED TO CREATE POSITIVE SURFACE DRAINAGE. THIS VOLUME SHALL BE CREATED BY EXCAVATING NO DEEPER THAN 1.5-FEET FROM THE SLIGHT MOUND LOCATED NORTH OF THE ACCESS ROAD. THE GROUND SURFACE OF THE EXCAVATION FOOTPRINT SHALL BE VEGETATED TO MATCH THE NEARBY GROUND SURFACE. EXCAVATION SHALL NOT OCCUR WITHIN THE KINDER MORGAN EASEMENT.
8. CONTRACTOR SHALL EXCAVATE PITS NEAR THE GROUNDWATER TREATMENT SYSTEM BUILDING, BEW-5, AND EW-2 AS SHOWN ON DESIGN DRAWINGS.
    a. A PIT AT THE PLANNED HDD TRANSITION VAULT LOCATION AT THE TREATMENT SYSTEM SHALL BE EXCAVATED PRIOR TO DRILLING FOR VISUAL CONFIRMATION AND CONTROL OF BEW-5 AND EW-2 HDD PATHS AND PIPE INSTALLATIONS AT THIS LOCATION.
    b. TWO EXIT PITS FOR DRILLING FLUID CONTAINMENT SHALL BE CONSTRUCTED 15-20 FT FROM PLANNED HDD VAULT AT EW-2 AND HDD TRANSITION LOCATION AT BEW-5 AS DIRECTED BY HDD DRILLER.
    c. PITS SHALL BE 2-3 FEET DEEP AND MINIMUM 4 FEET WIDE OR AS DIRECTED BY HDD DRILLER.
9. CONTRACTOR SHALL INSTALL A VERTICAL 8-FOOT-WIDE STEEL PLATE AT THE LOCATION SHOWN ON DRAWINGS WHICH IS 15 FEET WEST OF THE KINDER MORGAN GAS LINE.
    a. BASE OF STEEL PLATE SHALL BE A MINIMUM OF 12.5 FT BELOW LAND SURFACE.
    b. ENGINEER SHALL BE NOTIFIED IF DISTANCE FROM KINDER-MORGAN GAS LINE CHANGES OR DEPTH OF TRENCH CANNOT BE ACHIEVED.

HDD

1. HDD DRILLER SHALL MOBILIZE DRILL RIG AND IDW MANAGEMENT EQUIPMENT.
2. HDD DRILLER SHALL ADVANCE BEW-5 PILOT BORING FROM NEAR TREATMENT SYSTEM TO EXIT LOCATION NEAR BEW-5.
    a. HDD SHALL BE INITIATED FROM ENTRANCE LOCATION AT GROUND SURFACE. THE PIT AT THE HDD TRANSITION VAULT LOCATION NEAR THE TREATMENT SYSTEM SHALL BE USED FOR VISUAL CONFIRMATION AND CONTROL HDD PATHS AND PIPE INSTALLATIONS.
    b. HDD DEPTH BENEATH THE ASSABET RIVER SHALL BE A MINIMUM OF 15 FEET BELOW THE RIVER BED. A MINIMUM 20% SLOPE SHALL BE MAINTAINED BEGINNING AT THE BORING ENTRANCE TO ACHIEVE THIS 15-FT DEPTH BELOW THE RIVER. THIS 15-FT DEPTH BELOW THE RIVER CORRESPONDS TO DEPTH OFAPPROXIMATELY 16.7 FT BELOW GROUND SURFACE AT THE WESTERN RIVERBANK AND 17.8 FT BELOW GROUND SURFACE AT EASTERN RIVERBANK. ONCE THIS ELEVATION IS REACHED IT SHALL BE MAINTAINED UNTIL THE BEW-5 BORING HAS ADVANCED 745 LINEAR FEET.
    c. HDD DRILLER SHALL CONDUCT WALK-OVER, REAL-TIME TRACKING OF HDD ADVANCEMENT VIA A TRANSMITTER IN THE DRILL CUTTING HEAD AND A HAND-HELD RECEIVER OPERATED BY HDD DRILLER ABOVE THE LEADING EDGE OF THE HDD. WALK-OVER TRACKING SHALL BE CONDUCTED, IF FEASIBLE, EVEN WHILE THE DRILL BIT IS ADVANCING UNDERNEATH THE ASSABET RIVER.
3. HDD DRILLER SHALL REAM PILOT BORING FROM BEW-5 TO TREATMENT SYSTEM AND INSTALL OUTER CHASE PIPE WITH INTERNAL PIPES AND TRACER WIRE AS SHOWN IN THE DRAWINGS.
4. AFTER COMPLETION OF THE BEW-5 BORING, CONTRACTOR SHALL REMOVE STEEL PLATE FROM KINDER-MORGAN EASEMENT AND BACKFILL THE RESULTING TRENCH WITH EXCAVATED SOILS, COMPACTING THE BACKFILL IN 2-FOOT LIFTS.
5. AFTER COMPLETION OF THE BEW-5 HDD BORING, HDD DRILLER SHALL ADJUST THE DRILL RIG LOCATION AND EQUIPMENT AND ADVANCE THE PILOT BORING TO THE EXIT LOCATION NEAR EW-2 IN THE SAME MANNER AS THE BEW-5 WELL EXCEPT THAT THE MAXIMUM DEPTH OF THE PILOT BORING SHALL BE ADVANCED TO 275 LINEAR FEET BEFORE RISING TO THE EXIT PIT.
6. HDD DRILLER SHALL LEAK TEST ALL PIPES, BUT NOT THE 6-INCH OUTER CASING, AFTER INSTALLATION AND PRIOR TO CONNECTION TO OTHER PIPE. REFER TO WATER PIPING AND HOSE SECTION FOR LEAK TESTING REQUIREMENTS.
7. HDD DRILLER SHALL MANAGE DRILLING FLUID AND IDW CONCURRENT TO HDD ACTIVITIES INCLUDING REMOVING ALL DRILLING FLUID FROM EXIT PITS AND THE PIT NEAR THE TREATMENT SYSTEM BUILDING. HDD DRILLER SHALL TRANSPORT IDW TO THE ROLL-OFF AT THE TREATMENT SYSTEM. FOLLOWING CONTAINMENT WITHIN THE ROLL-OFF, CONTRACTOR WILL ASSUME RESPONSIBILITY FOR IDW MANAGEMENT.
8. CONTRACTOR SHALL BACKFILL EXIT PITS AND RESTORE THE SURFACE TO PRE-CONSTRUCTION CONDITIONS.
9. CONTRACTOR SHALL INSTALL SURVEY MARKERS ON THE GROUND SURFACE OF WHERE THE HDD ENTERS AND EXITS THE KINDER MORGAN EASEMENT. SURVEY MARKERS SHALL CONSIST OF GRANITE BLOCK INSTALLED TO BE FLUSH WITH THE GROUND SURFACE.

TRENCHING, VAULT AND PIPING INSTALLATION, AND CONNECTION TO EXISTING TREATMENT SYSTEM

1. CONTRACTOR SHALL INSTALL VAULTS, PIPING IN TRENCHES TO/FROM VAULTS, AND ELECTRICAL CONDUIT IN ACCORDANCE WITH THE DESIGN DRAWINGS.
    a. CONTRACTOR SHALL SEAL ANNULAR SPACE WHERE PIPES ENTER VAULTS SO THAT VAULTS ARE WATERTIGHT.
    b. AT THE BURIED HDD TRANSITION NEAR BEW-5, CONTRACTOR SHALL SEAL ANNULAR SPACE AROUND 1" AND 2" DIAMETER HDD PIPES WITHIN 6" OUTER PIPE TO BE WATERTIGHT.
    c. CONTRACTOR SHALL LEAK TEST ALL PIPES. REFER TO WATER PIPING AND HOSE SECTION FOR LEAK TESTING REQUIREMENTS.
2. ELECTRICIAN SHALL INSTALL LEAK DETECTION SYSTEM IN EW-2 VAULT, HDD TRANSITION VAULT NEAR EW-2, AND THE HDD TRANSITION VAULT AT THE TREATMENT SYSTEM.
    a. LEAK DETECTION SENSOR SHALL BE WIRED IN SERIES WHICH PROVIDES A SIGNAL TO THE TREATMENT SYSTEM PLC NOTIFYING IT OF FLOODING IN ANY VAULT.
    b. FLOODING IN ANY VAULT SHALL RESULT IN SYSTEM SHUTDOWN.
    c. SIGNAL WIRES SHALL BE SHIELDED.
    d. ALL JUNCTION BOXES SHAL BE NEMA 4 RATED OR BETTER.
    e. SAFETY SWITCH AT WELLS SHALL BE RATED FOR THE POWER OF THE PUMP OR GREATER, BE RATED FOR OUTDOOR USE AND MUST HAVE A LOCKABLE LEVER FOR BOTH ON AND OFF POSITIONS.
3. CONTRACTOR SHALL INSTALL WATERPROOF ENCLOSURE AROUND BEW-5.
    a. WATERPROOF ENCLOSURE SHALL CONSISTS OF A MINIMUM OF 4-INCHES OF CLOSED CELL FOAM INSULATION ON ALL SIDES, INCLUDING THE GROUND SURFACE AND ROOF.
4. O&M INC, THE OPERATOR OF THE KNOX TRAIL GROUNDWATER TREATMENT SYSTEM, AND ELECTRICIAN SHALL BE RESPONSIBLE FOR CONNECTING PIPING AND ELECTRICAL TO TREATMENT SYSTEM.

LEGEND FOR SURVEY BASE MAP

(SOURCE: FELDMAN LAND SURVEYORS, MAY 15, 2020)

LEGEND

Ⓢ	SEWER MANHOLE
Ⓓ	DRAIN MANHOLE
Ⓔ	ELECTRIC MANHOLE
Ⓣ	TELEPHONE MANHOLE
MH	MANHOLE
✲	HYDRANT
S	WATER SHUT OFF/WATER GATE
S	GAS SHUT OFF/GAS GATE
▦	CATCH BASIN
⊕	ROUND CATCH BASIN
●	GUY WIRE
○	UTILITY POLE
•	BOLLARD
P ●	POST
MAIL	MAIL BOX
—o—	SIGN
◎	MAGNAIL
▣	BOUND FOUND WITH DRILL HOLE
◉	IRON PIPE
⊗	IRON ROD
Ⓦ	OBSERVATION WELL
ѱ	WETLANDS
☒	TRANSFORMER
EM	ELECTRIC METER
▲	WETLAND FLAG
✿	DECIDUOUS TREE
✸	CONIFEROUS TREE
✽	SHRUB
● GP	GATE POST
⬭	BOULDER
○	STUMP
Z	INDICATES COMMON OWNERSHIP
BIT	BITUMINOUS
(C)	CALCULATED
CB	CONCRETE BOUND
CC	CONCRETE CURB
CLF	CHAIN LINK FENCE
CONC	CONCRETE
Δ=	DELTA ANGLE
DH	DRILL HOLE
DYL	DOUBLE YELLOW LINE

FD	FOUND
GR	GUARD RAIL
H.P.	HIGH PRESSURE
IP	IRON PIPE
IR	IRON ROD
L=	ARC LENGTH
MNF	MAGNETIC NAIL FOUND
PL	PLASTIC
PRSCP	POST REMOVAL SITE CONDITIONS PLAN
R=	RADIUS OR RIM ELEVATION
(R)	RECORD
(REC)	RECORD
RET	RETAINING
SB	STONE BOUND
SGC	SLOPED GRANITE CURB
SQ. FT.	SQUARE FEET
VGC	VERTICAL GRANITE CURB
WF	WIRE FENCE
WF-##	WETLAND FLAG NUMBER
—D—	DRAIN
—D—	DRAIN-PRSCP
—C—	CABLE TELEVISION
—E—	ELECTRIC
—G—	GAS
—OHW—	OVERHEAD WIRES
—S—	SEWER
—S—	SEWER-PRSCP
—T—	TELEPHONE
—UNK.—	UNKNOWN LINE (PRSCP)
—W—	WATER
—W—	WATER-PRSCP
—S(ABD)—	ABANDONED
—12"D(CI)—	PIPE SIZE AND MATERIAL
— CI —	CAST IRON PIPE
— CS —	COATED STEEL PIPE
— PL —	PLASTIC PIPE
—RCP—	REINFORCED CONCRETE PIPE
—X——X—	METAL FENCE
⌒⌒⌒⌒	EDGE OF WOODS
┈┈┈┈	GUARD RAIL
⬭⬭⬭⬭	STONE WALL
—DST—	DIGSAFE TELEPHONE
—DSW—	DIGSAFE WATER

REV	DATE	DESCRIPTION	DRN	APP

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TITLE:
GENERAL NOTES,SPECIFICATIONS II & BASE PLAN LEGEND

PROJECT:
100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER
EXTRACTION SYSTEM EXPANSION

SITE:
NUCLEAR METALS INC. SUPERFUND SITE
CONCORD, MASSACHUSETTS

DESIGN BY: AD, CE
DATE: SEPTEMBER 2022
DRAWN BY: RMK
PROJECT NO.: BR0090C
CHECKED BY: AD
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LEGEND

150	TOPOGRAPHIC CONTOUR 5' INTERVAL
	TOPOGRAPHIC CONTOUR 1' INTERVAL
GAS	NATURAL GAS LINE
— · · —	KINDER MORGAN UTILITY EASEMENT
WM	TOWN OF ACTON POTABLE WATER
W — W	TREATMENT SYSTEM POTABLE WATER
P — P	PROPANE LINE
	GROUNDWATER INFLUENT TO TREATMENT PLANT
D — D	TREATED GROUNDWATER EFFUENT
⊕	MONITORING WELL LOCATION
▣	EXTRACTION WELL LOCATION
— · · —	WETLAND BOUNDARY (NOTE 4)

0 50' 100'
SCALE IN FEET

NOTES:

1. TOPOGRAPHIC CONTOURS (2001) CREATED BY SANBORN. TOPOGRAPHY IN THE VICINITY OF THE GROUNDWATER TREATMENT SYSTEM IS KNOWN TO HAVE BEEN ALTERED SINCE 2001 AND CONTOURS ARE OMITTED IN THIS AREA.
2. LOCATION OF UNDERGROUND KINDER MORGAN NATURAL GAS PIPE AND UTILITY EASEMENT ARE APPROXIMATE BASED ON ABOVE-GROUND MARKINGS (BOLLARDS AND TEMPORARY FLAGGING) MADE BY KINDER MORGAN AND INFORMATION PROVIDED BY KINDER MORGAN REGARDING UTILITY EASEMENT WIDTH.
3. ALL UTILITY LINES ARE APPROXIMATE.
4. WETLAND BOUNDARY WAS OBTAINED FROM TOWN OF ACTON AND TOWN OF CONCORD WETLAND MAPS (OBTAINED IN FEBRUARY 2022) AND UPDATED IN THE VICINITY OF BEW-5 BASED ON WETLAND SURVEY COMPLETED BY FELDMAN LAND SURVEYORS IN JUNE 2022.
5. FOR SURVEY BASE MAP LEGEND SEE SHEET G-03.
6. VALLEY SPORTS, INC. SEPTIC SYSTEM LOCATION AND EXTENT ARE APPROXIMATE AND BASED ON A SKETCH DEVELOPED IN CONSULTATION WITH THE PROPERTY OPERATOR.

REV	DATE	DESCRIPTION	DRN	APP

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SITE PLAN AND EXISTING CONDITIONS

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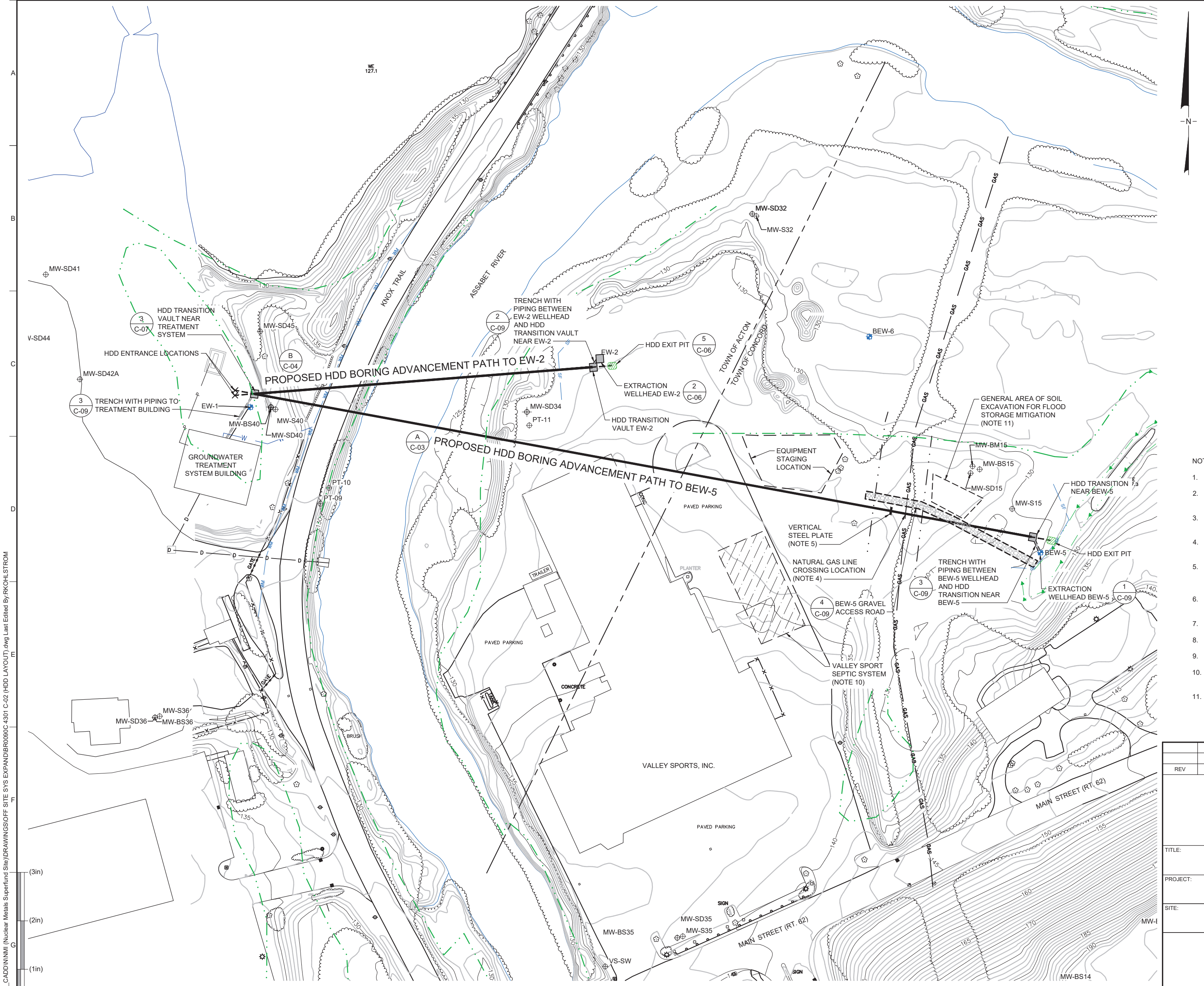
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

T:\Projects_CADD\NNM\NMI (Nuclear Metals Superfund Site)\DRAWINGS\OFF SITE SYS EXPAND\BR0090C 4301 C-01 (EXIST COND).dwg Last Edited By:RKOHLSTROM



LEGEND

150	TOPOGRAPHIC CONTOUR 5' INTERVAL
	TOPOGRAPHIC CONTOUR 1' INTERVAL
GAS	NATURAL GAS LINE
— · · —	KINDER MORGAN UTILITY EASEMENT
WM	TOWN OF ACTON POTABLE WATER
W — W	TREATMENT SYSTEM POTABLE WATER
P — P	PROPANE LINE
	GROUNDWATER INFLUENT TO TREATMENT PLANT
D — D	TREATED GROUNDWATER EFFUENT
⊕	MONITORING WELL LOCATION
▣	EXTRACTION WELL LOCATION
■	HDD TRANSITION TO BURIED PIPING / HDD TRANSITION VAULT / EXTRACTION WELL VAULT
═ ═ ═	TRENCH FROM HDD TO EXTRACTION WELL OR TREATMENT BUILDING
▨	HDD EXIT PIT
×	HDD ENTRANCE LOCATION
SF — SF	SILT FENCE
	TREE LINE
	WETLAND BOUNDARY
	PROPOSED HDD BORING ADVANCEMENT PATH

0 50' 100'
SCALE IN FEET

NOTES:

1. HDD INDICATES HORIZONTAL DIRECTIONAL DRILLING.
2. BASE MAP PREPARED BY SANBORN CAD FILE DATED NOVEMBER 2001. SOME AREAS HAVE BEEN UPDATED TO REFLECT CURRENT CONDITIONS. LOCATIONS ARE APPROXIMATE.
3. TREATMENT SYSTEM UTILITIES ARE APPROXIMATE AND NOT THE RESULT OF A FIELD SURVEY. CONTRACTOR SHALL VERIFY ALL UTILITY LOCATIONS PRIOR TO CONSTRUCTION.
4. NATURAL GAS LINE AND HDD CROSSING LOCATION BASED ON TEST BORING COMPLETED ON MARCH 28, 2022.
5. A VERTICAL STEEL PLATE (8 FEET WIDE) SHALL BE INSTALLED 15 FEET WEST OF NATURAL GAS LINE CROSSING LOCATION. BASE OF STEEL PLATE SHALL BE INSTALLED MINIMUM OF 12.5 FT BELOW LAND SURFACE; REFER TO SHEET C-03.
6. CONSTRUCTION ACTIVITIES WITHIN KINDER MORGAN UTILITY EASEMENT REQUIRE ON-SITE KINDER MORGAN REPRESENTATIVE.
7. HDD SHALL BE INITIATED FROM LAND SURFACE.
8. HDD EXIT SHALL BE WITHIN EXIT PITS FOR DRILLING FLUID MANAGEMENT.
9. FOR SURVEY BASE MAP LEGEND SEE SHEET G-03
10. VALLEY SPORTS, INC. SEPTIC SYSTEM LOCATION AND EXTENT ARE APPROXIMATE AND BASED ON A SKETCH DEVELOPED IN CONSULTATION WITH THE PROPERTY OPERATOR.
11. THE GENERAL AREA OF SOIL EXCAVATION FOR FLOOD STORAGE MITIGATION IS BASED ON A 1-FOOT EXCAVATION WITHIN THE MARKED EXTENT TO ACHIEVE REQUIRED EXCAVATION VOLUME OF 47 CUBIC YARDS. THE EXACT AREA MAY BE ADJUSTED BASED ON FIELD CONDITIONS AND LOCATION OF TREES.

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588, FL CERT #4321

TITLE:
PIPING AND VAULT LAYOUT

PROJECT:
100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER
EXTRACTION SYSTEM EXPANSION

SITE:
NUCLEAR METALS INC. SUPERFUND SITE
CONCORD, MASSACHUSETTS

DESIGN BY:	AD, CE	DATE:	SEPTEMBER 2022
DRAWN BY:	RMK	PROJECT NO.:	BR0090C
CHECKED BY:	AD	FILE:	
REVIEWED BY:	CE	DRAWING NO.:	C-02 OF 12
APPROVED BY:	CE		

(1in) (2in) (3in) (4in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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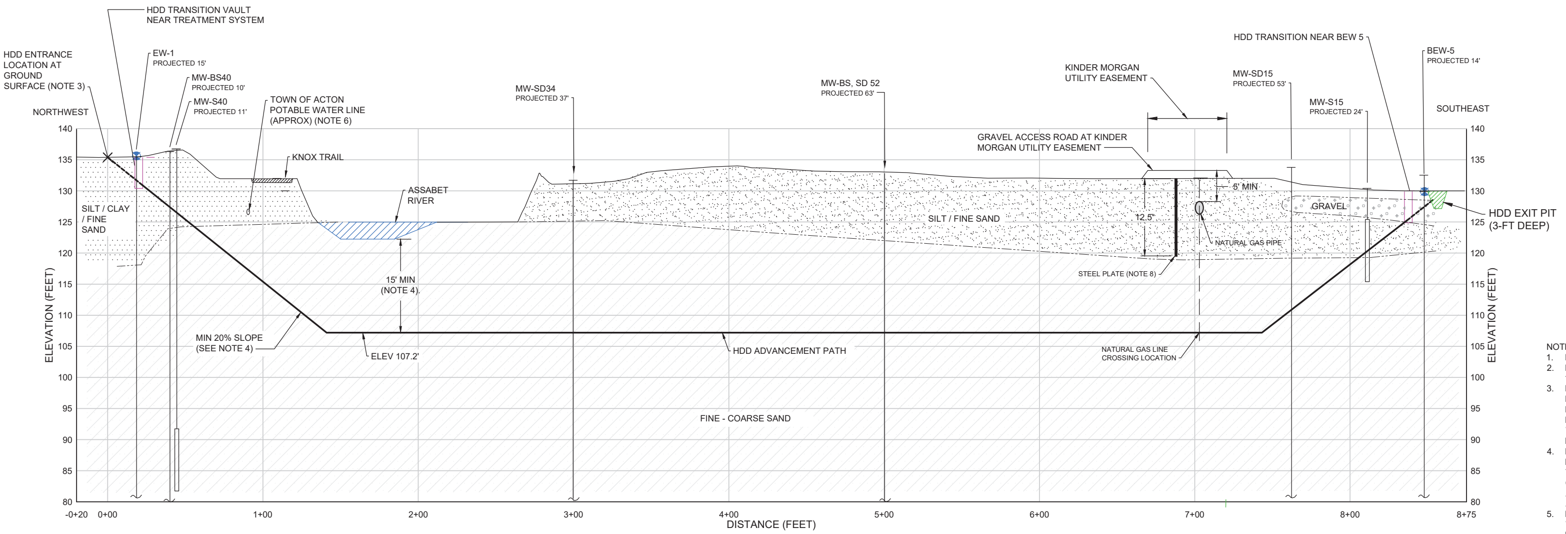
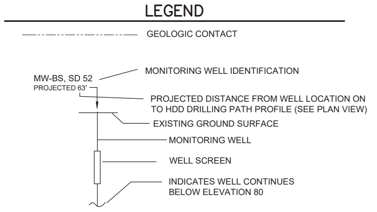


A C-02 PROFILE
HORIZONTAL DIRECTIONAL DRILLING PATH TO BEW-5

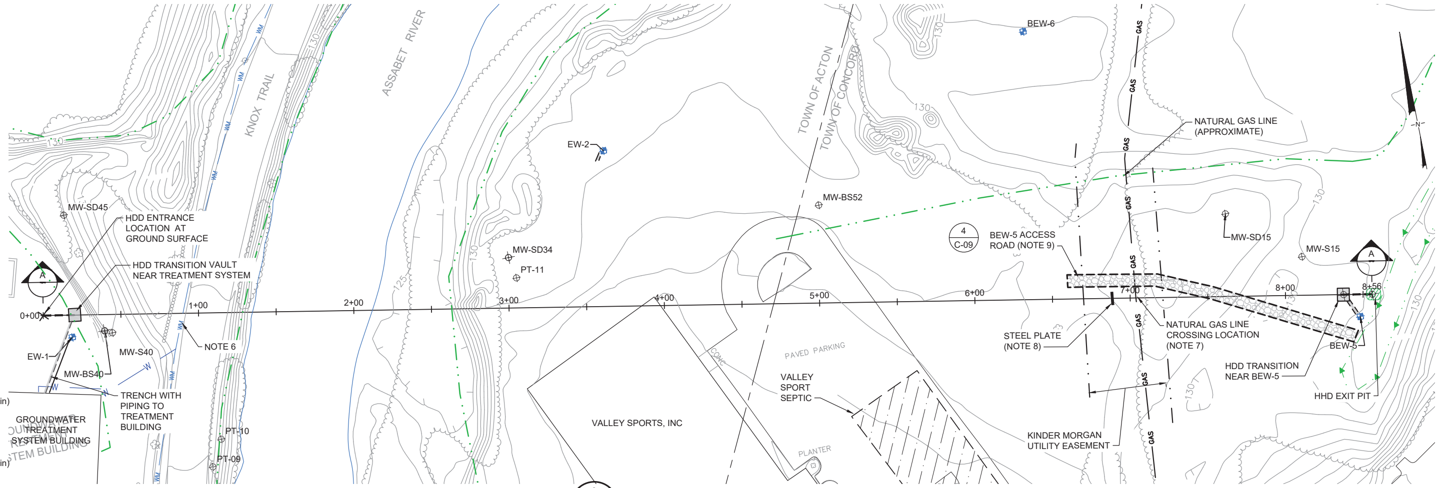
0 40' 80'
HORIZONTAL SCALE IN FEET

0 10' 20'
VERTICAL SCALE IN FEET



NOTES:

1. HDD INDICATES HORIZONTAL DIRECTIONAL DRILLING.
2. ELEVATIONS ARE PRESENTED RELATIVE TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
3. HDD SHALL BE INITIATED FROM ENTRANCE LOCATION AT GROUND SURFACE. A PIT AT THE HDD TRANSITION VAULT LOCATION AT THE KNOX TRAIL TREATMENT SYSTEM SHALL BE EXCAVATED PRIOR TO DRILLING FOR VISUAL CONFIRMATION AND CONTROL OF BEW-5 AND EW-2 HDD PATHS AND PIPE INSTALLATIONS AT THIS LOCATION. THE HDD TRANSITION VAULT AT THE TREATMENT BUILDING SHALL BE INSTALLED BY CONTRACTOR FOLLOWING DRILLING COMPLETION AND DRILLING FLUID REMOVAL.
4. HDD DEPTH BENEATH THE ASSABET RIVER SHALL BE A MINIMUM OF 15 FEET BELOW THE RIVER BED. A MINIMUM 20% SLOPE BEGINNING AT THE BORING ENTRANCE TO ACHIEVE THIS 15-FT DEPTH BELOW THE RIVER RESULTS IN DEPTH OFAPPROX. 16.7 FT BELOW GROUND SURFACE AT THE WESTERN RIVERBANK AND 17.8 FT BELOW GROUND SURFACE AT EASTERN RIVERBANK. THIS ELEVATION SHALL BE MAINTAINED UNTIL THE BORING HAS ADVANCED 745 FEET.
5. HDD DRILLER SHALL CONDUCT WALK-OVER, REAL-TIME TRACKING OF HDD ADVANCEMENT VIA A TRANSMITTER IN THE DRILL CUTTING HEAD AND A HAND-HELD RECEIVER OPERATED BY HDD DRILLER ABOVE THE LEADING EDGE OF THE HDD. WALK-OVER TRACKING SHALL BE CONDUCTED, IF FEASIBLE, EVEN WHILE THE DRILL BIT IS ADVANCING UNDERNEATH THE ASSABET RIVER.
6. 8-INCH POTABLE WATER MAIN APPROXIMATE DEPTH IS 5' (TOP OF PIPE) TO 5'10" (BOTTOM OF PIPE) BASED ON INFORMATION FROM THE TOWN OF ACTON WATER DISTRICT.
7. THE KINDER MORGAN NATURAL GAS LINE AND HDD CROSSING LOCATION IS BASED ON THE TEST BORING COMPLETED ON MARCH 28, 2022. THE 24-INCH DIAMETER GAS PIPE DEPTH IS 3'8" (TOP OF PIPE) TO 5'8" (BOTTOM OF PIPE).
8. A VERTICAL STEEL PLATE (8 FEET WIDE) SHALL BE INSTALLED 15 FEET WEST OF NATURAL GAS LINE CROSSING LOCATION. BASE OF STEEL PLATE SHALL BE INSTALLED MINIMUM OF 12.5 FT BELOW LAND SURFACE.
9. 10-FT WIDE GRAVEL ACCESS ROAD WITHIN THE KINDER MORGAN EASEMENT SHALL BE CONSTRUCTED ACCORDING TO DETAIL 4 / C-09. FINAL GRADE SHALL BE A MINIMUM OF 5 FT ABOVE THE TOP OF THE GAS PIPE.
10. CONSTRUCTION ACTIVITIES WITHIN KINDER MORGAN UTILITY EASEMENT REQUIRES ON-SITE KINDER MORGAN REPRESENTATIVE.
11. ELEVATION OF ASSABET RIVER BED BASED ON STAGE DATA REPORTED FOR ASSABET-MAYNARD MONITORING LOCATION REPORTED BY U.S. GEOLOGICAL SURVEY (STATION LOCATION 01097000), CORRELATIONS TO STAGE DATA COLLECTED AT THE ASSABET RIVER PUMP HOUSE, AND MANUAL MEASUREMENTS OF RIVER HEIGHT COLLECTED ON 3/21/2017.
12. LAND SURFACE ELEVATIONS BASED ON COMBINATION OF 2001 SURVEY DATA AND COLLECTED AT THE ILLUSTRATED WELLS.
13. FOR PLAN VIEW LEGEND AND NOTES SEE SHEET C-01
14. CONTRACTOR SHALL INSTALL SURVEY MARKERS ON THE GROUND SURFACE OF WHERE THE HDD ENTERS AND EXITS THE KINDER MORGAN EASEMENT. SURVEY MARKERS SHALL CONSIST OF GRANITE BLOCK INSTALLED TO BE FLUSH WITH THE GROUND SURFACE.
15. FOLLOWING HDD PIPE INSTALLATION, THE HDD DRILLER SHALL LEAK TEST ALL HDD PIPE AS DESCRIBED IN THE SPECIFICATIONS (DRAWINGS G-02 AND G-03).



A C-02 PLAN VIEW
HORIZONTAL DIRECTIONAL DRILLING PATH TO BEW-5

0 40' 80'
HORIZONTAL SCALE IN FEET

(1in) (2in) (3in) (4in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588, FL CERT #4321

TITLE:
PLAN AND PROFILE FOR HDD TO BEW-5

PROJECT:
100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER
EXTRACTION SYSTEM EXPANSION

SITE:
NUCLEAR METALS INC. SUPERFUND SITE
CONCORD, MASSACHUSETTS

DESIGN BY:	AD, CE	DATE:	SEPTEMBER 2022
DRAWN BY:	RMK	PROJECT NO.:	BR0090C
CHECKED BY:	AD	FILE:	
REVIEWED BY:	CE	DRAWING NO.:	
APPROVED BY:	CE	C-03 OF 12	

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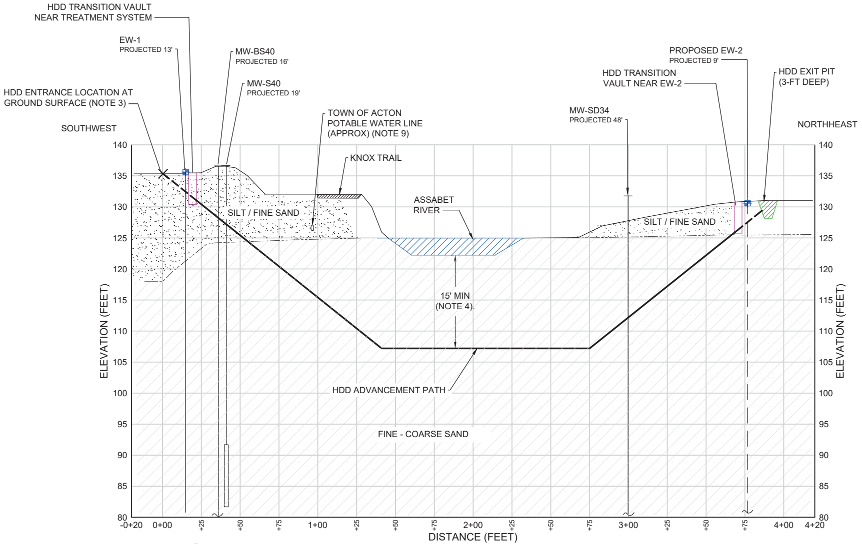
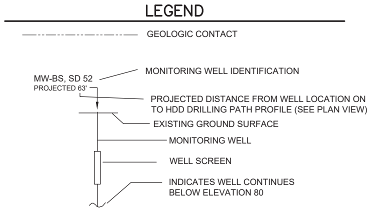


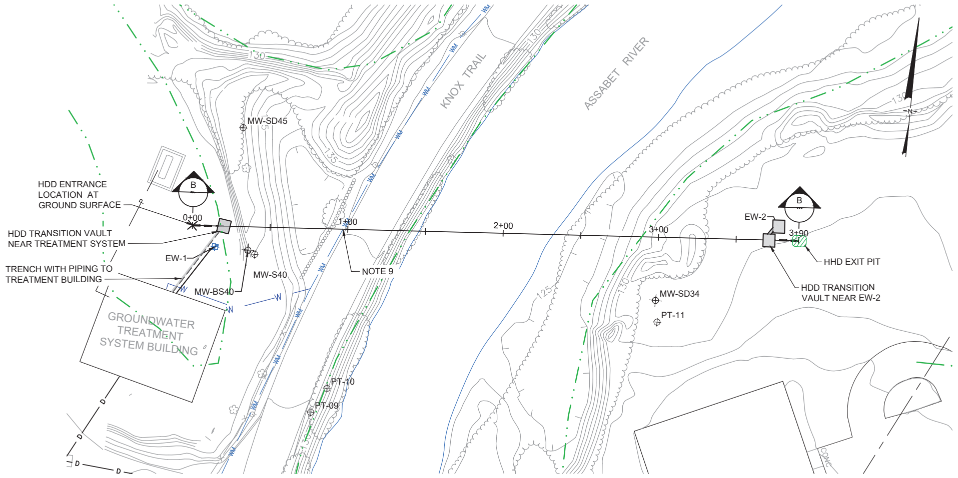
B
C-02
PROFILE
HORIZONTAL DIRECTIONAL DRILLING PATH TO EW-2

0 40' 80' HORIZONTAL SCALE IN FEET

0 10' 20' VERTICAL SCALE IN FEET



NOTES:
1. HDD INDICATES HORIZONTAL DIRECTIONAL DRILLING.
2. ELEVATIONS ARE PRESENTED RELATIVE TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
3. HDD SHALL BE INITIATED FROM ENTRANCE LOCATION AT GROUND SURFACE. A PIT AT THE HDD TRANSITION VAULT LOCATION NEAR THE KNOX TRAIL TREATMENT SYSTEM SHALL BE EXCAVATED PRIOR TO DRILLING FOR VISUAL CONFIRMATION AND CONTROL OF BEW-5 AND EW-2 HDD PATHS AND PIPE INSTALLATIONS AT THIS LOCATION. THE HDD TRANSITION VAULT NEAR THE TREATMENT BUILDING SHALL BE INSTALLED BY CONTRACTOR FOLLOWING DRILLING COMPLETION AND DRILLING FLUID REMOVAL.
4. HDD DEPTH BENEATH THE ASSABET RIVER SHALL BE A MINIMUM OF 15 FEET BELOW THE RIVER BED. A 20% SLOPE BEGINNING AT THE BORING ENTRANCE USED TO ACHIEVE THIS 15-FT DEPTH BELOW THE RIVER RESULTS IN DEPTH OFAPPROX. 17.8 FT BELOW GROUND SURFACE AT THE WESTERN AND EASTERN RIVERBANKS. THIS ELEVATION SHALL BE MAINTAINED UNTIL THE BORING HAS ADVANCED 275 FEET.
5. HDD DRILLER SHALL CONDUCT WALK-OVER, REAL-TIME TRACKING OF HDD ADVANCEMENT VIA A TRANSMITTER IN THE DRILL CUTTING HEAD AND A HAND-HELD RECEIVER OPERATED BY HDD DRILLER ABOVE THE LEADING EDGE OF THE HDD. WALK-OVER TRACKING SHALL BE CONDUCTED, IF FEASIBLE, EVEN WHILE THE DRILL BIT IS ADVANCING UNDERNEATH THE ASSABET RIVER.
6. ELEVATION OF ASSABET RIVER BED BASED ON STAGE DATA REPORTED FOR ASSABET-MAYNARD MONITORING LOCATION REPORTED BY U.S. GEOLOGICAL SURVEY (STATION LOCATION 01097000), CORRELATIONS TO STAGE DATA COLLECTED AT THE ASSABET RIVER PUMP HOUSE, AND MANUAL MEASUREMENTS OF RIVER HEIGHT COLLECTED ON 3/21/2017.
7. LAND SURFACE ELEVATIONS BASED ON COMBINATION OF 2001 SURVEY DATA AND COLLECTED AT THE ILLUSTRATED WELLS.
8. FOR PLAN VIEW LEGEND AND NOTES SEE SHEET C-01
9. 8-INCH POTABLE WATER MAIN APPROXIMATE DEPTH IS 5' (TOP OF PIPE) TO 5'10" (BOTTOM OF PIPE) BASED ON INFORMATION FROM THE TOWN OF ACTON WATER DISTRICT



B
C-02
PLAN VIEW
HORIZONTAL DIRECTIONAL DRILLING PATH TO EW-2

0 40' 80' HORIZONTAL SCALE IN FEET

(1in) (2in) (3in) (4in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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REV	DATE	DESCRIPTION	DRN	APP

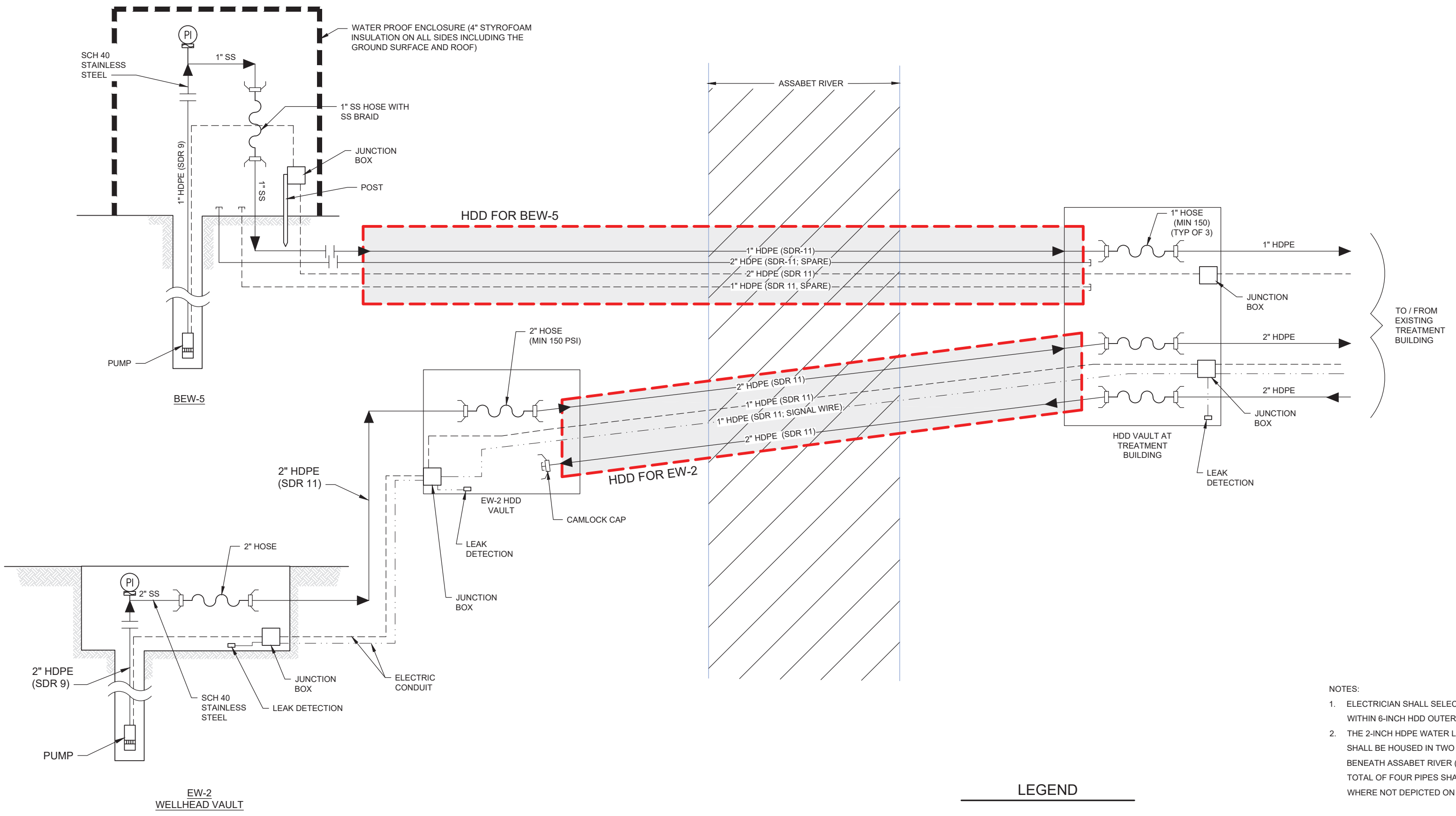
Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588, FL CERT #4321

TITLE: PLAN AND PROFILE FOR HDD TO EW-2

PROJECT: 100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER EXTRACTION SYSTEM EXPANSION

SITE: NUCLEAR METALS INC. SUPERFUND SITE
CONCORD, MASSACHUSETTS

DESIGN BY:	AD, CE	DATE:	SEPTEMBER 2022
DRAWN BY:	RMK	PROJECT NO.:	BR0090C
CHECKED BY:	AD	FILE:	
REVIEWED BY:	CE	DRAWING NO.:	C-04 OF 12
APPROVED BY:	CE		



NOTES:

1. ELECTRICIAN SHALL SELECT CONDUITS WITHIN VAULTS AND TRENCHES. ELECTRICAL CONDUIT WITHIN 6-INCH HDD OUTER PIPE SHALL BE 1" HDPE.
2. THE 2-INCH HDPE WATER LINES AND 1-INCH HDPE ELECTRICAL CONDUIT UNDER ASSABET RIVER SHALL BE HOUSED IN TWO 6-INCH HDPE (SDR-11) OUTER CHASE PIPES INSTALLED VIA HDD BENEATH ASSABET RIVER (ONE FROM EACH EXTRACTION WELL). WITHIN EACH 6-INCH PIPE, A TOTAL OF FOUR PIPES SHALL BE INSTALLED (TWO 2-INCH AND TWO 1-INCH DIAMETER PIPES). WHERE NOT DEPICTED ON THIS SHEET, ADDITIONAL PIPES SHALL BE SPARES.

LEGEND

2" HDPE →	PROCESS LINE WITH TYPE AND FLOW DIRECTION
– – – –	ELECTRICAL (1)
— · —	SIGNAL WIRE (1)
⊣⊢	UNION
⊐	CAMLOCK
[	END CAP
∿	MIN. 150 PSI RUBBER HOSE
PI	PRESSURE GAUGE
☐	JUNCTION BOX
⊐	CAMLOCK CAP

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

(1in) (2in) (3in) (4in)

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec
consultants

289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588, FL CERT #4321

TITLE:
PROCESS AND INSTRUMENTATION DIAGRAM

PROJECT:
100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER EXTRACTION SYSTEM EXPANSION

SITE:
NUCLEAR METALS INC. SUPERFUND SITE
CONCORD, MASSACHUSETTS

DESIGN BY:	AD, CE	DATE:	SEPTEMBER 2022
DRAWN BY:	RMK	PROJECT NO.:	BR0090C
CHECKED BY:	AD	FILE:	
REVIEWED BY:	CE	DRAWING NO.:	
APPROVED BY:	CE	C-05 OF 12	

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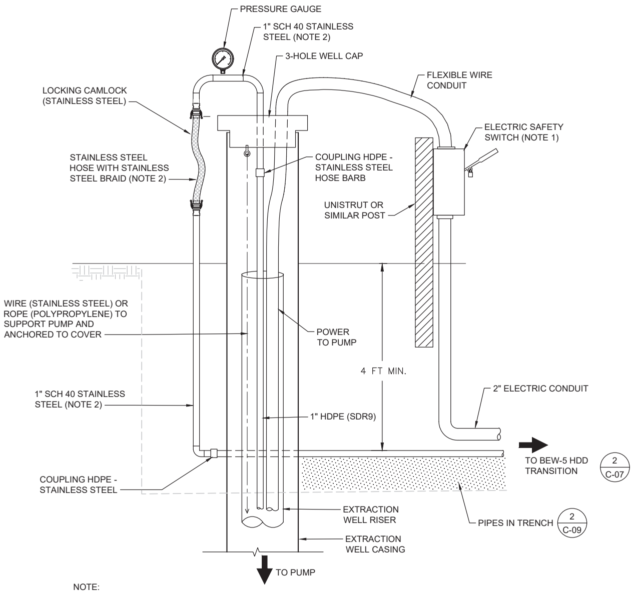


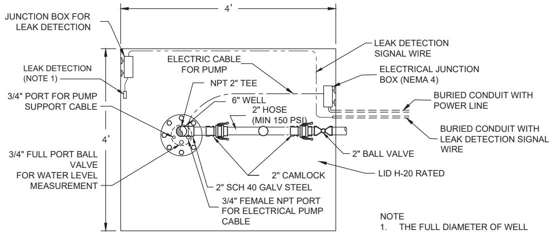
NOTE:

1. SAFETY SWITCH SHALL BE RATED FOR THE POWER OF THE PUMP OR GREATER, BE RATED FOR OUTDOOR USE, AND MUST HAVE A LOCKABLE LEVER FOR BOTH ON AND OFF POSITIONS.
2. ALL WATER PIPE AND HOSE ABOVE THE GROUND SURFACE AND TO A DEPTH OF 3 FEET BELOW GROUND SURFACE SHALL BE WRAPPED IN INSULATION WITH PVC JACKET RATED FOR OUTDOOR USE.

1
C-03

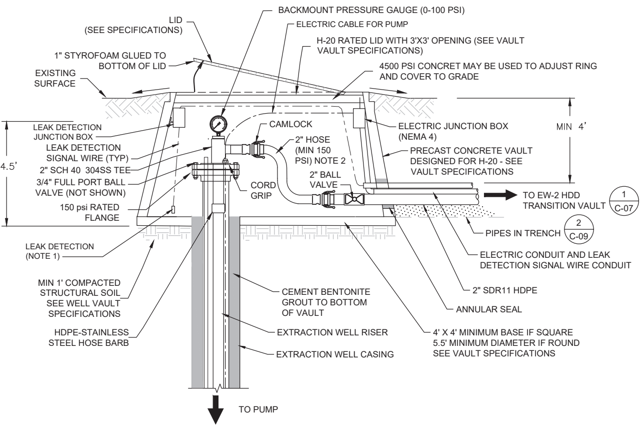
DETAIL (SIDE VIEW)
EXTRACTION WELLHEAD BEW-5

SCALE: N.T.S.



NOTE
1. THE FULL DIAMETER OF WELL SHALL BE BELOW THE VAULT LID.

PLAN VIEW



SIDE VIEW

NOTE:

1. EW-2 VAULT SHALL HAVE LEAK DETECTION WHICH PROVIDES A SIGNAL BACK TO THE TREATMENT PLANT PLC NOTIFYING IT OF FLOODING IN THE VAULT. FLOODING WOULD RESULT IN SYSTEM SHUT DOWN.
2. CONTRACTOR SHALL SEAL ANNULAR SPACE WHERE PIPES ENTER VAULT SO THAT THE VAULT IS WATERTIGHT.

2
C-03

DETAIL
EXTRACTION WELLHEAD NEAR EW-2

SCALE: N.T.S.

GENERAL NOTES FOR ALL DETAILS

1. ELECTRICIAN SHALL SELECT CONDUIT TYPE AND SIZE WITHIN VAULTS.
2. ALL JUNCTION BOXES SHALL BE NEMA 4 RATED OR BETTER.
3. ALL CAMLOCKS SHALL BE STAINLESS STEAL AND LOCKABLE.
4. REFER TO SPECIFICATIONS SHEET FOR ADDITIONAL DETAILS.

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants

289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588, FL CERT #4321

TITLE:
EXTRACTION WELLHEAD DETAILS

PROJECT:
100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER
EXTRACTION SYSTEM EXPANSION

SITE:
NUCLEAR METALS INC. SUPERFUND SITE
CONCORD, MASSACHUSETTS

DESIGN BY:	AD, CE	DATE:	SEPTEMBER 2022
DRAWN BY:	RMK	PROJECT NO.:	BR0090C
CHECKED BY:	AD	FILE:	
REVIEWED BY:	CE	DRAWING NO.:	
APPROVED BY:	CE	C-06 OF 12	

(1in) (2in) (3in) (4in)
(3in) (2in) (1in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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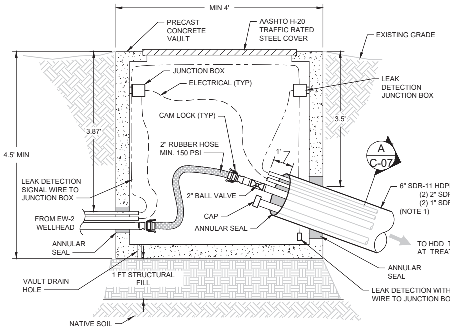
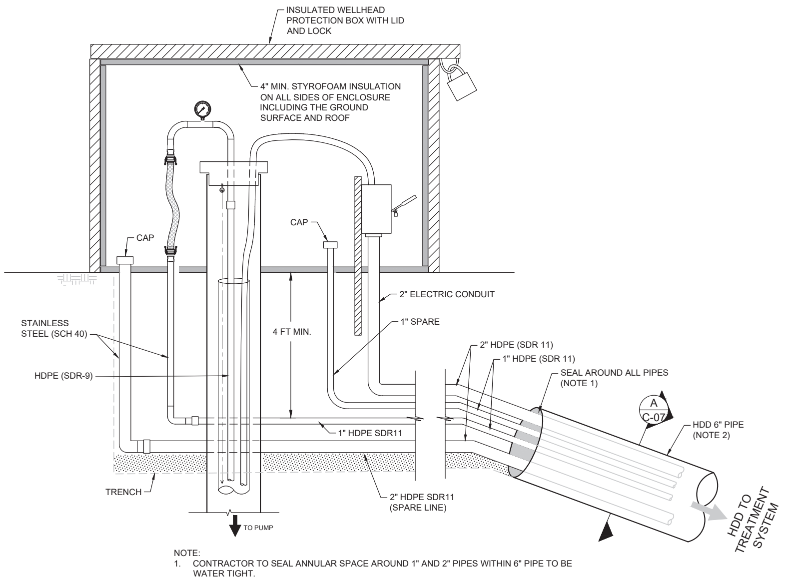


1/C-03 DETAIL (SIDE VIEW)
EW-2 HDD TRANSITION VAULT

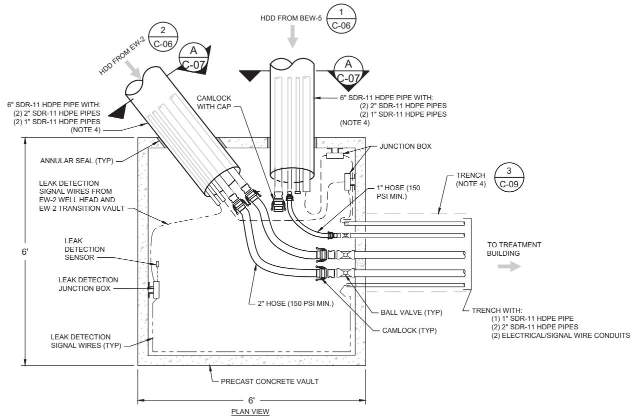
SCALE: N.T.S.



NOTE:
1. CONTRACTOR TO SEAL ANNULAR SPACE AROUND 1" AND 2" PIPES WITHIN 6" PIPE TO BE WATER TIGHT.
2. FOR INFORMATION NOT SHOWN SEE EXTRACTION WELLHEAD BEW-5 DETAIL, SHEET C-06

2/C-03 DETAIL (SIDE VIEW)
BEW-5 HDD TRANSITION

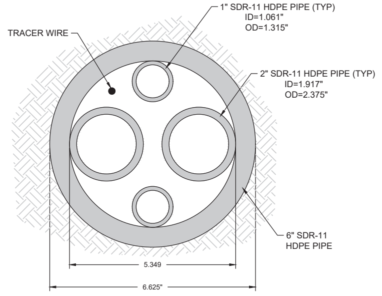
SCALE: N.T.S.



NOTE:
1. HOSES ARE MIN. 150 PSI

3/C-03 DETAIL (PLAN VIEW)
HDD TRANSITION VAULT NEAR TREATMENT SYSTEM

SCALE: N.T.S.



NOTE:
1. PIPE DIAMETERS MAY VARY SLIGHTLY BY MANUFACTURER

PIPE SECTION A

A/C-07 SECTION A
HDD TYPICAL PIPE SPACING

SCALE: 0 2' SCALE IN FEET

GENERAL NOTES FOR ALL DETAILS:

1. ELECTRICIAN SHALL SELECT CONDUIT TYPE AND SIZE WITHIN VAULTS. ELECTRICIAN SHALL SELECT CONDUITS WITHIN VAULTS AND TRENCHES. ELECTRICAL CONDUIT WITHIN 6-INCH HDD OUTER PIPE SHALL BE 1" HDPE.
2. ALL JUNCTION BOXES SHALL BE NEMA 4 RATED OR BETTER
3. CONTRACTOR SHALL SEAL ANNULAR SPACE WHERE PIPES ENTER VAULTS SO THAT THE VAULTS ARE WATERTIGHT
4. 1-INCH AND 2-INCH PIPES IN TRENCHES AND WITHIN OUTER HDD PIPES ARE SHOWN IN SCHEMATIC LINEAR POSITION FOR CLARITY. THE ACTUAL ORIENTATION OF PIPES ARE SHOWN IN SECTION VIEW (SECTION A, C-07) AND/ OR TRENCH DETAILS (DETAILS 3, 2, SHEET C-09)
5. ALL CAMLOCKS SHALL BE STAINLESS STEEL AND LOCKABLE.
6. THE TWO HDD TRANSITION VAULTS NEAR THE TREATMENT SYSTEM AND NEAR EW-2 AND THE EW-2 VAULT SHALL HAVE LEAK DETECTION SENSORS WIRED IN SERIES WHICH PROVIDE A SIGNAL BACK TO THE TREATMENT SYSTEM PLC NOTIFYING IT OF FLOODING IN ANY VAULT. FLOODING IN ANY VAULT WILL RESULT IN A SYSTEM SHUTDOWN.
7. REFER TO SPECIFICATION SHEET FOR ADDITIONAL DETAILS.
8. ALL HOSES SHALL BE MIN. 150PSI.

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants

289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588, FL CERT #4321

TITLE: HDD VAULT DETAILS

PROJECT: 100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER EXTRACTION SYSTEM EXPANSION

SITE: NUCLEAR METALS INC. SUPERFUND SITE
CONCORD, MASSACHUSETTS

DESIGN BY:	AD, CE	DATE:	SEPTEMBER 2022
DRAWN BY:	RMK	PROJECT NO.:	BR0090C
CHECKED BY:	AD	FILE:	
REVIEWED BY:	CE	DRAWING NO.:	
APPROVED BY:	CE	C-07 OF 12	

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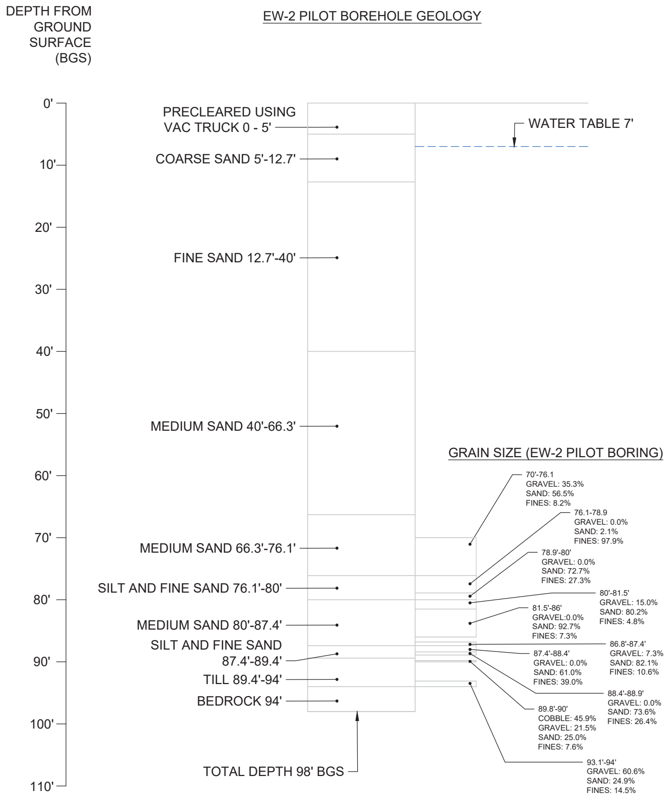
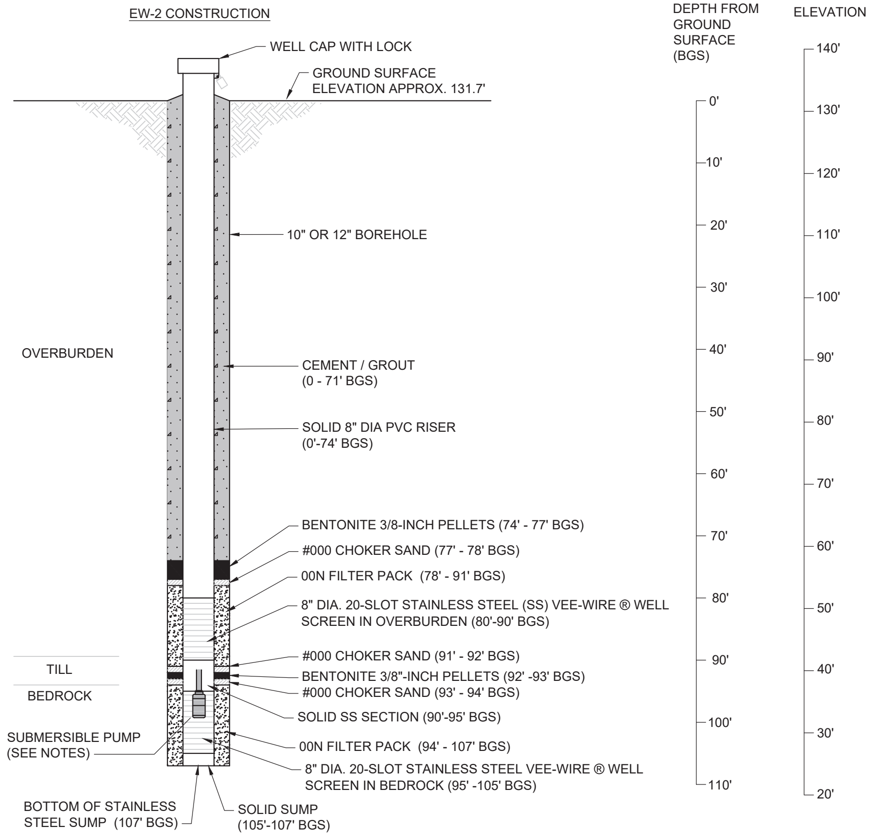
(3in) (2in) (1in)
(1in) (2in) (3in) (4in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")





NOTES:

1. DRILLER SHALL COMPLETE WELL AS STICK UP. CONTRACTOR SHALL CUT WELL AND INSTALL VAULT (SEE SHEET C-06)
2. GEOLOGY IS BASED ON VISUAL CLASSIFICATION OF RECOVERED SOIL SAMPLES AT EW-2 PILOT BOREHOLE COMPLETED ON 29 MARCH 2022 BY THE ON-SITE GEOLOGIST.
4. GRAIN SIZE ANALYSIS OF COLLECTED SOIL SAMPLES WAS PERFORMED BY GEOTESTING EXPRESS OF ACTON, MASSACHUSETTS ON SAMPLES FROM EW-2 PILOT TEST BORING.
5. EW-2 SHALL BE INSTALLED USING SONIC TECHNOLOGY OR ROTARY DRILLING METHODS. THE SPECIFIED FILTER SANDS WERE SELECTED WITH RELIANCE ON THE TYPICAL GRAIN SIZE ANALYSIS FOR US SILICA FILLPRO ® WELL GRAVELS, FROM THE MAURICETOWN, NEW JERSEY PLANT.
6. A GRUNDFOS 25S10-7 PUMP WITH 480 VOLT 3-PHASE MOTOR TO BE INSTALLED WITH A 2" OROFLEX DROP PIPE AND 1" PVC STILLING WELL.
7. BGS = BELOW GROUND SURFACE

1
-

DETAIL

EW-2 CONSTRUCTION DETAIL

SCALE: N.T.S.

(1in) (2in) (3in) (4in)

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

T:\Projects_CADD\N\NMI (Nuclear Metals Superfund Site)\DRAWINGS\OFF SITE SYS EXPAND\BR0090C-4301 C-08 (DETAILS EW-2).dwg Last Edited By:RKOHLSTROM

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants

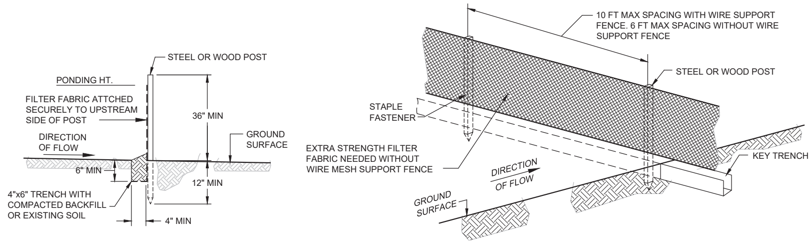
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588, FL CERT #4321

TITLE:
EW-2 PROPOSED CONSTRUCTION DETAIL

PROJECT:
100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER EXTRACTION SYSTEM EXPANSION

SITE:
NUCLEAR METALS INC. SUPERFUND SITE
CONCORD, MASSACHUSETTS

DESIGN BY:	AD, CE	DATE:	SEPTEMBER 2022
DRAWN BY:	RMK	PROJECT NO.:	BR0090C
CHECKED BY:	AD	FILE:	
REVIEWED BY:	CE	DRAWING NO.:	C-08 OF 12
APPROVED BY:	CE		

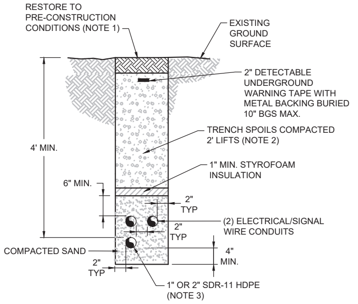


NOTES:

1. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY.
2. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.
3. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.

1 / - DETAIL SILT FENCE

SCALE: N.T.S.

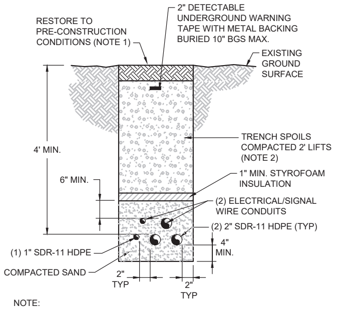


NOTE:

1. GROUND SURFACE SHALL BE RESTORED TO PRE-CONSTRUTION CONDITIONS, INCLUDING BUT NOT LIMITED TO, COMPACTED SAND FILL, LOAM AND SEED, ETC.
2. COMPACTION SHALL BE MINIMUM OF 4 PASSES OF A VIBRATING COMPACTOR PER 2 - FOOT LIFT.
3. DETAIL SHOWN IS AN EXAMPLE. TRENCHES MAY CONTAIN MORE OR FEWER PIPES BUT MEET THE SAME PIPE DEPTHS AND SPACING AS SHOWN.

2 / C-06 DETAIL TRENCH SECTION (THREE PIPES)

SCALE: N.T.S.

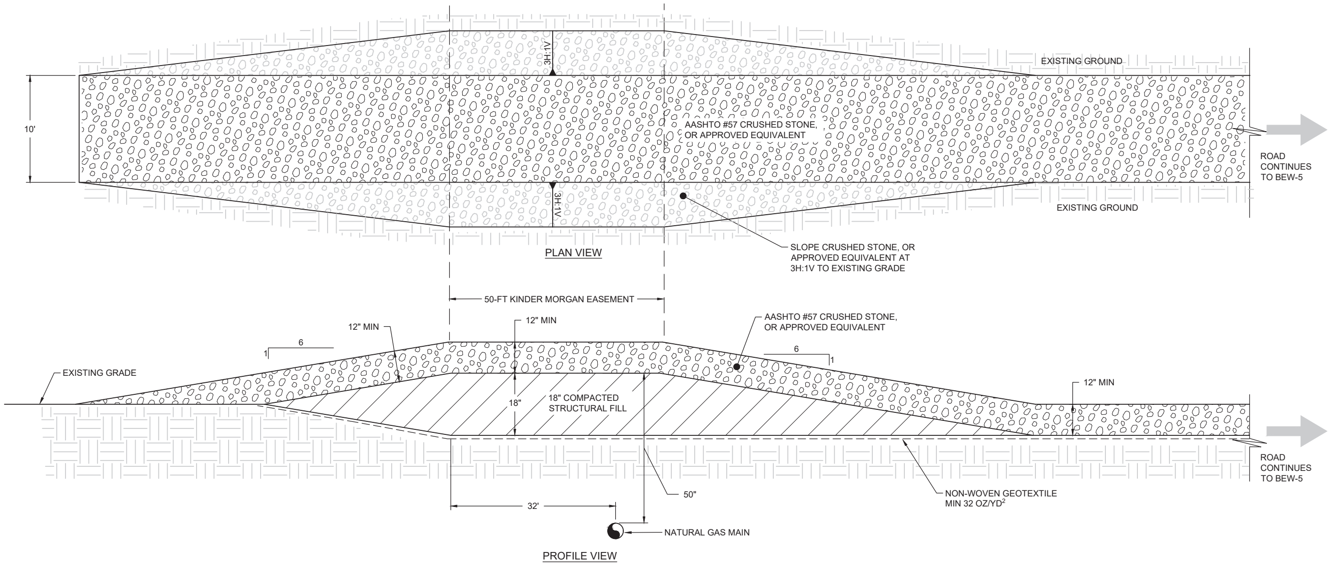


NOTE:

1. GROUND SURFACE SHALL BE RESTORED TO PRE-CONSTRUTION CONDITIONS, INCLUDING BUT NOT LIMITED TO, COMPACTED SAND FILL, LOAM AND SEED, ETC.
2. COMPACTION SHALL BE MINIMUM OF 4 PASSES OF A VIBRATING COMPACTOR PER 2 - FOOT LIFT.
3. DETAIL SHOWN IS AN EXAMPLE. TRENCHES MAY CONTAIN MORE OR FEWER PIPES BUT MEET THE SAME PIPE DEPTHS AND SPACING AS SHOWN.

3 / C-02 DETAIL TRENCH SECTION (FIVE PIPES)

SCALE: N.T.S.

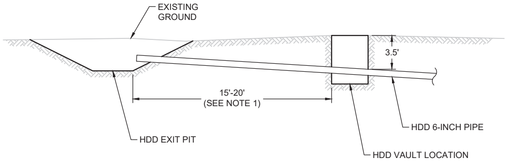


NOTE:

1. 1. ACCESS ROAD OUTSIDE OF KINDER MORGAN EASEMENT SHALL BE CONSTRUCTED BY REMOVING MINIMUM 1-FOOT OF EXISTING GROUND, INCLUDING ALL TREE STUMPS AND EXPOSED TREE ROOTS ALONG THE ROADWAY. THE EXCAVATED AREA SHALL THEN BE COMPACTED WITH MINIMUM THREE PASSES OF A VIBRATORY COMPACTOR. GEOTEXTILE AND GRAVEL SHALL THEN BE PLACED, AND COMPACTED BY A MINIMUM THREE PASSES OF A VIBRATORY COMPACTOR. FINAL GRADE SHALL MATCH EXISTING GRADE.
2. ACCESS ROAD WITHIN KINDER MORGAN EASEMENT SHALL BE CONSTRUCTED BY REMOVING MINIMUM 1-FOOT OF EXISTING GROUND, INCLUDING ALL TREE STUMPS AND EXPOSED TREE ROOTS ALONG THE ROADWAY, AND THE EXCAVATED SURFACE COMPACTED USING A MINIMUM THREE PASSES OF A COMPACTOR **WITH NO VIBRATION CONDUCTED WHEN WITHIN 5 FT ON EITHER SIDE OF GAS PIPE.** GEOTEXTILE SHALL THEN BE LAID IN THE EXCAVATED ROADWAY AND TOPPED WITH A MINIMUM OF 18 INCHES OF STRUCTURAL FILL. STRUCTURAL FILL SHALL BE COMPACTED USING A MINIMUM THREE PASSES OF A COMPACTOR **WITH NO VIBRATION CONDUCTED WHEN WITHIN 5 FT ON EITHER SIDE OF GAS PIPE.** A MINIMUM 12-INCHES OF AASHTO #57 GRAVEL SHALL THEN BE PLACED AND COMPACTED USING A MINIMUM THREE PASSES OF A COMPACTOR **WITH NO VIBRATION CONDUCTED WHEN WITHIN 5 FT ON EITHER SIDE OF GAS PIPE**. FINAL GRADE SHALL BE MINIMUM OF 5 FT ABOVE THE TOP OF THE GAS PIPE.
3. TRANSITION BETWEEN FINAL GRADE OF ROAD TO EAST AND WEST OF THE KINDER MORGAN EASEMENT SHALL BE SLOPED 6H:1V BEGINNING OUTSIDE OF THE EASEMENT.
4. ROAD IS MOUNDED BY 18-INCHES WHERE IT CROSSES THE GAS LINE EASEMENT. CONTRACTOR SHALL USE GRAVEL AT A 3H:1V SLOPE TO TRANSITION FROM THE EDGE OF ROAD TO EXISTING GROUND.
5. FINISHED ROAD SHALL BE SMOOTH AND FREE FROM HOLES, DIPS AND BUMPS.

4 / C-02 DETAIL ACCESS ROAD TO BEW-5

SCALE: N.T.S.



NOTES:

1. PIT SHALL BE CONSTRUCTED 15-20 FT FROM PLANNED HDD VAULT AT EW-2 AND HDD TRANSITION LOCATION AT BEW-5 AS DIRECTED BY DRILLER.
2. EXIT PITS SHALL BE 2-3 FEET DEEP AND MINIMUM 4 FEET WIDE.

5 / C-02 DETAIL HDD EXIT PIT

SCALE: N.T.S.

(1in) (2in) (3in) (4in)

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588, FL CERT #4321

TITLE: SYSTEM DETAILS

PROJECT: 100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER EXTRACTION SYSTEM EXPANSION

SITE: NUCLEAR METALS INC. SUPERFUND SITE
CONCORD, MASSACHUSETTS

DESIGN BY: AD, CE
DATE: SEPTEMBER 2022
DRAWN BY: RMK
PROJECT NO.: BR0090C
CHECKED BY: AD
FILE:
REVIEWED BY: CE
DRAWING NO.: C-09 OF 12
APPROVED BY: CE

T:\Projects_CADD\NMI (Nuclear Metals Superfund Site)\DRAWINGS\OFF SITE SYS EXPAND\BR0090C-4301 C-09 TRENCH AND ESC DETAILS (DETAILS MISC).dwg Last Edited By:RKOHLSTROM

APPENDIX B

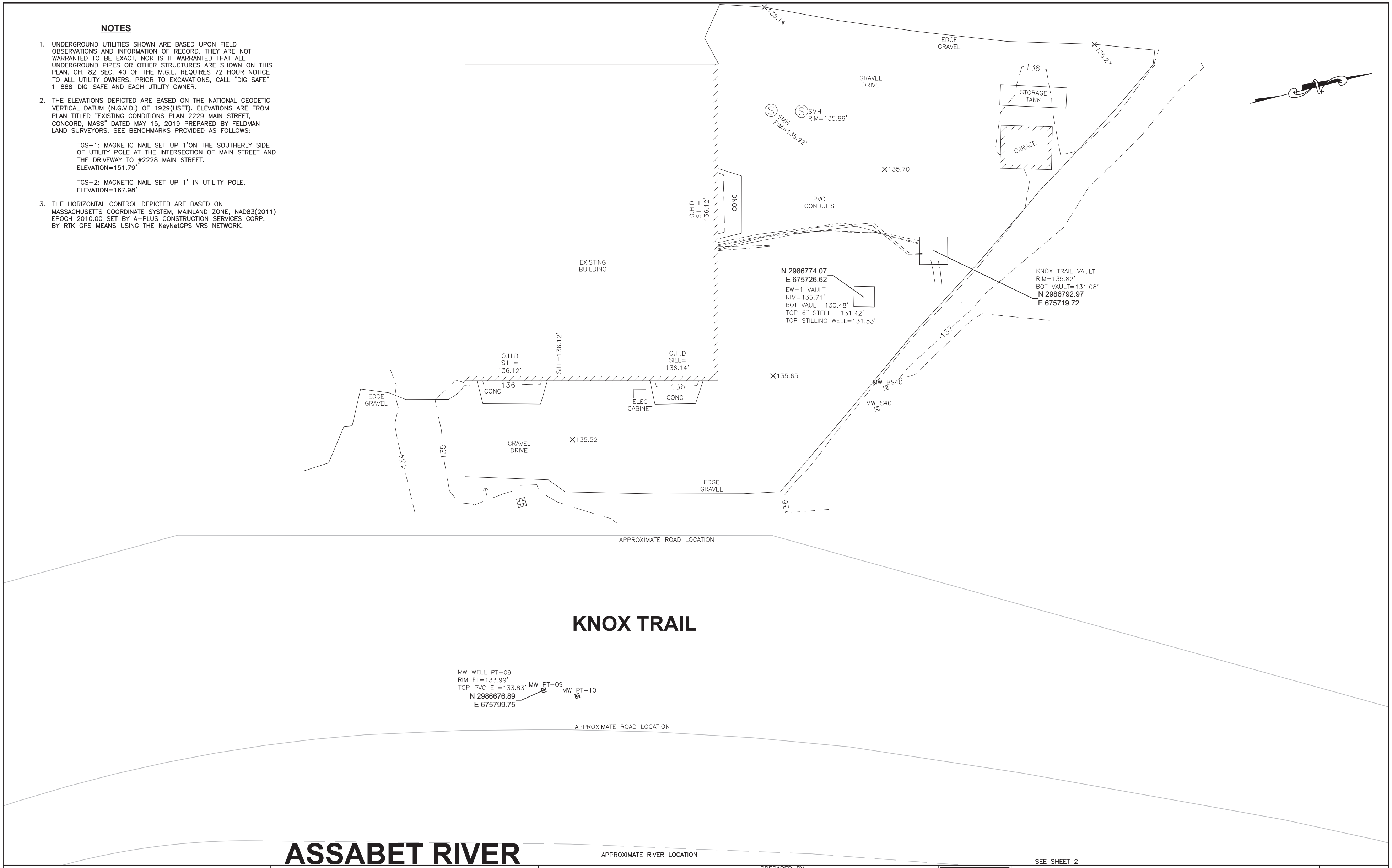
As-Built Drawings

NOTES

1. UNDERGROUND UTILITIES SHOWN ARE BASED UPON FIELD OBSERVATIONS AND INFORMATION OF RECORD. THEY ARE NOT WARRANTED TO BE EXACT, NOR IS IT WARRANTED THAT ALL UNDERGROUND PIPES OR OTHER STRUCTURES ARE SHOWN ON THIS PLAN. CH. 82 SEC. 40 OF THE M.G.L. REQUIRES 72 HOUR NOTICE TO ALL UTILITY OWNERS. PRIOR TO EXCAVATIONS, CALL "DIG SAFE" 1–888–DIG–SAFE AND EACH UTILITY OWNER.
2. THE ELEVATIONS DEPICTED ARE BASED ON THE NATIONAL GEODETIC VERTICAL DATUM (N.G.V.D.) OF 1929(USFT). ELEVATIONS ARE FROM PLAN TITLED "EXISTING CONDITIONS PLAN 2229 MAIN STREET, CONCORD, MASS" DATED MAY 15, 2019 PREPARED BY FELDMAN LAND SURVEYORS. SEE BENCHMARKS PROVIDED AS FOLLOWS:

    TGS–1: MAGNETIC NAIL SET UP 1'ON THE SOUTHERLY SIDE OF UTILITY POLE AT THE INTERSECTION OF MAIN STREET AND THE DRIVEWAY TO #2228 MAIN STREET.
    ELEVATION=151.79'

    TGS–2: MAGNETIC NAIL SET UP 1' IN UTILITY POLE.
    ELEVATION=167.98'
3. THE HORIZONTAL CONTROL DEPICTED ARE BASED ON MASSACHUSETTS COORDINATE SYSTEM, MAINLAND ZONE, NAD83(2011) EPOCH 2010.00 SET BY A–PLUS CONSTRUCTION SERVICES CORP. BY RTK GPS MEANS USING THE KeyNetGPS VRS NETWORK.



0 10 20 30 40

SCALE: 1" = 10'

REVISIONS

REV.	COMMENTS	DATE

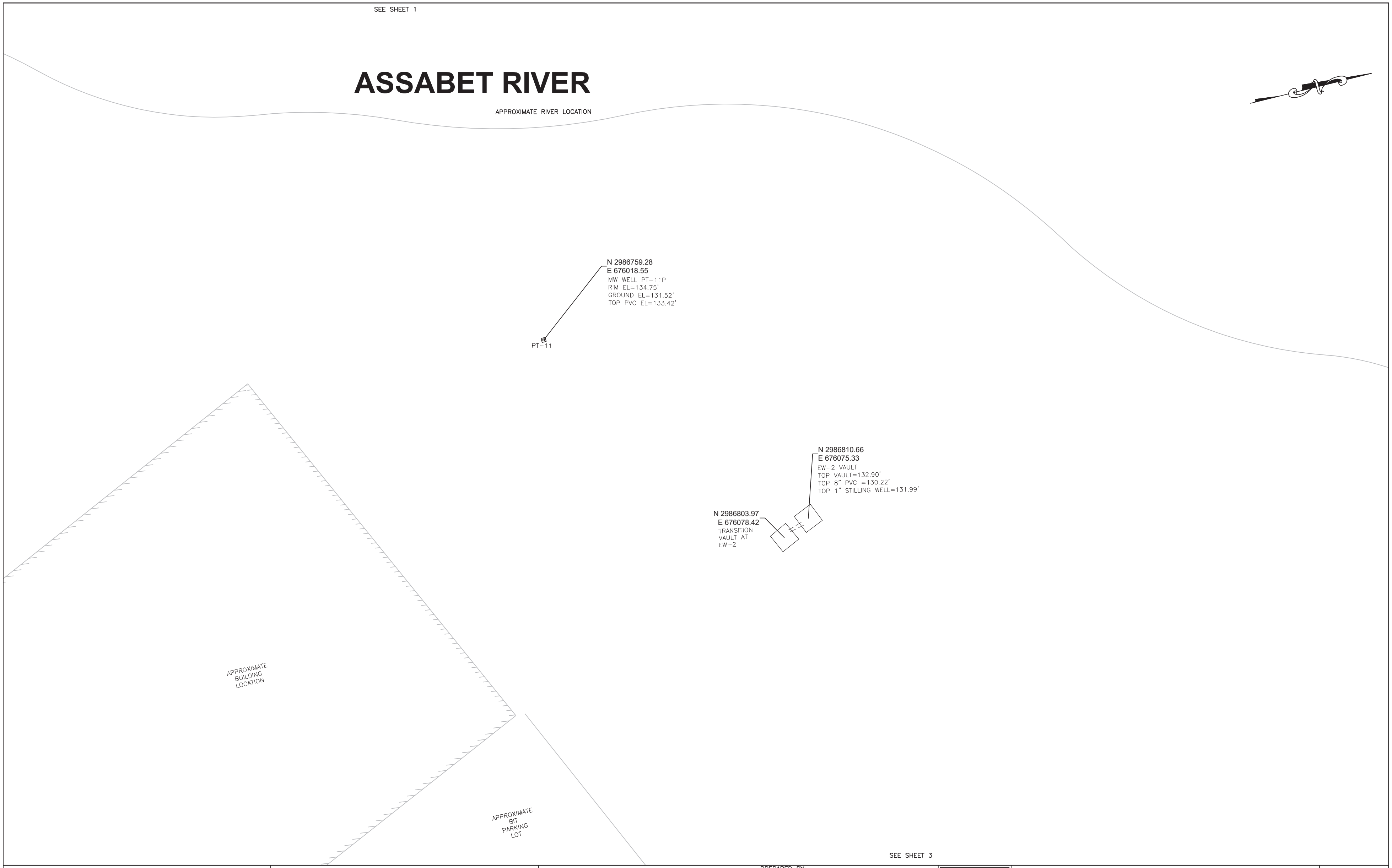
ORIGINAL FULL SIZE DRAWING=4"
REPRODUCTIONS MAY BE REDUCED SIZE

PREPARED BY:
A-PLUS
CONSTRUCTION SERVICES CORP.
17 ACCORD PARK DRIVE, UNIT #102
NORWELL, MA 02061-1629
PHONE (781) 681-6667
FAX (781) 681-6673

FIELD CHIEF: JW
DES/COMP: N/A
DRAFTED BY: JW
CHECKED BY: MC
DATE: October 31, 2023
SCALE: 1"=10'
JOB#: 4382
FILE: 4382 WELL_VAULT AS–BUILTS NMI 10–31–23

AS–BUILT PLAN
NUCLEAR METALS, INC.
CONCORD, MASS.
PREPARED FOR:
US ECOLOGY

SHEET
1 of 4
OF
REV 0



0 10 20 30 40

SCALE: 1" = 10'

REVISIONS

REV.	COMMENTS	DATE

ORIGINAL FULL SIZE DRAWING=4"

REPRODUCTIONS MAY BE REDUCED SIZE

PREPARED BY:

A-PLUS
CONSTRUCTION SERVICES CORP.

17 ACCORD PARK DRIVE, UNIT #102
NORWELL, MA 02061-1629
PHONE (781) 681-6667
FAX (781) 681-6673

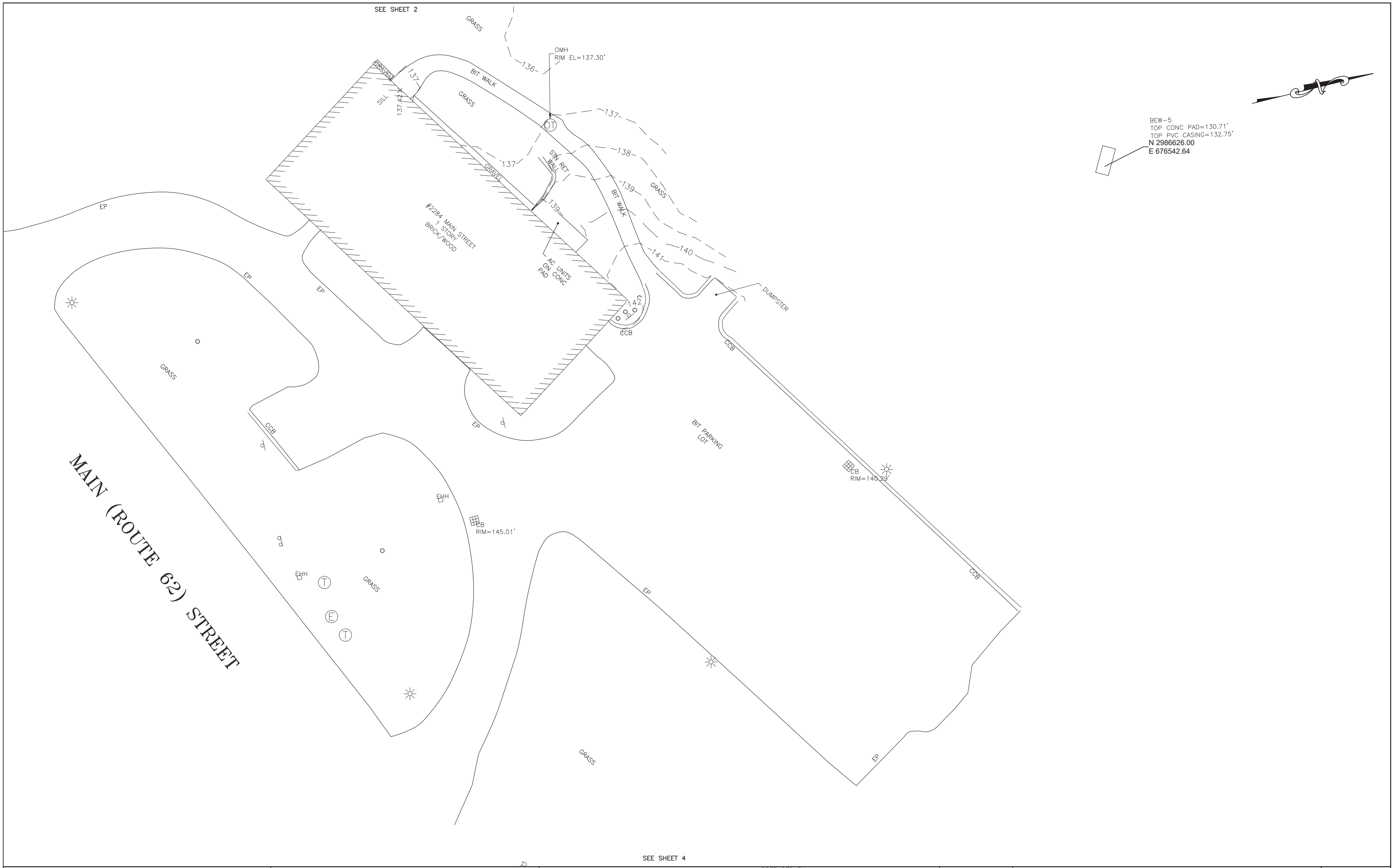
FIELD CHIEF: JW | DES/COMP: N/A | DRAFTED BY: JW | CHECKED BY: MC

DATE: October 31, 2023 | SCALE: 1"=10' | JOB#: 4382 | FILE: 4382 WELL_VAULT AS-BUILTS NMI 10-31-23

AS-BUILT PLAN
NUCLEAR METALS, INC.
CONCORD, MASS.

PREPARED FOR:
US ECOLOGY

SHEET
2 of 4
OF
REV 0



0 10 20 30 40

SCALE: 1" = 10'

REVISIONS

REV.	COMMENTS	DATE

ORIGINAL FULL SIZE DRAWING=4"
REPRODUCTIONS MAY BE REDUCED SIZE

PREPARED BY:

A-PLUS
CONSTRUCTION SERVICES CORP.

17 ACCORD PARK DRIVE, UNIT #102
NORWELL, MA 02061-1629
PHONE (781) 681-6667
FAX (781) 681-6673

FIELD CHIEF: JW | DES/COMP: N/A | DRAFTED BY: JW | CHECKED BY: MC

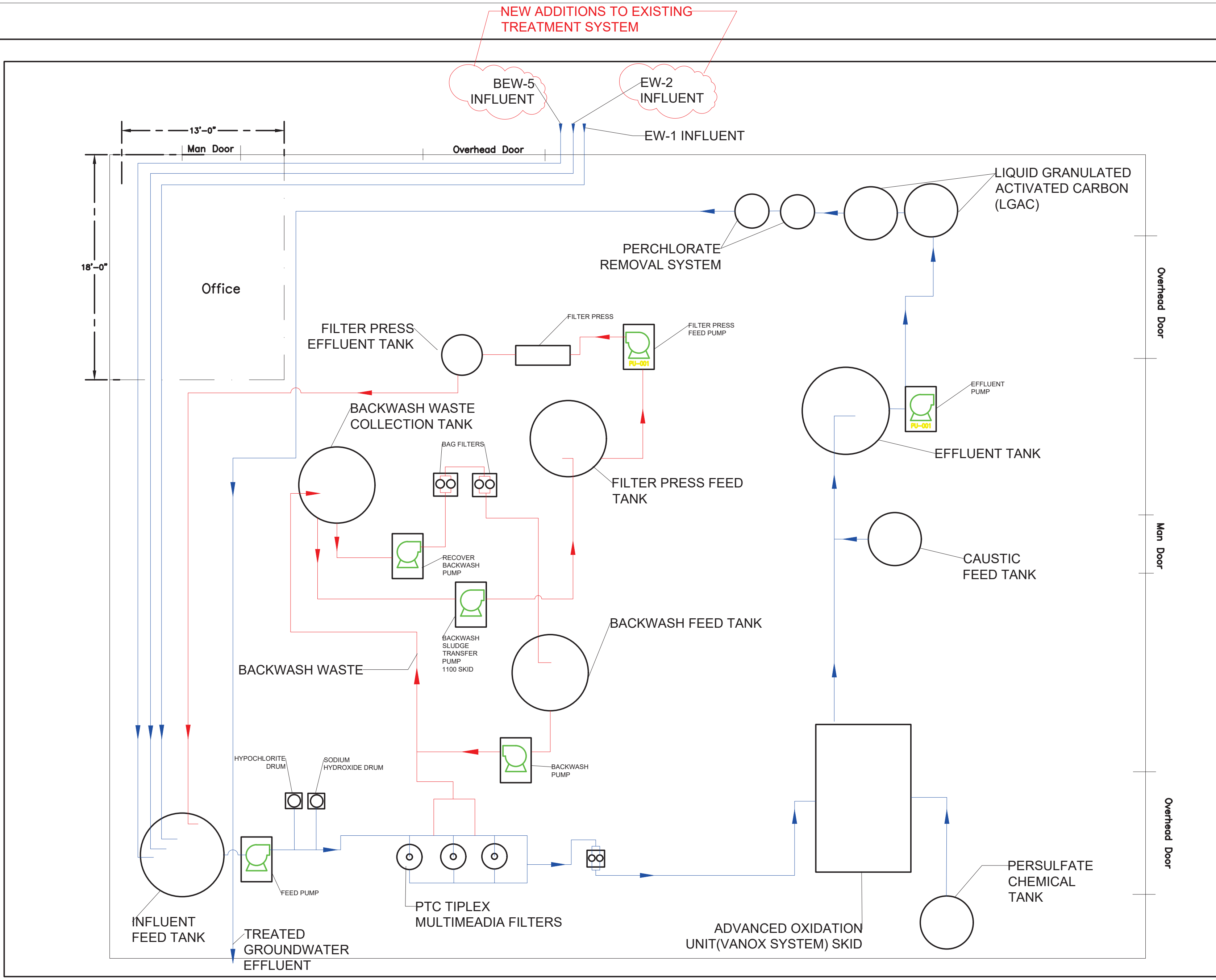
DATE: October 31, 2023 | SCALE: 1"=10' | JOB#: 4382 | FILE: 4382 WELL_VAULT AS-BUILTS NMI 10-31-23

AS-BUILT PLAN
NUCLEAR METALS, INC.
CONCORD, MASS.
PREPARED FOR:
US ECOLOGY

SHEET
3 of 4
OF
REV 0

APPENDIX C

Redline Showing Treatment Plant Modifications to Incorporate BEW-5 & EW-2



General Notes

N

Prepared For

200 Day Hill Road
Suite 200
Windsor, CT 06095

DRAWING NOT TO SCALE

No.	Revision/Issue	Date

Drawing Name

System Layout

Project Name and Address

Nuclear Metals
Superfund Site

Concord, Massachusetts

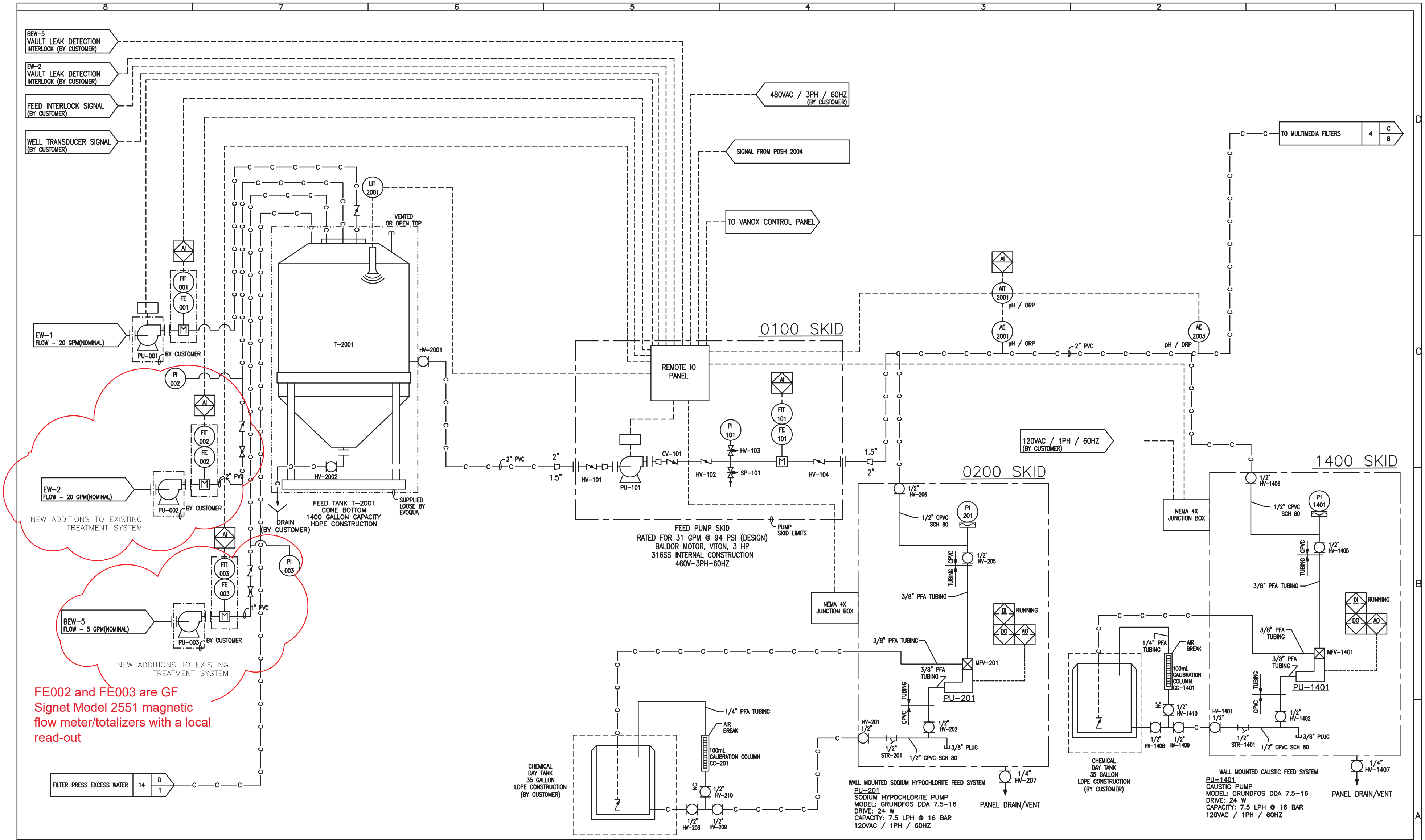
DRAWING
PFD

DATE
08/12/2022

AUTHOR
G. FUERST

STAMP

C:\Users\Ncarabillo\Desktop\Ncarabillo\NMI\NMI autoCAD\Orthos\DWGs\testortho.dwg



FE002 and FE003 are GF Signet Model 2551 magnetic flow meter/totalizers with a local read-out

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
-	SEE SHEET ONE					

STD: BORDER-0106-24X36D1

INTL REF:

BAR = 1" AT PLOT SCALE

COMPANY CONFIDENTIAL

DESIGNER	ASB	DATE	05/11/18
CHECKER	AP	DATE	05/11/18
ENGINEER	ASB	DATE	05/11/18
MANAGER	KB	DATE	05/11/18

FILE: 1200/000999-9100_A.dwg

SCALE: NONE

TITLE PROCESS AND INSTRUMENTATION DIAGRAM
1,4-DIOXANE REMOVAL SYSTEM

CLIENT *de maximis*
ACTON, MASSACHUSETTS

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
1200/000999		9100	3 OF 14	5

APPENDIX D

Summary Of Access Road Construction and Photolog

Construction of the access road to extraction well BEW-5 was completed in December 2022. The purpose of this access road is to allow for vehicles and equipment to access extraction well BEW-5 during and following Knox Trail Treatment System expansion activities completed in 2023. Republic Services (formerly US Ecology, Inc.) completed earthwork activities. A portion of the access road was constructed over a natural gas pipeline, within an easement owned by Tennessee Gas Pipeline Company, LLC, a Kinder Morgan Company (Kinder Morgan). For the work completed within the easement, a representative from Kinder Morgan was present to oversee the excavation and ensure that the grade of the access road, while crossing the pipeline, was at least 5 feet above the grade of the gas pipeline. Within the easement, the access road was constructed in the following manner:

- A 1-foot cut was excavated at a width of 10-feet using an excavator, while ensuring that the excavator was not stopped directly over the natural gas pipeline at any point.
- A double layer of 16-oz/yd^2 SKAPS GT-116 nonwoven geotextile was laid within the cut area over the native soils, in accordance with the design specifications and approved submittals.
- 18 inches of dense grade aggregate (DGA) was placed over the nonwoven geotextile as structural fill material using a loader, while ensuring that the loader was not stopped directly over the natural gas pipeline at any point. The DGA was compacted using a roller, with the vibrating mechanism switched off, in accordance with the design specifications and approved submittals.
- 12 inches of #57 stone (1.5 inch stone with up to 4% particles > 1.5 inch and up to 4% particles < 1.5 inch) was used to cover the DGA using a loader, while ensuring that the loader was not stopped directly over the natural gas pipeline at any point. The #57 stone was compacted using a roller, with the vibrating mechanism switched off, in accordance with the design specifications and approved submittals.
- A 3:1 slope of #57 stone was created off the sides of the 10-foot wide access road within the easement area to bring the sides back to the existing grade, in accordance with the design specifications.
- The Kinder Morgan representative approved the grade of the constructed access road within the easement area.
- Excavated soil was initially stored on site adjacent to the road, atop and covered by poly sheeting, before being transported to the main NMI site, where it was again stored atop and covered by poly sheeting.
- Representatives from AECOM and *de maximis* periodically checked the progress of the access road.

Outside of the Kinder Morgan easement area, the access road was constructed in the following manner:

- A silt fence was constructed between the proposed end of the access road near BEW-5 and the designated wetlands boundary.
- The access road was brought to existing grade on both ends of the Kinder Morgan easement area using a 6:1 slope composed of the #57 stone, in accordance with the design specifications.
- A 1-foot cut was excavated at a width of 10-feet using an excavator, beginning at the edge of the Kinder Morgan easement and continuing southeast to the silt fence boundary, before continuing east and concluding in a 5-foot radius around the BEW-5 extraction well.
    - This continuation of the excavation directly to and around the BEW-5 extraction well was approved during the work process through conversations between *de maximis* and Geosyntec, to improve the drainage around the well.
- A double layer of 16-oz/yd^2 SKAPS GT-116 nonwoven geotextile was laid within the cut area over the native soils, in accordance with the design specifications and approved submittals.

- 12 inches of #57 stone (1.5 inch stone with up to 4% particles > 1.5 inch and up to 4% particles < 1.5 inch) was used to cover the geotextile and bring the final road back to the existing grade using a loader, while ensuring that the loader was not stopped directly over the natural gas pipeline at any point. The #57 stone was compacted using a roller, with the vibrating mechanism switched on, in accordance with the design specifications and approved submittals.
- Excavated soil was stored on site initially on poly sheeting, covered by poly sheeting, before being transported to the main NMI site, where it was again stored on poly sheeting and covered by poly sheeting.
- Representatives from AECOM and *de maximis* periodically checked the progress of the access road.

A log of photos showing the construction of the access road follows. Approved submittal for the #57 stone, DGA, and geotextile used to construct the access road is included in **Appendix G**.

GEOSYNTEC CONSULTANTS
Photographic Record

Client: de maximis, inc. | **Project Number: BR0090C**

Site Name: Nuclear Metals, Inc. | **Site Location: Concord, MA**

Pre-construction 1

Date: 12/12/2022

Direction: SE

Comments: The work area prior to commencement of access road construction

Pre-construction 2

Date: 12/12/2022

Direction: E

Comments: The work area prior to commencement of access road construction

GEOSYNTEC CONSULTANTS
Photographic Record

Client: de maximis, inc.	**Project Number: BR0090C**
Site Name: Nuclear Metals, Inc.	**Site Location: Concord, MA**

Pre-construction 3

Date: 12/12/2022

Direction: W

Comments: The work area prior to commencement of access road construction

Pre-construction 4

Date: 12/12/2022

Direction: SE

Comments: The material and equipment staging area prior to commencement of access road construction

GEOSYNTEC CONSULTANTS
Photographic Record

Client: de maximis, inc.	**Project Number: BR0090C**
Site Name: Nuclear Metals, Inc.	**Site Location: Concord, MA**

Staging Area

Date: 12/12/2022

Direction: N

Comments: The staging area after arrival of material and equipment

Silt Fence

Date: 12/12/2022

Direction: S

Comments: The silt fence placed between the excavation area and the designated wetlands

Client: de maximis, inc.	**Project Number: BR0090C**
Site Name: Nuclear Metals, Inc.	**Site Location: Concord, MA**

KM Easement 1

Date: 12/13/2022

Direction: W

Comments: Excavation of a 1 foot cut within the Kinder Morgan easement

Excavated Material

Date: 12/13/2022

Direction: E

Comments: Excavated material was placed on poly sheeting prior to transport to the main NMI site

Client: de maximis, inc.	**Project Number: BR0090C**
Site Name: Nuclear Metals, Inc.	**Site Location: Concord, MA**

KM Easement 2

Date: 12/13/2022

Direction: E

Comments: The geotextile fabric was placed in a double layer within the 1 foot cut within the easement area

KM Easement 3

Date: 12/13/2022

Direction: E

Comments: The geotextile fabric within the easement was covered with 18 inches of structural fill material and 12 inches of #57 stone

Client: de maximis, inc.	**Project Number: BR0090C**
Site Name: Nuclear Metals, Inc.	**Site Location: Concord, MA**

KM Easement 4

Date: 12/13/2022

Direction: NE

Comments: The access road within the Kinder Morgan easement was completed on 12/13/22 with approval from Kinder Morgan's representative

Staging Area

Date: 12/13/2022

Direction: N

Comments: The #57 stone was received in several shipments over multiple days

Client: de maximis, inc.	**Project Number: BR0090C**
Site Name: Nuclear Metals, Inc.	**Site Location: Concord, MA**

Excavation 1

Date: 12/14/2022

Direction: W

Comments: The 1 foot cut was made outside of the Kinder Morgan easement area starting at the BEW-5 well. This was a deviation from the 100% design and approved by all parties to facilitate drainage around the well.

Excavation 2

Date: 12/14/2022

Direction: N

Comments: Excavation of the 1 foot cut outside of the easement area continued with a 10 foot width until meeting up with the previously constructed access road within the easement

Client: de maximis, inc.	**Project Number: BR0090C**
Site Name: Nuclear Metals, Inc.	**Site Location: Concord, MA**

Outside Easement 1

Date: 12/15/2022

Direction: SE

Comments: Geotextile fabric was placed in a double layer within the 1 foot cut outside of the easement area

Outside Easement 2

Date: 12/15/2022

Direction: N

Comments: 12 inches of #57 stone was placed over the geotextile fabric to bring the level back to existing grade

GEOSYNTEC CONSULTANTS
Photographic Record

Client: de maximis, inc.	**Project Number: BR0090C**
Site Name: Nuclear Metals, Inc.	**Site Location: Concord, MA**

Completed Road 1

Date: 12/15/2022

Direction: SE

Comments: The access road outside of the easement was completed after compacting the #57 stone using 3 passes of a vibrating roller

Completed Road 2

Date: 12/15/2022

Direction: W

Comments: The access road outside of the easement was completed after compacting the #57 stone using 3 passes of a vibrating roller

Completed Road 3

Date: 12/15/2022

Direction: W

Comments: The access road construction within the easement was completed with 3:1 slopes on the sides and 6:1 slopes exiting the easement area

Cleared Staging Area

Date: 12/15/2022

Direction: N

Comments: The material and equipment staging area was cleared after construction, with excavated material and excess material transported to the main NMI site

GEOSYNTEC CONSULTANTS
Photographic Record

Client: de maximis, inc.	**Project Number: BR0090C**
Site Name: Nuclear Metals, Inc.	**Site Location: Concord, MA**

Excavated Material Staging

Date: 12/15/2022

Direction: W

Comments: The IDW from the excavation was placed on poly sheeting and covered with poly sheeting at the main NMI site

APPENDIX E

Summary of EW-2 Installation/Testing and Photolog

1. PURPOSE FOR EW-2 INSTALLATION

EW-2 was installed as a supplemental groundwater extraction location for the Knox Trail Hydraulic Control System. As indicated in the Remedial Action Work Plan, Knox Trail Groundwater Extraction System Expansion (Geosyntec, 2022), the performance objective for EW-2 is to provide hydraulic capture of 1,4-dioxane in the deep overburden and shallow bedrock east of the Assabet River. Prior to the Knox Trail expansion, Knox Trail system had been in operation using one extraction well (EW-1) to contain the plume of 1,4-dioxane in overburden groundwater and cutoff migration of the 1,4-dioxane plume to the Assabet 1A municipal well. EW-1 is located west of the Assabet River along Knox Trail (see **Figure 2** of the main report) and has been pumping continuously since June 2017 at approximately 20 gallons per minute (gpm), with periodic shutdowns for redevelopment and system maintenance. Since EW-1 started, the width of the 1,4-dioxane plume at the EW-1 location has consistently been contained from migrating west toward Assabet 1A, and 1,4-dioxane concentrations west of the river have steadily declined.

Concentrations of 1,4-dioxane on the east side of the Assabet River have persisted both in the bedrock and the overburden. Further, vertical gradients are upward from the bedrock to the overburden immediately east of the river resulting in the 1,4-dioxane plume moving from bedrock into deep overburden in the vicinity of the MW-34 well cluster. To contain the 1,4-dioxane plume in the deep overburden and shallow bedrock in this area, as well as to remove more mass, an additional overburden extraction well (EW-2) was installed as part of the Knox Trail expansion. The expansion also included connecting an existing bedrock extraction well, BEW-5, located east of the Valley Sports skating rink, into the Knox Trail system.

The width of the 1,4-dioxane plume exceeding the 0.46 micrograms per liter (µg/L) Site cleanup level at the EW-2 location is approximately 200 ft. A pumping test was conducted at EW-2 to ascertain the well's likely capture width relative to the 1,4-dioxane plume width. Details of EW-2 well installation and pumping are found in Sections 2.0 and 3.0.

The 100% Remedial Design for the Knox Trail System Expansion provides details on the design, installation, and testing of EW-2, as well as how EW-2 and existing bedrock extraction well, BEW-5 would be connected to the Knox Trail system to capture the plume east of the Assabet River. The 100% Remedial Design was submitted to USEPA on September 15, 2022 and approved by USEPA on September 23, 2022. This appendix focuses on the installation and testing of EW-2.

2. EW-2 DESIGN

The design of EW-2 was focused on extracting groundwater impacted with 1,4-dioxane from the deep overburden on the east side of the Assabet River. In March 2022, a pilot boring was advanced at the proposed EW-2 location to collect groundwater grab samples to profile concentrations of 1,4-dioxane in deep overburden. The pilot boring program also included collecting soils for grain size analysis to be used for filter pack and screen slot size design. The EW-2 well was designed to extract water from the deep overburden on top of till and shallow bedrock beneath till since EW-2 coincides with the location where the 1,4-dioxane plume moves from shallow bedrock into deep overburden. Thus, the design included a dual well screen separated by a blank section of pipe between the screens and across till. This design allows for pumping from deep overburden and shallow rock while limiting fines (e.g. silt and clay particles) in the till from migrating into the well. EW-2 is intended to function in partnership with upgradient bedrock pumping well, BEW-5 operating at 2.3 gpm, to hydraulically contain 1,4-dioxane in bedrock. The locations for EW-1, EW-2, and BEW-5 are shown on **Figure 3** of the main report.

2.1 EW-2 Installation and Well Construction

EW-2 was installed by Cascade Drilling with oversight by Geosyntec. The drilling was executed via sonic methods from August 20 through September 11, 2023. A photo log of the drilling is attached to the end of this appendix.

Cores from the sonic drilling were carefully reviewed to estimate the depth below ground surface (bgs) to top of till and top of bedrock as markers to assigning final depths for well screen installation. An as-built construction diagram and a detailed boring log for EW-2 is included as **Figure E-1**. The final screen/casing installation and annular materials included:

Feet (ft) bgs	Material
0 - 79	8-inch solid schedule 40 PVC riser
79 - 89	8-inch stainless v-wire wrap 20-slot screen
89 – 94	8-inch solid stainless-steel casing
94 – 104	8-inch stainless-steel v-wire wrap 20-slot screen
0 – 73	cement/bentonite grout
73 – 76	bentonite, pellets 3/8”
76 – 77	choker sand #000S
77 – 90	filter sand #0S
90 – 91	choker sand #000S
91 – 92	bentonite, pellets 3/8”
92 – 93	choker sand #000S
93 – 106	filter sand #0S

Specification sheets with the particle size distribution for the filter sand and choker sand are included in **Appendix H**.

2.2 EW-2 Well Development

EW-2 was developed by Cascade Drilling, Inc. between September 20 and 21, 2023 with guidance and oversight by Geosyntec. The well was developed using surge blocks and a downhole pump, with sequential surging and purging to remove fines. The well was repeatedly surged and then purged at rate of approximately 20 gpm. The observed depth to water when developing at 20 gpm was approximately 16.2 ft, which corresponds to approximately 8 ft of drawdown from ambient conditions. In accordance with the Work Plan, the well was considered sufficiently developed when at least five (5) well volumes (1,250 gallons) plus water lost during drilling had been removed and turbidity was measured below 5 nephelometric turbidity units (NTUs). Approximately 4,000 gallons of drill water was lost to the formation during well drilling and thus the target volume to remove during development was ~5,250 gallons. The total volume removed during development was 5,860 gallons. The turbidity dropped rapidly upon development with a value of 0.59 NTUs at the cessation of purging.

3. EW-2 HYDRAULIC TESTING

Step drawdown and constant rate pumping tests were completed at EW-2. The step test was designed to estimate an achievable and sustainable longer-term constant pumping rate and was performed in accordance with Standard Operating Procedure[1] (SOP) NMI-GW-017. A subsequent constant rate pumping test was then implemented in accordance with SOP NMI-GW-018 at the rate determined from step testing to understand the hydraulic capture capacity for the well. Appendix E of the 100% RD provides additional detail on the step and pump testing including wells that were monitored during the test.

A target pumping rate for EW-2 was informed by modeling EW-2 using the W.R. Grace NMI Joint Regional Groundwater Model (JRGM); this exercise found that an extraction rate of 10 gpm was likely to capture the width of the 1,4-dioxane plume at EW-2. This flow rate, when added to worst case flow from EW-1 (20 gpm; assumes no change) and BEW-5 (2.3 gpm) slightly exceeds the 30-gpm hydraulic capacity of the Knox Trail Treatment System and was considered as a possible target for EW-2 operation.

During well development when pumping EW-2 at a rate of 20 gpm, only 8 ft of drawdown was observed. Thus, the initial indication was that EW-2 could easily sustain 20 gpm and even higher rates.

Approximately seven days prior to step and constant rate testing, non-vented Solinst Levelogger Model 3001 and Model 5 electronic transducers were installed in fourteen monitoring wells, EW-2 and the Assabet River at the former Pumphouse location (AR-PHS) according to the work plan provided as Appendix E of the 100%RD. The transducers were set to collect data at 10-minute intervals. In addition, manual water levels were collected from 36 wells on the morning of October 9, 2023 to provide pre-pumping groundwater elevation data. Pre-pumping water levels are shown on **Table E-1**. Pre-pumping water level contours in overburden and bedrock are shown on **Figure E-2a** and **Figure E-2b**, respectively.

3.1.1 Step Drawdown Testing

The step drawdown tests involved pumping EW-2 at successively increasing rates over similar time intervals until the drawdown at each step approached steady state. The drawdowns and pumping rates were used to estimate the specific capacity of the well across a range of pumping rates, evaluate the potential for a stable specific capacity at a specific pumping rate, and infer a

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[1] SOPs can be found in the Field Sampling Plan (Appendix I) of the 2020 Remedial Design Work Plan.

maximum sustainable rate for the constant-rate pumping tests. Details concerning the step test are presented below.

3.1.1.1 Step Test Setup

A 4-inch submersible pump (Grundfos Model 25S10-7, 230V, single-phase, 1 hp) was placed within the upper screen of EW-2. The pump was suspended in the well and connected to a 1-inch polyethylene drop pipe. The drop pipe passed through a wellhead and then 1-inch polyethylene pipe carried groundwater into a manifold equipped with a control valve, pressure gauge and a sampling port. From the manifold, the extracted water was conveyed via 1-inch polyethylene pipe to a nearby fractionation tank for storage and subsequent treatment as described in Section 2.6 of the main report. A Solinst Levelogger non-vented pressure transducer was installed in a 1-inch PVC stilling pipe and set to record water level every minute to measure the drawdown within EW-2 during step testing.

3.1.1.2 Step Test Procedures

The step test was run on October 9, 2023 at four increasing rates of 5, 10, 15 and 20 gpm. The testing was started at 5 gpm and each step was continued for approximately one-hour prior to increasing the pump rate to the next step. **Figure E-3** shows drawdown in EW-2 during the step test. Using the final drawdown at each pumping rate, specific capacities at each pumping rate were estimated as the flow rate (Q) divided by drawdown (s) [Q/s]. These specific capacities are as follows:

Pump Rate (Q) (gpm)	Duration (minutes)	Drawdown (s) (ft)	Specific Capacity (gpm/foot)
5	60	1.63	3.07
10	60	3.61	2.77
15	60	5.64	2.66
20	60	8.13	2.46

Results indicate steady state conditions developed for the first three steps and near steady state was achieved for the last step at 20 gpm. The average Specific Capacity from the step testing was 2.74 gpm/foot, although specific capacity decreased with higher pumping rate.

Based on these results, a pumping rate of 14 gpm was selected for the 3-day constant rate test. Considerations incorporated into this decision included:

- Knowing that drawdown would be <10 ft so a water column above the pump intake would be at least 65 ft,

- Knowledge from modeling that 10 gpm was likely to achieve capture so 14 gpm was conservative,
- The total frac-tanks storage capacity was approximately 65,000 gallons for the test so a 3-day test was possible.

3.1.2 Constant Rate Testing

The constant rate test was run at 14 gpm for approximately 73 hours. The test started on October 10, 2023 at 09:00, with continuous oversight by Geosyntec, *de maximis*, and O&M personnel. The wellhead instrumentation for the step test was utilized for the constant rate test and included a digital flow meter, valves for adjusting flow, a pressure gauge and a sample port. Water from the wellhead instrumentation passed through the manifold and then through 1-inch diameter hose prior to discharging into an on-site fractionation tanks. Fractionation tanks were plumbed in parallel so discharge into one tank filled all tanks simultaneously.

Water levels in the pumping well, one shallow overburden well, nine deep overburden wells, and four bedrock monitoring wells were recorded electronically at 10-minute intervals using pressure transducers. Because the transducers were non-vented, they read both the water and air pressure above the transducer and thus an additional transducer (Solinst Barologger) was deployed to record the barometric pressure to be used to perform a barometric compensation. Manual monitoring of wells instrumented with transducers occurred throughout the test to verify electronically-collected water level data.

Groundwater analytical samples were collected at the end of the step test, and at the mid-point and the end of the constant rate test to evaluate contaminant concentrations. In addition, the extracted groundwater was screened for field geochemical parameters, including temperature, dissolved oxygen, specific conductivity, pH, oxidation reduction potential, and turbidity using a calibrated multi-parameter field meter approximately every six hours during pumping as described in Section 4.1.1.1 below. These data were used to help understand the likely influent concentrations that would affect the operation of the Knox Trail treatment system and discharge to the Assabet River. At the end of the pumping phase prior to stopping extraction, a full water level round was conducted to provide groundwater elevations and estimate the capture zone for EW-2 at the pump test rate of 14 gpm. Due to the permeability contrast between the overburden and bedrock, the majority of groundwater extracted from EW-2 originates from the overburden, however, a fraction of the total groundwater is derived from bedrock.

Manual water levels measured prior to pumping and during pumping are presented on **Table E-1**. The pre-pumping groundwater elevations in overburden and bedrock are presented on **Figures E-2a** and **E-2b**, respectively. **Figures E-4a** and **E-4b**, depict groundwater elevations at the end of the pump test and inferred capture zones in overburden and bedrock at 14 gpm, respectively. 1,4-dioxane concentrations from April 2023 are also shown on **Figures E-4a and E-4b** to aid in interpretation.

A discussion of how the electronically-collected water levels were used to evaluate hydraulic parameters (transmissivity, hydraulic conductivity), how manually collected water levels were used to evaluate capture, and a presentation of analytical results are provided below.

3.1.2.1 Transmissivity Estimates

The 10-minute water level data were used to evaluate the response to pumping and estimate aquifer parameters. Water-level data from observation wells exhibiting measurable response to pumping were evaluated using Aqtesolv® (Duffield 2007) aquifer test analysis software to match the observed water level versus time data to type curves for estimating transmissivity and storativity. Water levels collected before, during, and after pumping are plotted on **Figures E-5a** and **E-5b**. Results of water levels corrected for ambient changes indicate seven of the ten monitored overburden and three of the four bedrock monitoring wells exhibited a clear response to pumping at EW-2 (**Figure E-5b**). Note that the observed increase in water levels which occurred on the first day of pumping (elapsed hours of 1 to 6) was due to a temporary shutdown of EW-1; this shutdown is noted on the figure.

During the pumping period, ambient water levels were steadily dropping as no rainfall occurred from just after midnight on October 8 (approximately 32 hours prior to pumping) to October 16, 2023 (three days after the test ended). An ambient decline in water levels was estimated using transducer data from the Assabet River for the overburden and MW-BS26 for bedrock aquifers. The change in the Assabet River stage during the pumping test was selected for the ambient water level correction in overburden because the river decline rate tracks closely with that in the overburden aquifer and the river was unaffected by pumping. The ambient drop in water levels during the pumping period was approximately 0.23 ft in the Assabet River and 0.19 ft in bedrock. To account for this drop, the 10-minute water level data was corrected for ambient changes to discern the drawdown due to pumping (only) from natural change in water level during the test. The resulting drawdown due to pumping EW-2 was minimal and was only confirmed for seven wells in overburden and three wells in bedrock. The magnitude of drawdown corrected for ambient decline in overburden wells during pumping ranged from only 0.23 ft at MW-SD34 (70 ft SW) to 0.14 ft at MW-SD52 (147 ft ESE). All other overburden wells exhibiting drawdown were less than 0.1 ft. Small drawdowns were difficult to discern amidst the ambient decline in water levels during the test so aquifer hydraulic parameters were not estimated for these wells. Observed drawdown at bedrock well MW-BS34 (70 ft SW) was 0.39 ft. Observed drawdowns due to pumping and corrected for ambient changes are shown on **Figure E-6a** and **E-6b** and presented on **Table E-2**.

The resultant time versus drawdown data, after compensating for barometric pressure and ambient declines, were used to estimate transmissivity using the Hantush-Jacob, Leaky Aquifer solution with partial penetration (without aquitard storage) in Aqtesolv™. This solution was considered representative as it incorporated partially-penetrating wells, provided a good match to the test data, and approximated general overburden hydrogeology and conceptual groundwater flow during pumping, that is, pumping-induced leakage from the silts and fine sands in shallow overburden to the underlying fine to coarse sands in deep overburden. Note that due to the EW-2 construction using dual screens in bedrock and overburden, and general knowledge of the overburden and bedrock yields, it was assumed that 13.5 gpm of the 14 gpm extracted from EW-2 originated from the overburden. Transmissivity results in overburden, for two wells where drawdown was sufficient (>0.1 feet) for curve matching and reliable estimates, were approximately 5,331 ft^2/d at MW-SD34 and 7,308 ft^2/day at MW-SD52. Drawdowns at each well along with the distance and bearing from the extraction well and transmissivity results are shown on **Table E-2**.

Although minimal drawdowns were observed in bedrock, it is unknown what portion of the water extracted from EW-2 was derived from bedrock and thus transmissivity estimates were not estimated from the time versus drawdown data in bedrock wells. Bedrock transmissivities in the area were estimated during the BEW-5 pumping test. The influence of EW-2 pumping on water levels in surrounding bedrock zones was apparent and used to graphically infer its capture zone in bedrock.

3.1.2.2 Capture Zones

The groundwater elevations under pumping are shown on **Figures E-4a** and **E-4b**. It should be noted that at the time of water level gauging, and during the pumping test, the following extraction wells were active at the rates listed:

Extraction Well	Rate (gpm)
EW-1 (Knox Trail Hydraulic Cutoff System)	20
Assabet 1A (Acton Water District)	200
Assabet 2 (Acton Water District)	110
Assabet 2A (Acton Water District)	120
Assabet 3 (Acton Water District)	200

The rates for the Assabet wells were acquired from Matt Mostoller of the Acton Water District. These rates may be slighter higher than the average rate for each well for the week before Site water levels were gauged.

The deep overburden capture zone for EW-2 is drawn on **Figure E-4a** as the region within two dashed black lines. This shows an approximately 600-foot-wide lateral capture, which is far wider than the estimated width of the 1,4-dioxane plume at the EW-2 location (approximately 200 ft). This means that the extraction rate at EW-2 can be lower than 14 gpm and still achieve capture. The capture zone in bedrock at EW-2 is shown on **Figure E-4b** and extends from approximately the Assabet River to the west, to beyond well BEW-6 to the east. The extent of EW-2 capture in bedrock extends beyond the toe of the bedrock, 1,4-dioxane plume to the west and to wells MW-BS15 and BEW-5 to the east.

Typically, an analytical estimate of the capture width can be made using the pumping rate, ambient gradient and transmissivity using the standard equation for capture zone analysis as shown in USEPA, 2008, *A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems, EPA600/R-08/003.* This analytical estimate of capture width can be compared to the graphically estimated capture width from manual water level data at the end of the pumping period. If considered comparable, the width of capture can be estimated analytically for varying pump rates. For the EW-2 pump test, however, it is problematic to estimate the ambient gradient in the area because there is a relatively flat gradient and EW-2 is near a divide caused by other pumping wells. Due to the unique flow in this portion of the site (e.g., influence from several other nearby pumping wells), an analytical analysis was not performed.

4. CAPTURE ZONE FOR THE EXPANDED KNOX TRAIL SYSTEM

Because the certainty of the required pumping rate at EW-2 to capture the plume in deep overburden (with an approximately safety factor of 20%) could not be estimated analytically and 14 gpm provided an overly large capture width, a graphical estimation of capture width was performed to select the pumping rate for EW-2 during Phase 3 of the expanded treatment system start-up (Section 2.1.5 of the main report). Phase 3 of start-up began on December 11, 2023 and included continuous pumping at 10 gpm from EW-1, 11.5 gpm from EW-2, and 2.3 gpm at BEW-5. The Acton Water District extraction wells (Assabet 1A. Assabet 2, Assabet 2A, and Assabet 3) were also active during this period. A rate of 11.5 gpm was selected for EW-2 based on the graphical estimate, judgement from the pumping test (i.e., 14 gpm produced capture approximately 3-time broader than the 1,4-dioxane plume) as well as predictions from the site numerical groundwater model.

EW-2 operated at 11.5 gpm (and EW-1 at 10 gpm and BEW-5 at 2.3 gpm) for seventeen days as part of Phase 3 start-up and then a complete round of water levels measurements was collected on December 28, 2023. Using these data, the capture zone width at pumping locations was again estimated graphically utilizing groundwater elevation contours. Results indicated EW-2 capture at 11.5 gpm continued to exceed the width of the 1,4-dioxane plume at EW-2 in overburden and bedrock, EW-1 capture exceeded plume width at EW-1, and BEW-5 captured most of the width of the bedrock plume at BEW-5. These capture zones are illustrated on **Figures E-7a and E-7b** for deep overburden and shallow bedrock, respectively.

As inferred from the groundwater elevation contours presented on **Figure E-7a**, EW-2 pumping at 11.5 gpm is capturing the full width of the overburden 1,4-dioxane plume beneath Valley Sports and portions of the Assabet River. The hydraulic gradient near well MW-SD34, where elevated 1,4-dioxane concentrations have been detected, is oriented to the east instead of westwards towards EW-1. Also, the hydraulic gradient is significantly higher in this area as MW-34 wells are located close to EW-2.

Under the new pumping regime for the expanded Knox Trail system, EW-1 continues to capture the full width of the 1,4-dioxane plume to the west of the Assabet River at its adjusted pumping rate of 10 gpm (formerly 20 gpm). The lower flow rate has resulted in a shift of the western extend of capture to the area between EW-1 and well MW-SD42A. In the past (e.g., April 2022 and 2023, refer to 2022 and 2023 Annual Groundwater Monitoring Reports), capture from EW-1 had extended to the MW-37 well cluster. Overall, the combined capture zones for EW-1 and EW-2 are effectively intercepting downgradient migration of the 1,4-dioxane plume.

The combined bedrock capture zone presented of **Figure E-7b** is strongly influenced by pumping from BEW-5 at 2.3 gpm and from groundwater drawn into the lower screen of EW-2 that spans a 10-foot portion of shallow bedrock. The lateral extent of capture in bedrock due to pumping from EW-2 is inferred to extend from approximately the Assabet River in the west to the area just east of wells MW-BS52 and BEW-6. This capture zone overlaps the toe of the bedrock 1,4-dioxane plume and compliments capture provided by BEW-5. The capture zone due to pumping from BEW-5 is inferred to extend from approximately Forest Ridge Road near MW-BS35 to the west, and the area near MW-BS51 to the east. This capture zone extends across the highest downgradient 1,4-dioxane concentrations in shallow bedrock (i.e. concentrations greater than 5 µg/L and up to 50 µg/L) including the MW-15 cluster which has historically some of the highest concentrations of the 1,4-dioxane plume in shallow bedrock. Due to competing flow to BEW-5 (screened 20 ft in bedrock), the EW-2 capture zone is slightly narrower compared to the extent inferred from the constant rate pumping test. Nonetheless, the combined pumping from EW-2 and BEW-5 captures the core of the bedrock 1,4-dioxane plume at Bew-5 plus the full width of the 1,4-dioxane plume at EW-2.

4.1.1.1 Analytical Results

Samples were collected prior to pumping and at 32 (midway) and 72 (end) hours into pumping. The analytical results are presented on **Table 1** of the main report. Key analytical results are summarized below.

	End of Step Test (10/09/2023)	Midpoint of Pumping Test (10/11/2023)	End of Pumping Test (10/13/2023)
1,4-dioxane (µg/L)	8.13	7.83	7.62
Trichloroethene (µg/L)	2.2	1.9	1.7

In addition, a full Remediation General Permit (RGP) suite of chemicals was analyzed for in groundwater collected at the end of the pump test to evaluate (1) whether groundwater may potentially impact the Knox Trail treatment system and (2) plan for treatment and subsequent discharge of step/pump test water to the Assabet River. Analytical results for these samples are provided in **Table 1** of the main report.

The pre-pumping 1,4-dioxane and trichloroethene (TCE) concentrations of 8.13 µg/L and 2.2 µg/L, respectively, were comparable to the concentrations detected in deep overburden Push-Ahead™ grab samples collected at the EW-2 pilot boring during March 2022 (9.91 µg/L and 2.1 µg/L, respectively). The concentrations of 1,4-dioxane and TCE decreased slightly during the 73-

hour pumping test which may be attributable to less impacted groundwater from the edges or below the plume and/or unimpacted groundwater from beyond the extent of the plume being drawn into EW-2.

4.2 Overall Results

Pumping at EW-2 demonstrated that the new extraction well, EW-2, is effective at capturing the full width of the 1,4-dioxane plume in overburden and bedrock east of the Assabet River and removing 1,4-dioxane in overburden and shallow bedrock. With the addition of EW-2 and BEW-5, and reconfiguring the pumping rate at EW-1, the combined system intercepts 1,4-dioxane plumes in the overburden and shallow bedrock further upgradient from the Assabet wellfield than when pumping from EW-1 only. The expanded system also increases the mass removal rate (see discussion in main report). Therefore, the combined pumping strategy is an improvement to the system because it (1) removes more mass with only a small increase in total extraction rate, (2) provides more redundant capture of the plumes (i.e. , the deep overburden plume is now captured by EW-2 and EW-1 as opposed to only EW-1, and bedrock plumes are capture by BEW-5 and EW-2), and (3) the plumes are intercepted further upgradient from the Assabet well field.

5. REFERENCES

Geosyntec. 2022. *100% Remedial Design – Knox Trail Groundwater Extraction System Expansion*. Nuclear Metals Inc. Superfund Site, Concord, MA. September.

TABLES

Table E-1
EW-2 Pumping Test Pre-Pumping and Pumping Groundwater Elevations - October 2023
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

			10/9/2023 Pre Pumping		10/13/2023 Pumping - 3 days at 14 gpm	
Well	**Well or Location Type**	**Measuring Point Elevation (ft NGVD)**	**Depth to Water (feet BTOC)**	**Groundwater Elevation (ft NGVD)**	**Depth to Water (feet BTOC)**	**Groundwater Elevation (ft NGVD)**
MW-S15	OB	134.17	6.89	127.28	7.05	127.12
MW-SD15	OB	136.44	9.41	127.03	9.57	126.87
MW-BS15	BRS	135.29	8.55	126.74	8.74	126.55
MW-BM15	BRM	135.6	8.91	126.69	8.88	126.72
BEW-5	BEW	132.48	5.58	126.90	5.66	126.82
MW-S26	OB	130.65	4.41	126.24	4.65	126.00
MW-SD26	OB	130.56	4.98	125.58	5.27	125.29
MW-BS26	BRS	131.87	5.01	126.86	5.15	126.72
MW-S32	OB	131.23	5.79	125.44	6.08	125.15
MW-SD32	OB	131.37	5.88	125.49	6.21	125.16
MW-BS32	BRS	131.36	5.89	125.47	6.25	125.11
MW-SD34	OB	133.56	8.19	125.37	8.58	124.98
MW-BS34	BRS	133.6	8.10	125.50	8.58	125.02
MW-S35	OB	138.95	12.98	125.97	13.14	125.81
MW-SD35	OB	138.79	10.69	128.10	10.86	127.93
MW-BS35	BRS	138.8	10.33	128.47	10.49	128.31
MW-S36	OB	135.09	9.31	125.78	9.62	125.47
MW-SD36	OB	134.78	8.68	126.10	8.95	125.83
MW-BS36	BRS	134.76	8.69	126.07	8.98	125.78
MW-S40	OB	138.71	13.31	125.40	13.62	125.09
MW-SD40	OB	138.67	15.08	123.59	15.43	123.24
MW-BS40	BRS	138.76	13.76	125.00	14.11	124.65
MW-SD45	OB	140.15	15.21	124.94	15.57	124.58
MW-SD52	OB	132.56	6.45	126.11	6.73	125.83
MW-BS52	BRS	132.58	6.59	125.99	6.98	125.60
MW-BS31	BRS	139.37	12.20	127.17	12.41	126.96
MW-BS53	BRS	140.36	11.64	128.72	11.77	128.59
AR-02	OB	137.38	10.91	126.47	11.10	126.28
9-78	OB	138.96	12.42	126.54	12.70	126.26
LF-20SBR	BRS	150.16	23.80	126.36	24.03	126.13
LF-20D	OB	150.16	24.68	125.48	24.96	125.20
PT-09	OB	133.83	8.97	124.86	8.81	125.02
PT-11P	OB	133.30	8.88	124.42	8.10	125.20
EW-1	EW	135.62	28.50	107.12	28.88	106.74
AR-PHS	SW	128.62	3.38	125.24	3.69	124.93
EW-2	EW/BEW	131.99	6.22	125.77	12.07	119.92
BEW-6	BEW	132.91	NM	-	6.14	126.77

Notes:

1. The EW-2 Pumping test was conducted between 9:00AM on 10 October and 9:45 AM on 13 October 2023 at a rate of 14 gallons per minute gpm .
2. Well Designations: EW - Extraction Well; OB - Oveburden; BEW - Bedrock Extraction Well; BRS - Shallow Bedrock; BRM - Intermediate (medium Bedrock; EW/BEW - Well EW-2 was installed with a 10-foot screen in deep overburden and a 10-foot screen in bedrock, separated by a 5-foot section of a blank riser. SW - Surface Water.
3. Wells shaded gray were instrumented with pressure transducers.

ft BTOC - feet below the top of casing

ft NGVD - feet relative to National Geodetic Vertical Datum of 1929
gpm - gallons per minute

Table E-2
EW-2 Pumping Test Drawdown and Aquifer Parameter Estimates
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

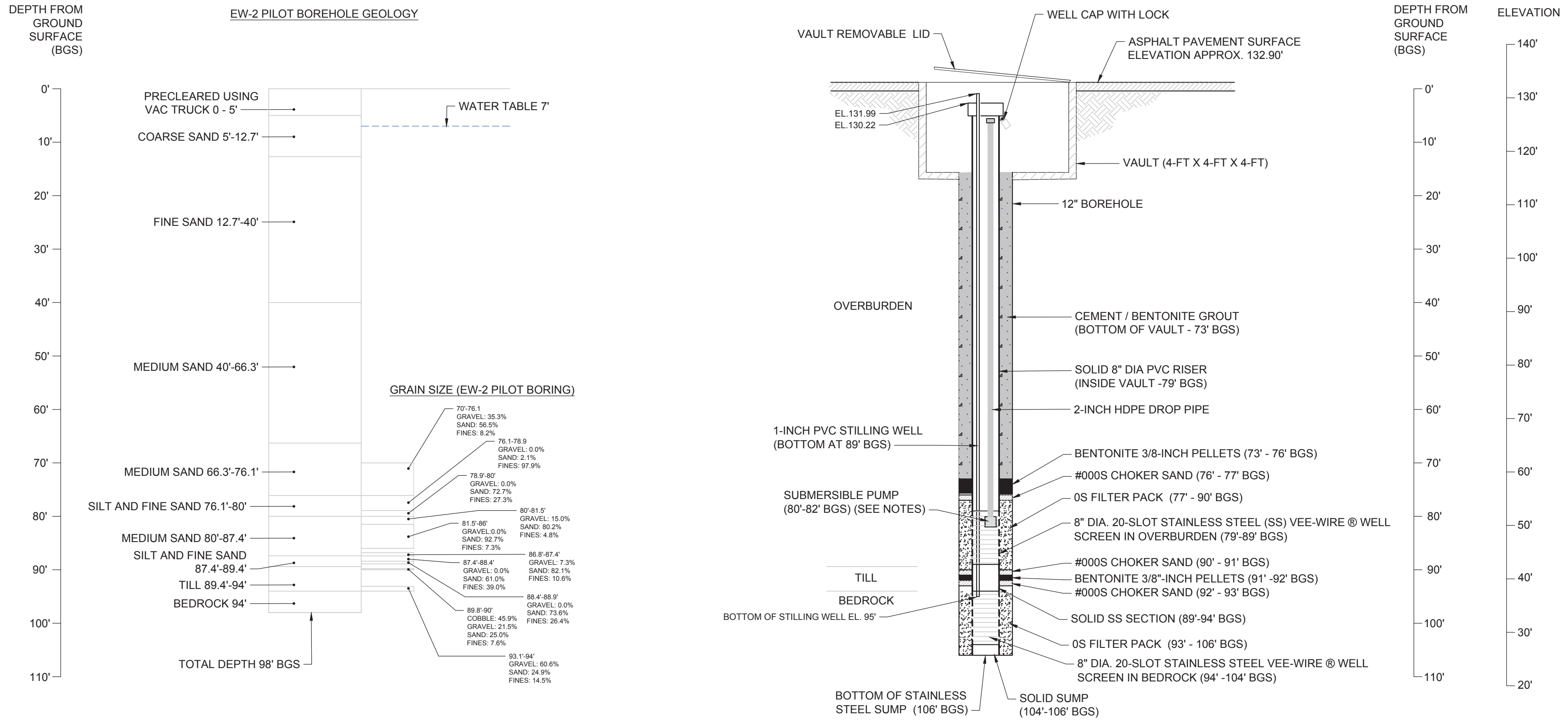
	Well Construction							**Aquifer Hydraulic Parameter Estimates**		
Well	**Depth To Bedrock ft bgs)**	**Screen Top Depth ft bgs)**	**Screen Bottom Depth ft bgs)**	**Unit (BR-Bedrock, OB-Overburden)**	**Radial Distance from EW-2 (feet)**	**Bearing from EW-2 degrees)**	**Observed Drawdown at the end of the Pumping Test Corrected for Ambient Change See Notes 3 and 4) (feet)**	**Transmissivity ft^2/day)**	**Storativity unitless)**	**Solution**
EW-2 (Pumping)	92	79 94	89 104	OB BR	0	0°	5.93	Not Estimated		
Observation Wells										
MW-SD34	94.7	84.5	94.5	OB	70	241° SW	0.23	5331	2.95E-04	Hantush-Jacob, Leaky Aquifer solution with partial penetration
MW-SD52	93	78	88	OB	147	108° ESE	0.14	7308	2.11E-04	
MW-SD32	87.1	65	75	OB	241	45° NE	0.08	Not Estimated (See Note 6)		
MW-S32	87.1	35	45	OB	243	45° NE	0.05			
PT-09	94.7	79	89	OB	303	245° SW	0.05			
MW-SD40	113.5	87	97	OB	327	265° W	0.06			
MW-SD45	95.5	75	85	OB	339	279° W	0.04			
MW-SD15	102	81	91	OB	409	105° ESE	-	-	-	
MW-SD35	100	82	92	OB	585	171°S	-	-	-	
MW-SD26	105	80	90	OB	599	90°E	-	-	-	
MW-BS34	94.7	101	111	BR	70	241° SW	0.39	Not Estimated (See Note 7)		
MW-BS52	93	100	110	BR	147	108° ESE	0.31			
MW-BS32	87.1	92	102	BR	241	45° NE	0.27			
							Overburden Observation Well Average	6319	2.53E-04	

Notes:

1. The EW-2 pumping test was conducted between 9:00AM on 10 October and 9:45AM on 13 October, 2023 at a rate of 14 gallons per minute (gpm).
2. Extraction well EW-2 is constructed with a dual screen in deep overburden and shallow bedrock, separated by a 5-foot section of a steel riser.
3. Overburden well drawdowns were corrected for ambient changes in water level using the Assabet River stage recorded at the former Gravel Pit Pumphouse along Knox Trail (AR-PHS).
4. Bedrock well drawdowns were corrected for ambient changes in water level using data from well MW-BS26.
5. "-" indicates the well was unaffected by pumping
6. Not estimated – Ambient water levels were declining throughout the EW-2 pumping test due to over 5.5 inches of precipitation in the four weeks preceeding the test. These declines made it difficult to separate out declines in water levels strictly due to EW-2 pumping vs. ambient declines. During the correction process it appeared that drawdown due to pumping did occur at overburden wells MW-S32, MW-SD32, PT-09, MW-SD40, and MW-SD45, however, the corrected drawdown was less than 0.1 feet and due to the difficulty described above, were considered not reliable enough to estimate aquifer parameters.
7. As indicated above, the EW-2 construction includes separate wellscreens in the overburden and the bedrock. Due to the contrast in permeability it is assumed that the bulk of the 14 gpm extraction occurred from the overburden. Although drawdowns were observed in bedrock wells MW-BS32, MW-BS34, and MW-BS52, the contribution of flow from bedrock to the total EW-2 pumping rate was considered unknown, and thus bedrock aquifer parameters were not estimated.

ft bgs - feet below ground surface
ft2/day - feet square per day
gpm - gallons per minute

FIGURES



NOTES:

1. 1. EW-2 WAS INSTALLED BY CASCADE DRILLING, L.P., USING BOART LONGYEAR LS(TM)600 ROTOSONIC DRILL RIG. THE BOREHOLE WAS DRILLED BETWEEN 8/30 AND 9/1/2023. THE WELL INSTALLATION WAS COMPLETED ON 9/1 and 9/11/2023. WELL DEVELOPMENT BY SURGING AND PUMPING WAS COMPLETED ON 9/21 and 9/22/2023. A TOTAL OF 5,860 GALLONS OF WATER WERE EXTRACTED DURING DEVELOPMENT. FINAL DEVELOPMENT TURBIDITY WAS 0.59 NEPHELOMETRIC TURBIDITY UNITS (NTUs).
2. GEOLOGY IS BASED ON VISUAL CLASSIFICATION OF RECOVERED SOIL SAMPLES AT EW-2 PILOT BOREHOLE COMPLETED ON 29 MARCH 2022 BY THE ON-SITE FIELD GEOLOGIST. GRAIN SIZE SAMPLES FROM THE PILOT BOREHOLE WERE ANALYZED BY GEOTESTING EXPRESS OF ACTON, MASSACHUSETTS.
3. THE WELL VAULT WAS INSTALLED BY O&M AND US ECOLOGY BETWEEN 10/1 and 10/6/2023.
4. A GRUNDFOS MODEL 25S10-7, 230V, SINGLE PHASE, 1 HP, SUBMERSIBLE PUMP WAS INSTALLED IN THE WELL ON 10/6/2023 AT 80 FT BGS. A 1-INCH PVC STILLING WELL WAS SET AT 95 FT BGS THE SAME DAY.

1
-
DETAIL
EW-2 AS BUILT CONSTRUCTION DETAIL
SCALE: N.T.S.

(1in) (2in) (3in) (4in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

T:\Projects_CADD\N\NMI (Nuclear Metals Superfund Site)\FIGURES\2024 EW-2 AS-BLT\BR0090E FIG 1 (AS-BLT DETAILS EW-2).dwg Last Edited By:RKOHLSTROM

REV	DATE	DESCRIPTION	DRN	APP

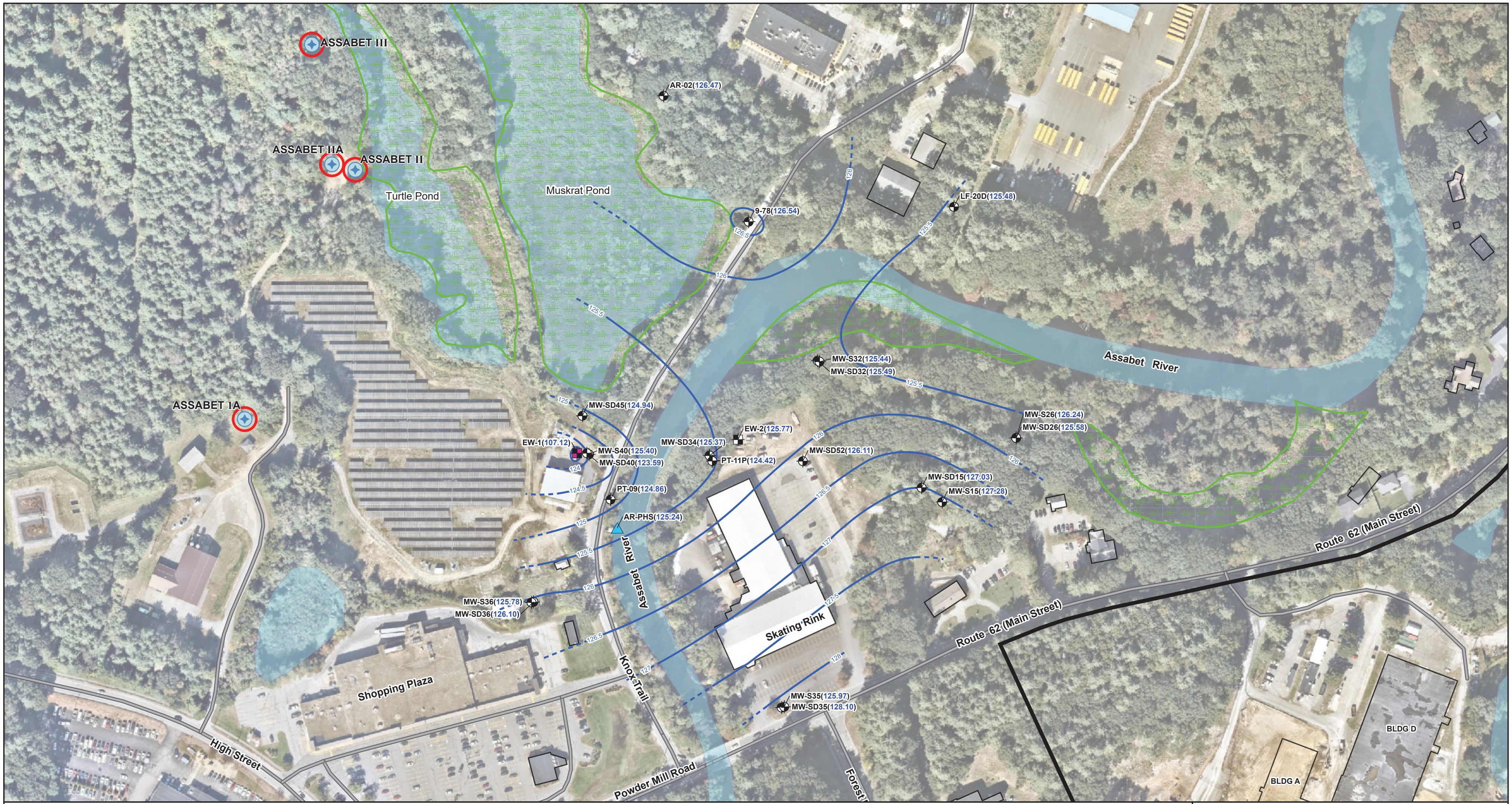
Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588, FL CERT #4321

TITLE: Figure D-1: EW-2 AS-BUILT DETAIL

PROJECT: 100% REMEDIAL DESIGN - KNOX TRAIL GROUNDWATER EXTRACTION SYSTEM EXPANSION

SITE: NUCLEAR METALS INC. SUPERFUND SITE
CONCORD, MASSACHUSETTS

DESIGN BY:	DC, CE	DATE:	FEBRUARY 2024
DRAWN BY:	RMK	PROJECT NO.:	BR0090C
CHECKED BY:	DA	FILE:	
REVIEWED BY:	CE	DRAWING NO.:	E-1 OF --
APPROVED BY:	CE		



Legend

- ▲ Assabet River Stage Elevation
- ⊕ Monitoring Well
- ▚ Extraction Well
- ▚ Active Extraction Well
- ⊕ Active Public Water Supply Well
- — Building Outline
- 🟩 Wetlands
- ▭ Surface Water
- ▬ Site Boundary
- — Groundwater Elevation Contour - October 9, 2023
- - - Estimated Groundwater Elevation Contour - October 9, 2023

Notes:
1. The potentiometric elevations are in feet relative to National Geodetic Vertical Datum of 1929
2. The ambient water level round was completed 9 October 2023 over a one-hour period
3. Extraction well EW-1 was pumping at approximately 20 gallons per minute (gpm) during the water level round.
4. The Acton Water District Assabet Wellfield Municipal wells were pumping at the following rates: Assabet 1A – 200 gallons per minute (gpm); Assabet 2 – 110 gpm; Assabet 2A – 120 gpm; Assabet 3 – 200 gpm.
5. Where multi-level wells are co-located at a single location, data from the deeper overburden well was used in drafting contours. Assabet River Stage at AR-PHS, and groundwater elevations at shallow wells MW-S15, MW-S26, MW-S35, MW-S36, MW-S40, and PT-11P were not used for contouring. The potentiometric contours are interpreted and may not represent actual flow directions or gradient.

N

0 200 Feet

EW-2 Pumping Test: Pre-Pumping Groundwater Elevations in Overburden

Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

Geosyntec consultants

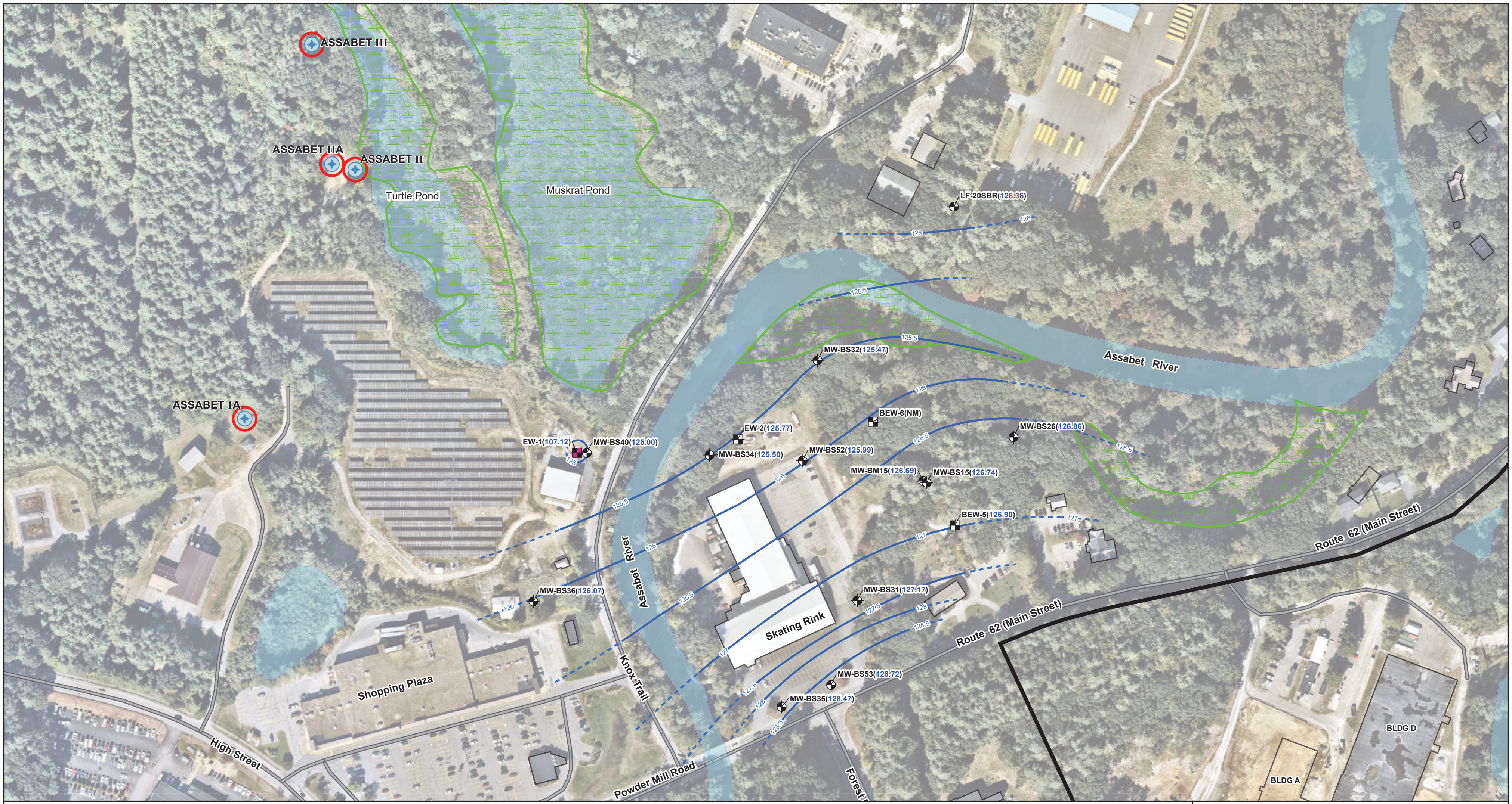
de maximis, inc.

Acton, Massachusetts

January 2024

Figure
E-2a

\\Boston-01\data\GIS\GISProjects\BR0090-NMISite\Projects\APRX\EW2_PumpingTest.aprx\Figure 1a - Pumping Contours and Capture Zone in OB (October 09) 1/30/2024 4:39 PM (Grace.Kane)



Legend

- Active Extraction Well
- Extraction Well
- Monitoring Well
- Active Public Water Supply Well
- Building Outline
- Wetlands
- Surface Water
- Site Boundary
- Groundwater Elevation Contour - October 9, 2023
- Estimated Groundwater Elevation Contour - October 9, 2023

Notes:
1. NM - Not Measured
2. The ambient water level round was completed 9 October 2023 over a one-hour period
3. Extraction well EW-1 was pumping at approximately 20 gallons per minute (gpm) during the water level round.
4. The Acton Water District Assabet Wellfield Municipal wells were pumping at the following rates: Assabet 1A – 200 gallons per minute (gpm); Assabet 2 – 110 gpm; Assabet 2A – 120 gpm; Assabet 3 – 200 gpm.
5. The potentiometric elevation contours are interpreted and may not represent actual flow directions or gradients.

EW-2 Pumping Test: Pre-Pumping Groundwater Elevations in Bedrock

Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

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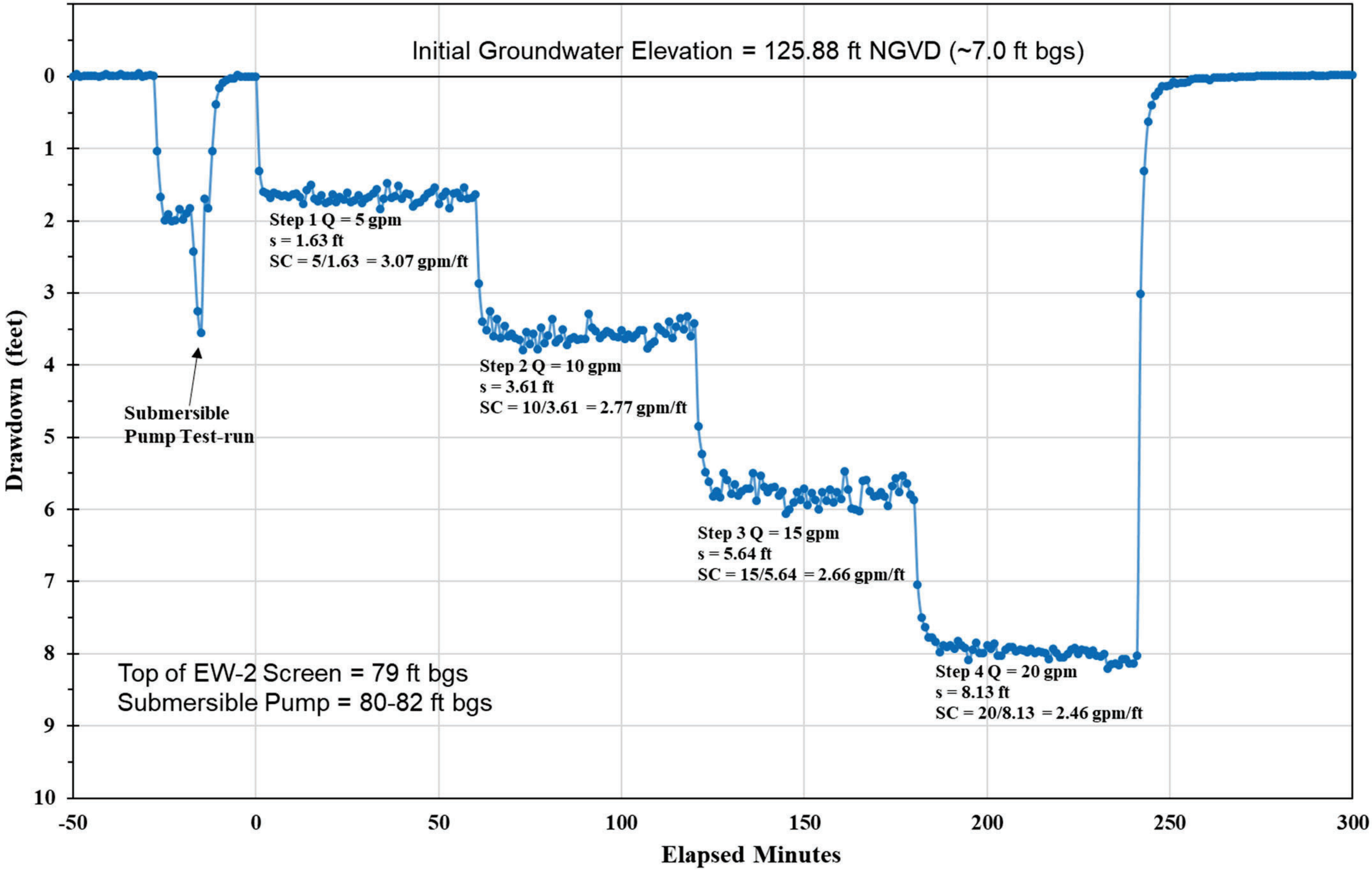
Acton, Massachusetts
January 2024

Figure
E-2b

\\Boston-01\data\GIS\GISProjects\BR0090-NMISite\Projects\APRX\EW2_PumpingTest.aprx\Figure 1b - Pumping Contours and Capture Zone in BR (October 09) 1/30/2024 2:39 PM (Grace.Kane)



Notes:

1. The EW-2 step drawdown test was conducted between 12:00 PM and 4:00PM on 9 October 2023 at a four pumping rates; 5, 10, 15, and 20 gallons per minute (gpm). Water level in EW-2 was monitored with a pressure transducer recording at 1 minute intervals.
2. Specific Capacity (SC) was calculated by dividing extraction rate (Q) by the drawdown (s) observed at the end of each pumping step.
3. Abbreviations: ft: feet, bgs: below ground surface, gpm: gallons per minute

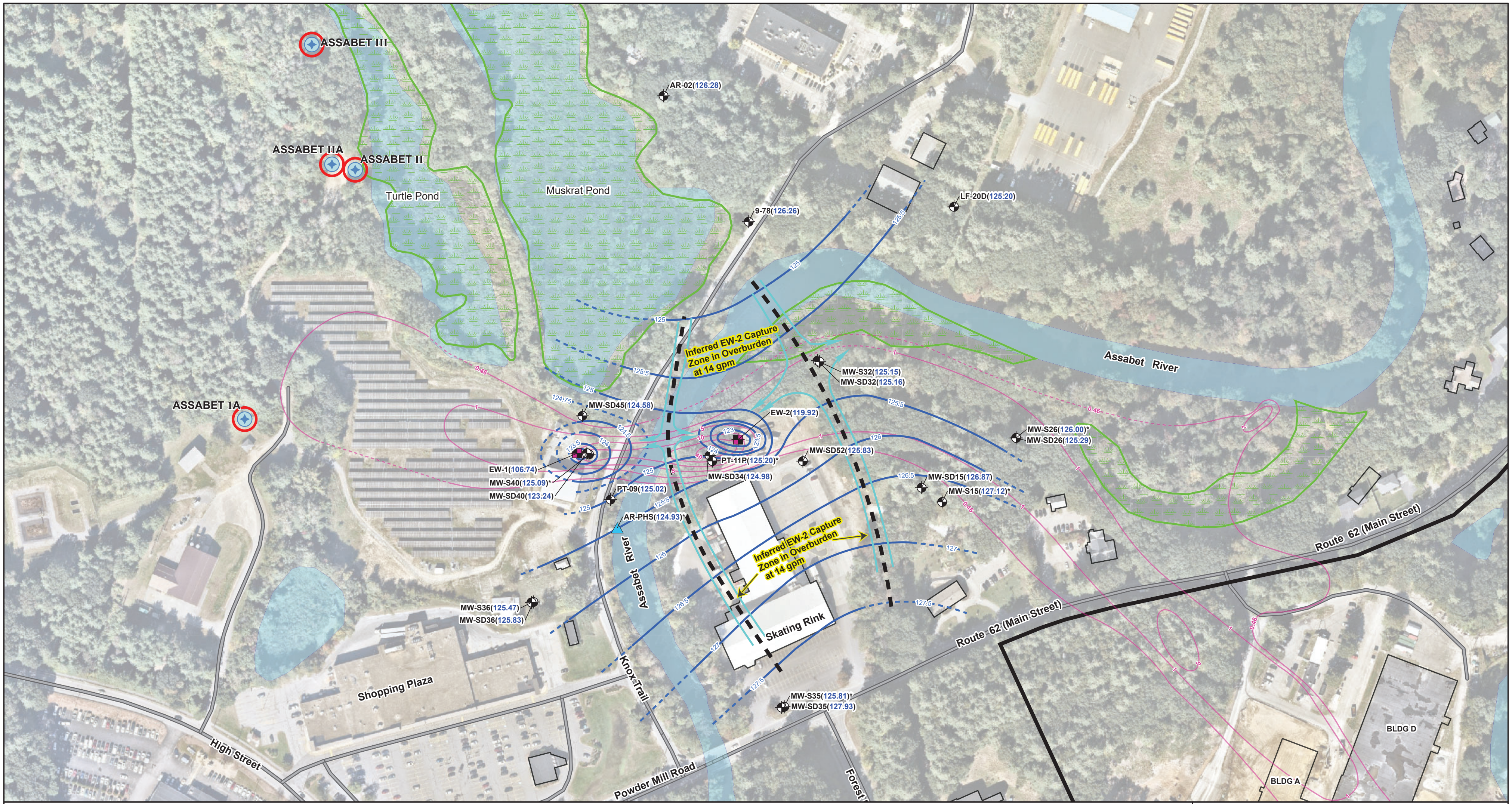
EW-2 Step Drawdown Test
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

Geosyntec consultants

Acton, Massachusetts | April 2024

Figure

E-3



Legend

- ▲ Assabet River Stage Elevation
- ⊕ Monitoring Well
- Extraction Well
- Active Extraction Well
- Active Public Water Supply Well
- Building Outline
- 🟩 Wetlands
- Surface Water
- Site Boundary
- Pumping Contours (ft) - October 13, 2023
- Estimated Pumping Contours (ft) - October 13, 2023
- EW-2 Capture Zone
- Inferred Groundwater Flow Direction
- 1,4-Dioxane Isoconcentration Contour in Overburden Through April 2023 (µg/L)
- Estimated 1,4-Dioxane Isoconcentration Contour in Overburden Through April 2023 (µg/L)

0 200
Feet

N

Notes:
1. * - Not used for contouring
2. The EW-2 pumping test was completed between 9:00AM on 10 October and 9:45AM on 13 October, 2023 at a pumping rate of 14 gallons per minute (gpm).
3. The pumping water level round was completed on 13 October 2023 over a period of one hour, prior to the end of the pumping test.
4. During the EW-2 pumping test, the Acton Water District Assabet Wellfield Municipal wells were pumping at the following rates: Assabet 1A – 200 gallons per minute (gpm); Assabet 2 – 110 gpm; Assabet 2A – 120 gpm; Assabet 3 – 200 gpm.
5. Extraction well EW-1 was pumping at approximately 20 gpm prior to and during the pumping test, with exception of a one hour shutdown between 2:25PM and 3:35PM on 9 October 2023, and a five-hour shutdown between 9:55AM and 2:55PM on 10 October 2023.
6. Where multi-level wells are co-located at a single location, data from the deeper overburden well was used in drafting contours. Assabet River Stage at AR-PHS, and groundwater elevations at MW-S15, MW-S26, MW-S35, MW-S36, MW-S40, and PT-11P were not used for contouring. The potentiometric contours are interpreted and may not represent actual flow directions or gradient.
7. The 1,4-dioxane distribution contours in overburden were inferred from the most recent data collected through April 2023.

EW-2 Pumping Test: Pumping Overburden Groundwater Elevations and Capture Zone (3 days at 14 gpm)

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Concord, Massachusetts

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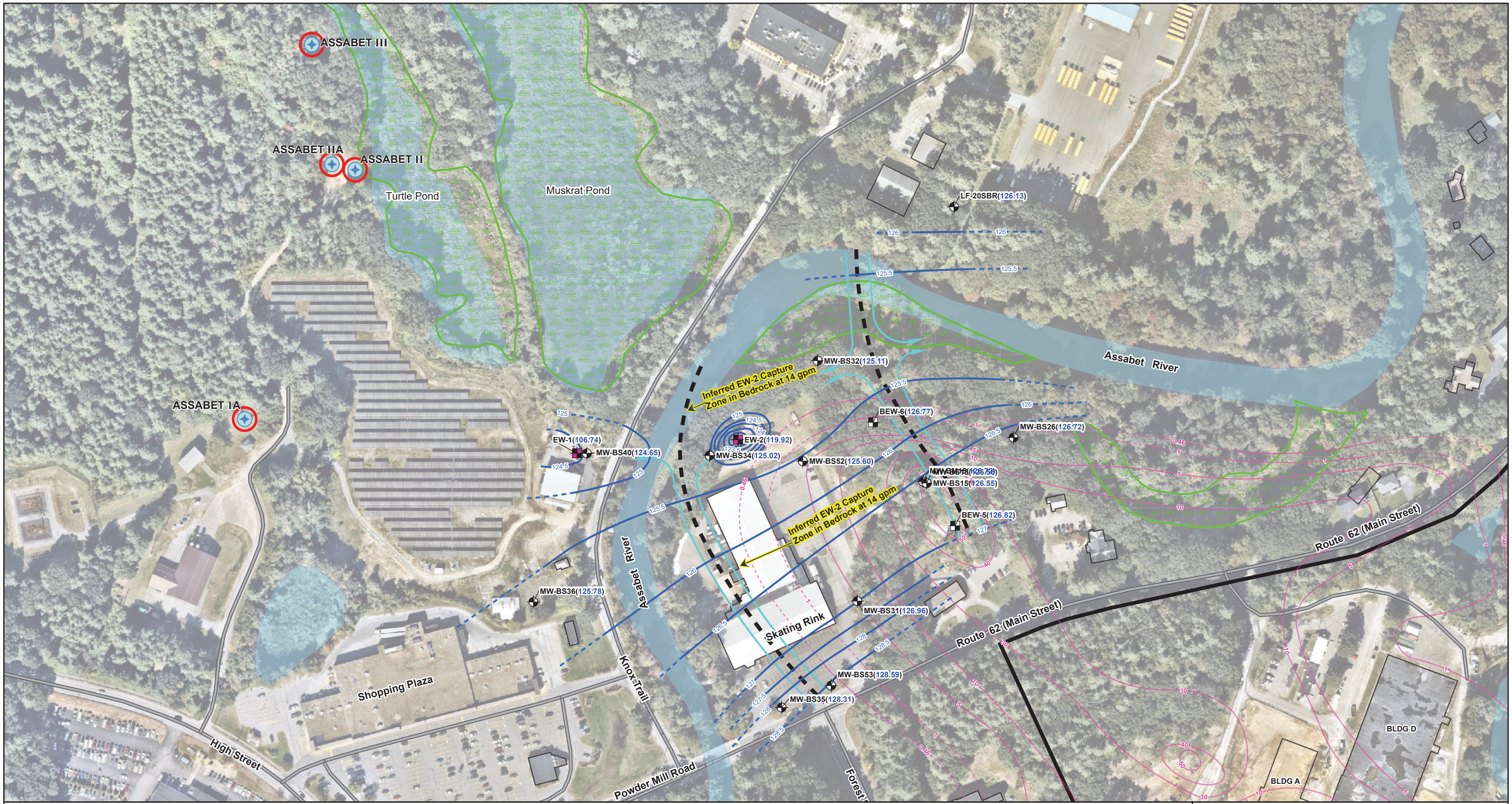
Acton, Massachusetts
January 2024

Figure
E-4a

\\Boston-01\data\GIS\GISProjects\BR0090-NMISite\Projects\APRX\EW2_PumpingTest.aprx\Figure 2a - Pumping Contours and Capture Zone in OB (October 13) 1/30/2024 2:41 PM (Grace.Kane)



Legend

- ■ Active Extraction Well
- ■ Extraction Well
- ⊕ Monitoring Well
- ⊕ Active Public Water Supply Well
- — Building Outline
- 🟩 Wetlands
- ▭ Surface Water
- ▬ Site Boundary
- — Pumping Contours (ft) - October 13, 2023
- - - Estimated Pumping Contours (ft) - October 13, 2023
- ▬ ▪ EW-2 Capture Zone
- → Inferred Groundwater Flow Direction
- — 1,4-Dioxane Isoconcentration Contour in Bedrock Through April 2023 (µg/L)
- - - Estimated 1,4-Dioxane Isoconcentration Contour in Overburden Through April 2023 (µg/L)

Notes:
1. The EW-2 construction includes a 10-ft wellscreen in the deep overburden and a 10-ft wellscreen in the shallow bedrock, separated with blank casing. Although the bulk of water extracted from EW-2 is from the overburden, there is some water extracted from the bedrock and thus the bedrock capture zones for EW-2 has been inferred from the water level data.
2. The EW-2 pumping test was completed between 9:00AM on 10 October and 9:45AM on 13 October, 2023 at a pumping rate of 14 gallons per minute (gpm).
3. The pumping water level round was completed on 13 October 2023 over a period of one hour, prior to the end of the pumping test.
4. During the EW-2 pumping test, the Acton Water District Assabet Wellfield Municipal wells were pumping at the following rates: Assabet 1A – 200 gallons per minute (gpm); Assabet 2 – 110 gpm; Assabet 2A – 120 gpm; Assabet 3 – 200 gpm.
5. Extraction well EW-1 was pumping at approximately 20 gpm prior to and during the pumping test, with exception of a one hour shutdown between 2:25PM and 3:35PM on 9 October 2023, and a five-hour shutdown between 9:55AM and 2:55PM on 10 October 2023.
6. The potentiometric elevation contours are interpreted and may not represent actual flow directions or gradients. Groundwater elevation at open bedrock borehole well BEW-6 was not honored in contouring.
7. The 1,4-dioxane distribution contours in bedrock were inferred from the most recent data collected through April 2023.

N

0 200 Feet

EW-2 Pumping Test: Pumping Bedrock Groundwater Elevations and Capture Zone (3 days at 14 gpm)

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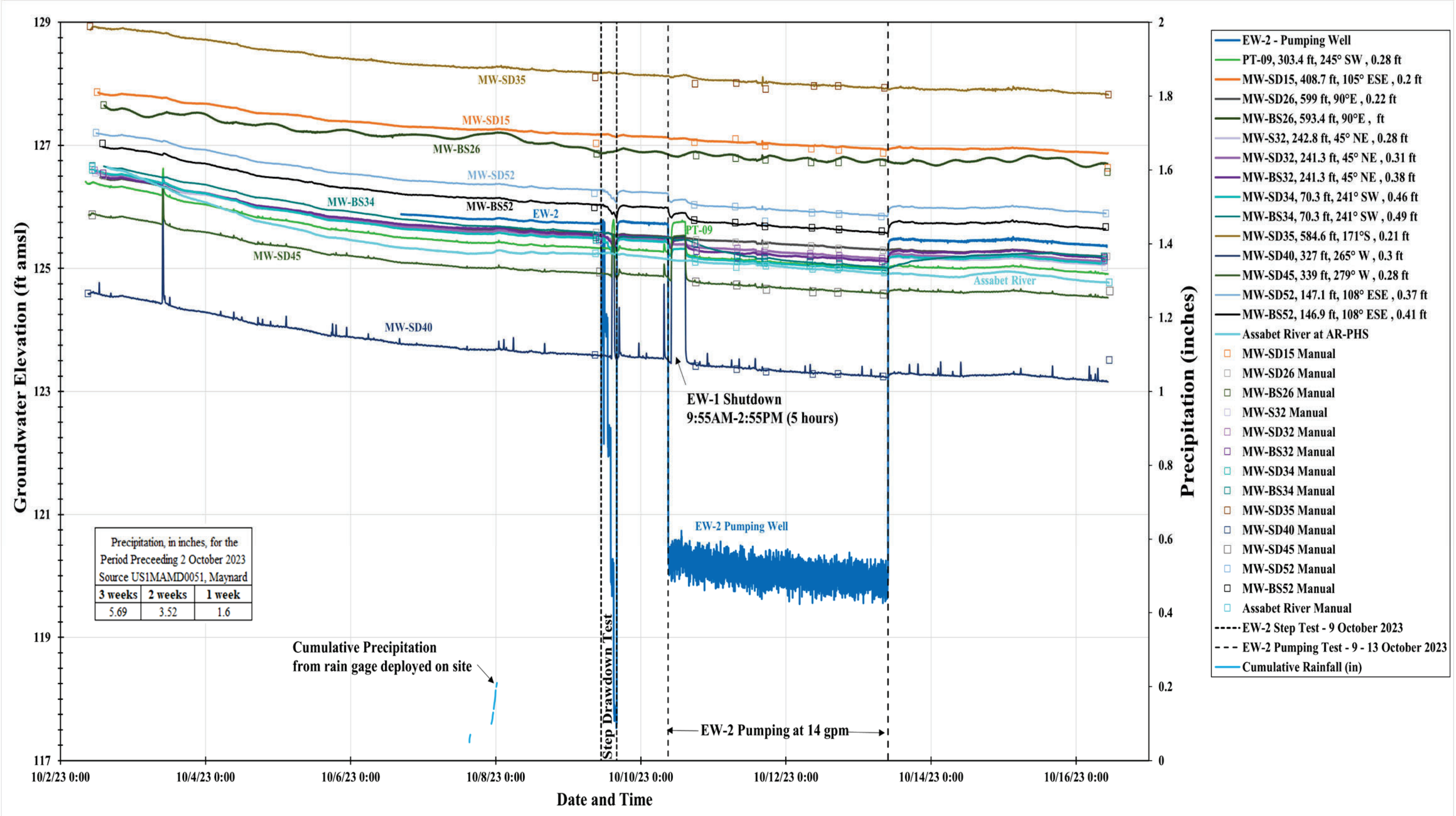
January 2024

Figure
E-4b

\\Boston-01\data\GIS\GISProjects\BR0090-NMISite\Projects\APRX\EW2_PumpingTest.aprx\Figure 2b - Pumping Contours and Capture Zone in BR (October 13) 1/30/2024 2:42 PM (Grace.Kane)



Notes:

1. The EW-2 pumping test was conducted between 9:00AM on 10 October and 9:45AM on 13 October 2023 at a rate of 14 gallons per minute (gpm).
2. Plot series (i.e. PT-09, 303.4 ft, 245 SW°, 0.28 ft) designate the well name, linear distance from well EW-2, compass bearing in degrees off North between well EW-2 and the respective well, and total drawdown observed during the test and uncorrected for ambient change.
3. Precipitation was recorded using a rain gage deployed on Site deployed on 2 October 2023. Data prior to 2 October 2023 are from National Climatic Data Center (NCDC), Station GHCND: US1MAMD0051, located in Maynard, Massachusetts.

amsl: above mean sea level
ft: feet
gpm: gallons per minute

EW-2 Pumping Test: Groundwater Elevation Data - All Wells – Uncorrected

Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

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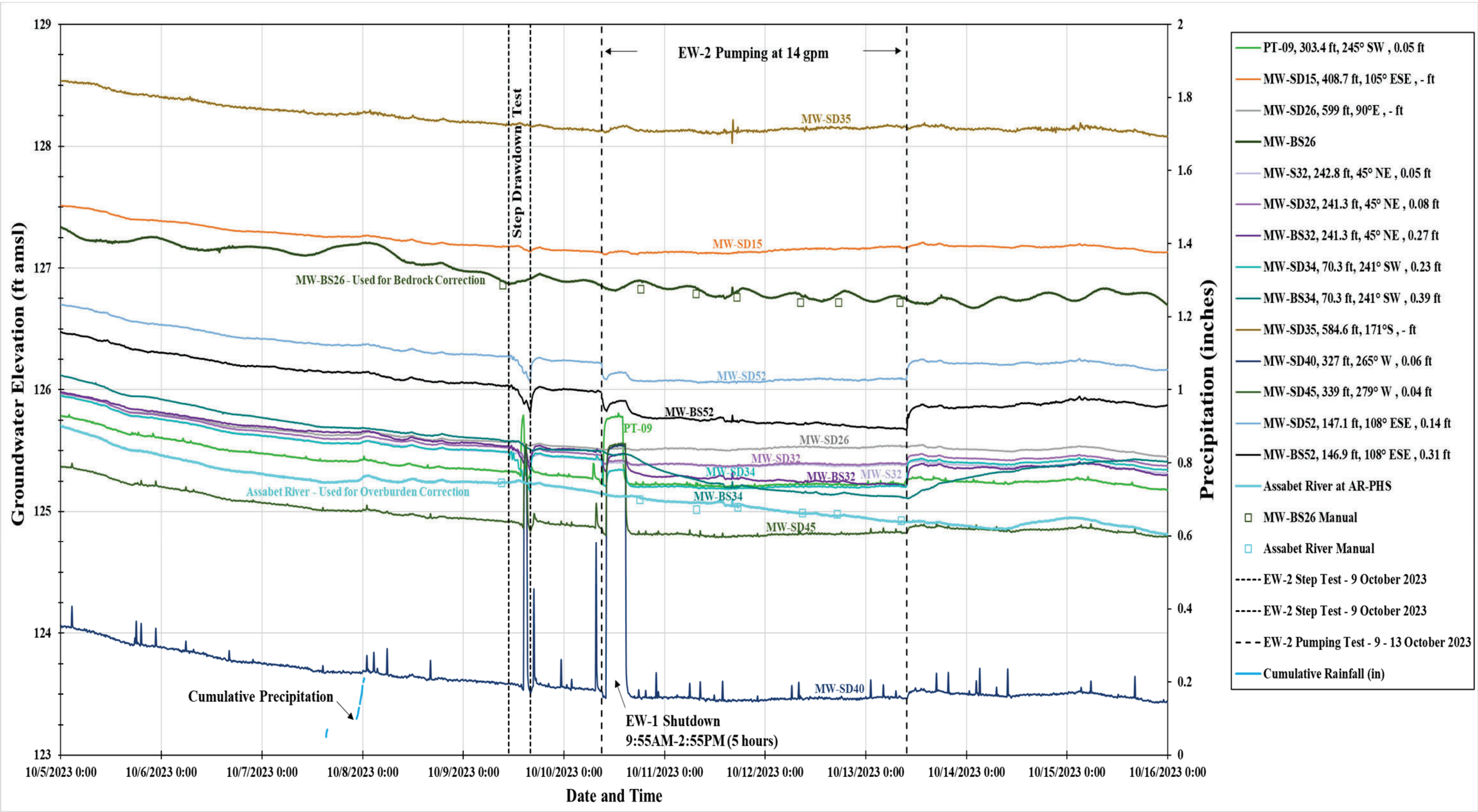
January 2024

Figure
E-5a



Notes:

1. The EW-2 pumping test was conducted between 9:00AM on 10 October and 9:45AM on 13 October 2023 at a rate of 14 gallons per minute (gpm).
2. Plot series (i.e. PT-09, 303.4 ft, 245 SW°, 0.28 ft) designate the well name, linear distance from well EW-2, compass bearing in degrees off North between well EW-2 and the respective well, and total drawdown observed during the test and uncorrected for ambient change.
3. Overburden wells groundwater elevations were corrected for ambient changes using the Assabet River stage recorded at the former Gravel Pit Pumphouse along Knox Trail (AR-PHS).
4. Bedrock well drawdowns were corrected for ambient changes in water level using data from well MW-BS26.
3. Precipitation was recorded using a rain gage deployed on Site.

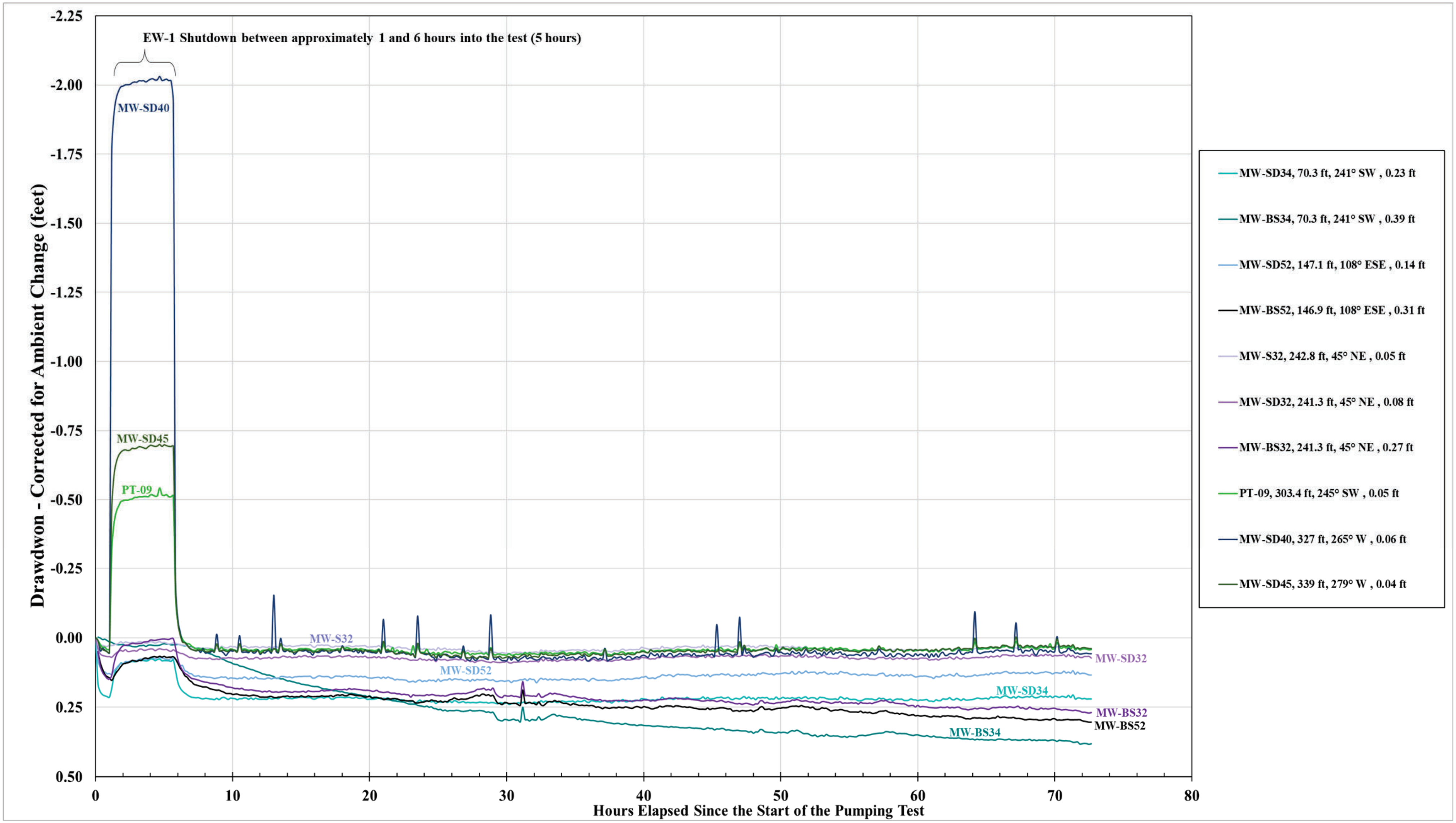
amsl: above mean sea level
ft: feet
gpm: gallons per minute

EW-2 Pumping Test: Groundwater Elevation Data - All Wells – Corrected
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

Geosyntec consultants

Acton, Massachusetts | January 2024

Figure
E-5b



Notes:

1. The EW-2 pumping test was conducted between 9:00AM on 10 October and 9:45AM on 13 October 2023 at a rate of 14 gallons per minute (gpm).
2. Plot series (i.e. PT-09, 303.4 ft, 245 SW°, 0.05 ft) designate the well name, linear distance from well EW-2, compass bearing in degrees off North between well EW-2 and the respective well, and total drawdown observed during the test and corrected for ambient change.
3. Overburden wells groundwater elevations were corrected for ambient changes using the Assabet River stage recorded at the former Gravel Pit Pumphouse along Knox Trail (AR-PHS).
4. Bedrock well drawdowns were corrected for ambient changes in water level using data from well MW-BS26.

EW-2 Pumping Test: Drawdown Corrected for Ambient Change
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

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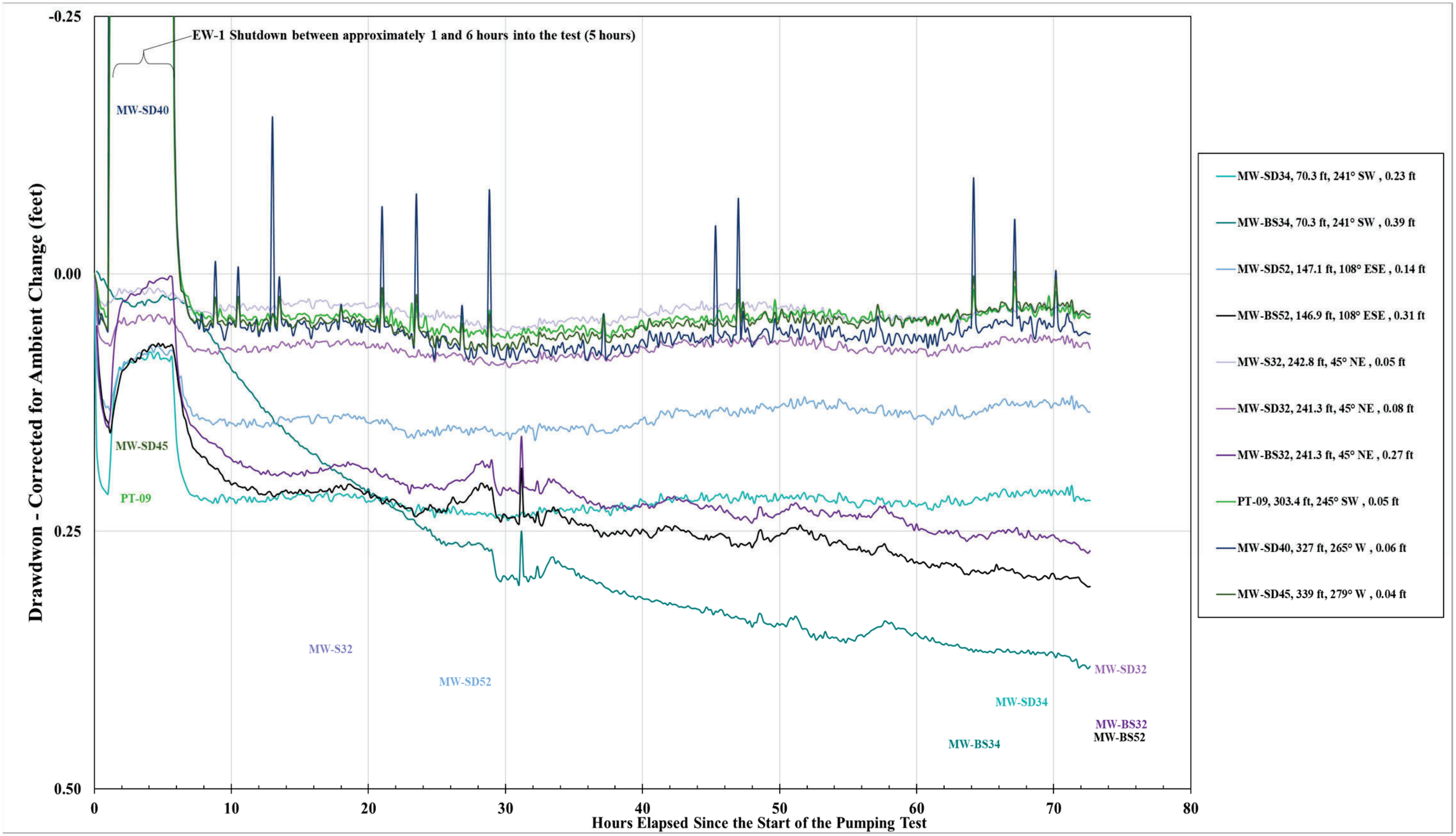
Figure
E-6a

Acton, Massachusetts
January 2024



Notes:

1. The EW-2 pumping test was conducted between 9:00AM on 10 October and 9:45AM on 13 October 2023 at a rate of 14 gallons per minute (gpm).
2. Plot series (i.e. PT-09, 303.4 ft, 245 SW°, 0.05 ft) designate the well name, linear distance from well EW-2, compass bearing in degrees off North between well EW-2 and the respective well, and total drawdown observed during the test and corrected for ambient change.
3. Overburden wells groundwater elevations were corrected for ambient changes using the Assabet River stage recorded at the former Gravel Pit Pumphouse along Knox Trail (AR-PHS).
4. Bedrock well drawdowns were corrected for ambient changes in water level using data from well MW-BS26.

EW-2 Pumping Test: Drawdown Corrected for Ambient Change (enlarged)

Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

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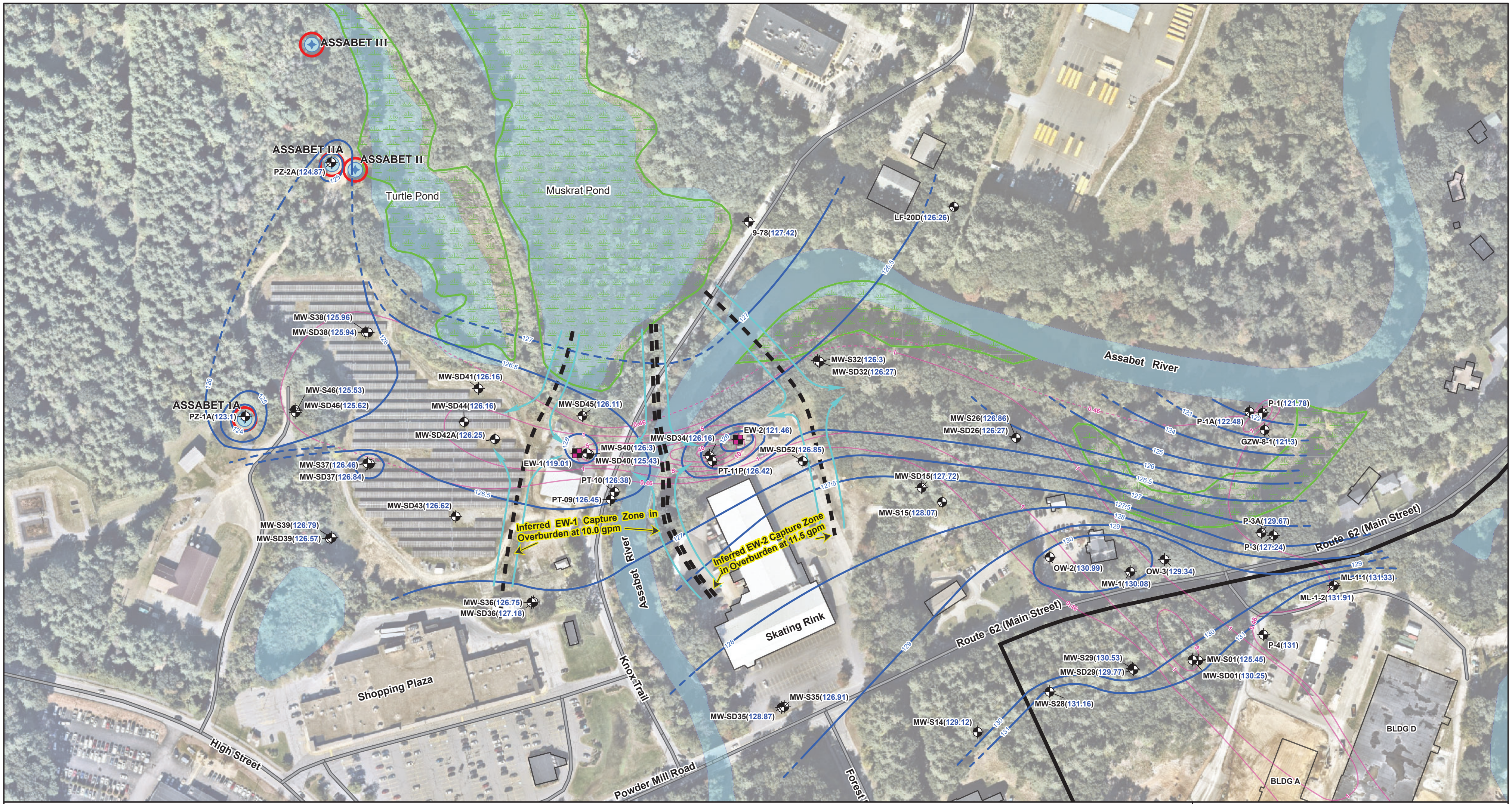
Acton, Massachusetts | January 2024

Figure

E-5b



Legend

Active Extraction Well	Active Public Water Supply Well	Wetlands
Extraction Well	Building Outline	Surface Water
Monitoring Well		Site Boundary

Pumping Contours (ft) - December 28, 2023

Estimated Pumping Contours (ft) - December 28, 2023

Inferred Groundwater Flow Direction

Estimated Capture Zone

1,4-Dioxane Isoconcentration Contour in Overburden Through April 2023 (µg/L)

Estimated 1,4-Dioxane Isoconcentration Contour in Overburden Through April 2023 (µg/L)

Notes:
1. The water level round was completed on 28 December 2023 over a 3.5 hour period as part of Startup Phase 3 of Knox Trail System Expansion.
2. Phase 3 began on 11 December 2023, at the following extraction rates: EW-1- 10 gallons per minute (gpm); EW-2 - 11.5 gpm; BEW-5 - 2.3 gpm.
3. During the water level round, the Acton Water District Assabet Wellfield municipal wells were pumping at the following rates: Assabet 1A - 200 gpm; Assabet 2 - 100 gpm; Assabet 2A - 130 gpm; Assabet 3 - 200 gpm.
4. Where multi-level wells are co-located at a single location, data from the deeper overburden well was used in drafting contours. Assabet River Stage at AR-PHS, and groundwater elevations shallow overburden locations MW-S15, MW-S26, MW-S35, MW-S36, MW-S40, PT-11P, P-3A, P-4, and GZW-8-1 were not used for contouring. The potentiometric contours are interpreted and may not represent actual flow directions or gradient.
5. The 1,4-dioxane distribution contours in overburden were inferred from the most recent data collected through April 2023.

N

0 200 Feet

Potentiometric Map and 1,4-Dioxane Distribution in Deep Overburden for the Expanded Knox Trail Extraction System

Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

Geosyntec consultants

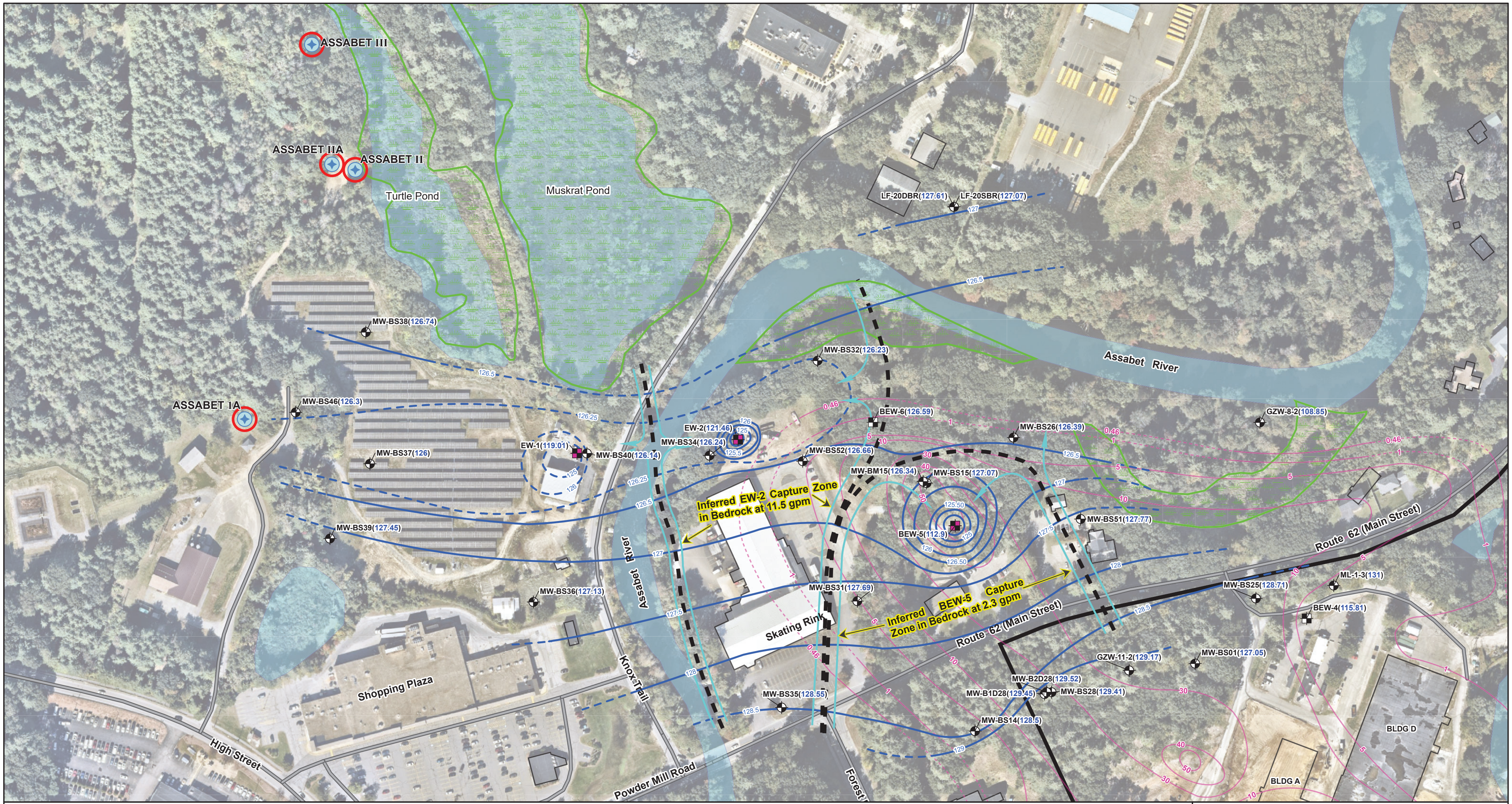
de maximis, inc.

Acton, Massachusetts

January 2024

Figure
E-7a

\\Boston-01\data\GIS\GISProjects\BR0090-NMISite\Projects\APRX\EW2_PumpingTest.aprx\GWE_Dec2028_OB 1/30/2024 2:42 PM (Grace.Kane)



Legend

■	Active Extraction Well
■	Extraction Well
⊕	Monitoring Well
◉	Active Public Water Supply Well
—	Building Outline
🟩	Wetlands
▭	Surface Water
▭	Site Boundary
—	Pumping Contours (ft) - December 28, 2023
– –	Estimated Pumping Contours (ft) - December 28, 2023
→	Inferred Groundwater Flow Direction
▬ ▪	Estimated Capture Zone
—	1,4-Dioxane Isoconcentration Contour in Bedrock Through April 2023 (µg/L)
- - -	Estimated 1,4-Dioxane Isoconcentration Contour in Overburden Through April 2023 µg/L)

Notes:
1. The EW-1 wellscreen extends from approximately 23 feet above the rock to 1 foot below the top of rock. The EW-2 is constructed with dual screens in overburden and bedrock separated by a 5-foot solid riser. The overburden screen extends from approximately 3 to 13 feet above the the top of rock. The bedrock wellscreen extends from approximately 2 to 12 feet below the top of rock. Although the bulk of water extracted from these wells is from the overburden, there is some water extracted from the bedrock and thus capture zones within the bedrock for these wells have been inferred from the water level data.
2. The water level round was completed on 28 December 2023 over a 3.5 hour period as part of Startup Phase 3 of Knox Trail System Expansion.
3. Phase 3 began on 11 December 2023, at the following extraction rates: EW-1 @ 10 gallons per minute (gpm); EW-2 @ 11.5 gpm; BEW-5 @ 2.3 gpm.
4. During the water level round, the Acton Water District Assabet Wellfield municipal wells were pumping at the following rates: Assabet 1A - 200 gpm; Assabet 2 - 100 gpm; Assabet 2A - 130 gpm; Assabet 3 - 200 gpm.
5. The potentiometric elevation contours are interpreted and may not represent actual flow directions or gradients.
6. The groundwater elevation at BarCad Well GZW-8-2 is unreliable and because BEW-6 is a 42-ft open bedrock borehole bedrock well BEW-6 is an water levels at these locations were not utilized. were not honored in drafting contours. In addition, potentiometric contours were not inferred near an operating open borehole extraction well BEW-4, and nearby wells MW-BS01, and ML-1-3 because of a limited dataset on the NMI property.
7. The 1,4-dioxane distribution contours in bedrock were inferred from the most recent data collected through April 2023.

N

0 200 Feet

Potentiometric Map and 1,4-Dioxane Distribution in Shallow Bedrock for the Expanded Knox Trail Extraction System

Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

Geosyntec consultants
de maximis, inc.

Acton, Massachusetts
January 2024

Figure
E-7b

\\Boston-01\data\GIS\GISProjects\BR0090-NMISite\Projects\APRX\EW2_PumpingTest.aprx\GWE_Dec2028_Bedrock 1/30/2024 2:42 PM (Grace.Kane)

PHOTO LOG

Client: de maximis, inc. **Project Number: BR0090E**

Site Name: Nuclear Metals, Inc. **Site Location: Concord, MA**

Drill Rig 1 **Date: 08/30/2023** **Direction: NE** **Comments: The drill rig used to create the borehole and install EW-2.**	
Drill Rig 2 **Date: 08/30/2023** **Direction: SE** **Comments: The drill rig used to create the borehole and install EW-2.**	

Client: de maximis, inc.	**Project Number: BR0090E**
Site Name: Nuclear Metals, Inc.	**Site Location: Concord, MA**

EW-2 Screen 1

Date: 09/01/2023

Direction: N/A

Comments: 8” diameter, 20-slot stainless steel vee-wire screen prior to EW-2 well assembly.

EW-2 Screen 2

Date: 09/01/2023

Direction: S

Comments: EW-2 well screen being lowered into well following assembly.

Client: de maximis, inc. **Project Number: BR0090E**

Site Name: Nuclear Metals, Inc. **Site Location: Concord, MA**

Soil Core

Date: 08/31/2023

Direction: N/A

Comments: Soil core recovered and logged during the process of drilling the EW-2 borehole.

APPENDIX F

Summary of Horizontal Directional Drilling, Piping and Vault Installation, Photolog, HDD Boring Logs, and Leak Testing Certification Report

Work for the installation of piping from the Knox Trail system (Knox Trail) to EW-2 and BEW-5 commenced in July 2023 and was completed in September 2023. Horizontal drilling and pipe installation was performed by DTI under contract to and oversight by Geosyntec. Vault installation and electrical and system connections were performed by various contractors hired by ***de maximis, inc***.

The first HDD boring installed was to the location of EW-2 and the second HDD installed was to BEW-5. Steps performed during each of these HDD borings are described below. Prior to the HDD work, several associated preliminary activities were performed; these are also described below.

- Preliminary Activities
    - Republic Services (Republic; formerly US Ecology, Inc. [1]) installed a protective steel road plate vertically in the path of the HDD on the western boundary of the Kinder Morgan easement for the gas pipeline. This plate was installed as a physical barrier to protect the gas line if the HDD drilling path deviated from the planned depth targets. The plate was installed per the design drawings approximately 15 feet west of the pipe. The plate was later removed by Republic.
    - Under direction of DTI, Republic constructed a HDD entry pit in the parking lot north of the Knox Trail treatment system building. Construction of this pit required removal of crushed stone covering the parking lot and the plastic supports for the stone. A pit that was approximately 20 feet by 20 feet and 4 feet deep. The purpose of this pit was to contain drilling fluid used for HDD.
    - Under direction of DTI, Republic excavated smaller exit pits for the HDD at exit locations near EW-2 and BEW-5. These exit pits were approximately 5 feet wide, 10 feet long and 3 feet deep. The purpose of constructing these pits was to collect drilling fluid which may emerge when the bit exits the ground.
    - Other minor preliminary activities were performed by Republic such as mobilization of a roll-off and vacuum truck for management/collection of drilling mud, assistance moving DTI drill rods, etc.
    - DTI mobilized to the Site on July 24, 2023 and a two-man crew welded sections of 6-inch, 2-inch and 1-inch diameter HDPE pipe which had been delivered the prior week. Sufficient HDPE was welded to meet the required lengths for HDD-installed pipe to EW-2 and BEW-5. Pipe welding was performed in the gravel west of the parking lot for Valley Sports. Welded sections of HDPE were snaked around the west and north sides of the parking lot at the tree line.
- HDD
    - DTI mobilized their drilling rig on August 7, 2023. After unloading and set-up, DTI started drilling from Knox Trail towards EW-2.
    - Drilling entailed advancing a pilot bit using mud rotary methods. The bit has a transponder which provided a signal to a DTI helper who walked across the ground surface above the bit receiving a signal using a handheld receiver. The depth and location of the bit was assessed and marked on the ground approximately every 20 feet where feasible (i.e., not under the Assabet River) to ensure the bit followed the design alignment and maintained depths greater than the minimum depth prescribed in the design. The helper marked the horizontal location of the HDD bit on the ground surface using pin flags, stakes or spray

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[1] US Ecology was acquired by Republic during the RA. For consistency, the RA Report refers to US Ecology/Republic as Republic. Despite the name change, US Ecology/Republic management and field personnel involved in the RA remained consistent throughout the project.

paint. The helper and driller were in continuous communication via radio such that the lead driller could steer the bit up/down or right/left as needed to maintain the target alignment and depth.

- Once the pilot hole to EW-2 was drilled, DTI attached a reaming bit that was pulled back through the pilot boring to enlarge the boring sufficiently to fit the pipe. After reaming, 6-inch HDPE pipe, which served as the chase for inner 1-inch and 2-inch pipes, was pulled from the EW-2 location back through the boring to Knox Trail. The 6-inch pipe was left as a stick-up on each end of the boring and was capped.
- On August 14, 2023, DTI mobilized a larger rig to perform HDD to BEW-5 since it was a longer distance (approximately 850 feet). The process for HDD and pipe installation to BEW-5 was the same as was used for pipe installation to EW-2 except for the following:
  - Pins on the larger rig broke during pilot drilling to BEW-5 which resulted in several days of delay until replacement pins were fabricated and installed.
  - Drilling paused prior to reaching the Kinder Morgan easement to coordinate with a Kinder Morgan representative who was required to be on-site as HDD progressed within the easement and below the pipeline.
  - When pulling the 6-inch HDPE pipe back through the boring, the steel swivel (which connects a cap on the HDPE pipe to drilling rods) broke. The swivel broke after approximately half (~400-feet) of the HDPE pipe had been pulled through the boring from BEW-5 toward Knox Trail. After spending ~1.5 days attempting to pull the HDPE out of the boring unsuccessfully, the DTI decided to abandon pipe stuck in the ground and re-drill the HDD between the point where the swivel broke and BEW-5. Redrilling involved pushing the drill bit through the initial HDD borehole from the entrance at Knox Trail toward BEW-5, until it approached the buried end of the stuck pipe. The bit was then steered to the side a few feet and then on a trajectory that advanced a new pilot boring parallel to and a few feet to the side of the stuck pipe. This new boring continued next to the stuck pipe until it emerged near BEW-5. The new pilot hole was then reamed.
  - The stuck pipe was then cut at the ground surface leaving ~450 feet of unused pipe. An additional 400-feet of 6-inch diameter HDPE pipe was mobilized to the site, welded and connected to the existing 6-inch pipe (i.e., 400 feet of new pipe was added to the ~450 feet of pipe which had not been pulled through the boring). The new (now 850-feet) of pipe was then successfully pulled through the new boring from BEW-5 to Knox Trail.
  - The ~400 feet of HDPE that remained stuck in the ground was decommissioned, with EPA approval, by filling with bentonite grout, cutting the pipe slightly below the ground surface and affixing a cap to the end of the pipe (the lower end of the pipe was also sealed by a cap that formed the connection to the shackle; this cap remained affixed to the pipe after the shackle broke).
- Following installation of 6-inch lines to EW-2 and BEW-5, Geosyntec surveyed the horizontal position of the HDD lines using a survey-grade hand-held GPS. The alignment of HDDs is provided as Figure 3.
- DTI installed two 2-inch diameter and two 1-inch diameter HDPE pipes in each of the 6-inch pipe chases. Inner pipes were installed by pushing drilling rods through the 6-inch pipe until they emerged at the EW-2 or BEW-5 ends of pipe. All four inner pipes were then affixed to the HDD drilling rods and the four pipes were pulled simultaneously through the 6-inch outer pipe from EW-2 or BEW-5 toward Knox Trail. Inner pipes were

  installed in the 6-inch pipe chase from EW-2 first and then into the pipe chase from BEW-5.
  - Following installation, inner 1- and 2-inch pipes were leak tested by B&F Water and Sewer Services, Inc. (a subcontractor to DTI) per the design specifications. Leak testing was performed under oversight of Geosyntec. All lines to EW-2 passed leak testing. One of the 2-inch lines to BEW-5 failed the initial leak test. Water could be heard leaking from the pipe during the test so DTI began pulling inner lines towards Knox Trail (while adding sections of pipe at BEW-5). After approximately 30 feet of pipe had been pulled, a slice in one of the 2-inch pipes was discovered along with a rock that had become wedged between pipes. It was presumed that this rock had penetrated the 2-inch line. After the rock was removed, 1- and 2-inch pipes from BEW-5 were trimmed to remove sections damaged by the rock, and all lines were retested by B&F Water and Sewer Services, Inc. The repaired lines all passed leak testing. Leak test reports are provided as an attachment to this construction summary.
  - DTI demobilized on September 15, 2023.

- Vault Installation and Piping Connections
  - While DTI was completing HDD work, the new extraction well, EW-2, was installed by Cascade. A description of work related to the installation and testing of EW-2 is provided in **Appendix E**.
  - Republic Services (formerly Republic) commenced installation of two 4-foot by 4-foot vaults at EW-2 and one 6-foot by 6-foot vault in the north parking lot of the Knox Trail system on September 18, 2023 once EW-2 was drilled and DTI had completed pipe installation and testing. Vaults were installed on compacted DGA and placed such that their lids were flush with the ground surface as required in the 100% Remedial Design. Contractor submittals for the DGA and vaults are provided in **Appendix G**.
  - By October 27, 2023, the following other components of remedial action construction had been completed:
    - Republic Services completed horizontal trenches and installed water pipes and electrical conduits to connect piping installed by DTI to the Knox Trail system and wells.
    - Plumbing connections in the vaults and for the Knox Trail system were completed by O&M, Inc.
    - Electrical conduit and wiring, as well as signal wiring and leak detection probes, were installed by the electrician.
    - Republic Services installed a small concrete pad and insulated fiberglass enclosure around the well head at BEW-5.
    - O&M, Inc. and/or Cascade set pumps in EW-2 and BEW-5, and made final connections at the wellheads.
    - O&M, Inc. bump tested pumps and performed shakedown and leak testing of piping in the vaults and new piping in the treatment plant.
    - Republic Services performed final clean-up including activities such as removing the steel road plate near at the Kinder Morgan easement, backfilling pits at either end of the HDD, repairing/graded the parking lot at Knox Trail, etc.

- Geosyntec was on-site at least weekly during the work above and inspected vaults, piping, etc. upon completion. All construction was performed per the design with the exception of limited deviations detailed in the RA Report.

Not a component of the design, but included as a component of the construction, the northern portion of the parking lot of Valley Sports was paved by the NMI Site as in-kind services for property access that was granted by Valley Sports. This included installing asphalt pavement around the well and HDD transition vaults at EW-2. Republic Services performed the paving and engineered grading so that vaults were set to be flush with the surface of new asphalt.

System construction and shakedown was completed by October 27, 2023. The system then transitioned into start-up operations. A log of photos showing HDD and vaults construction followvs.

GEOSYNTEC CONSULTANTS
Photographic Record

Client: DE MAXIMIS, INC	Project Number: BR0090C

Site Name: NMI Superfund Site
Site Location: Concord, MA

Photograph 1

Date:
August 10, 2023

Comments:
Entry pit at Knox Trail, directional drilling toward EW-2

Photograph 2

Date:
August 16, 2023

Comments:
Exit pit at EW-2 after completion of HDD, with end of installed 6-inch HDPE conduit visible

GEOSYNTEC CONSULTANTS
Photographic Record

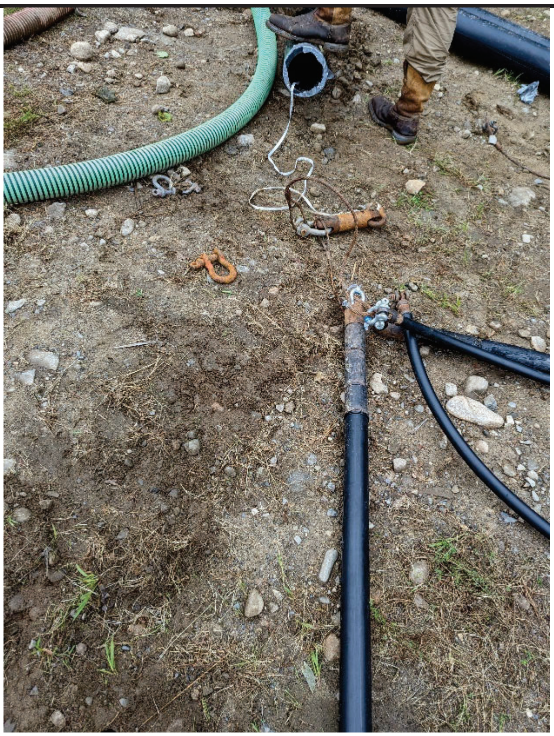
Client: DE MAXIMIS, INC	Project Number: BR0090C

Site Name: NMI Superfund Site
Site Location: Concord, MA

Photograph 3

Date:
August 16, 2023

Comments:
1-inch and 2-inch HDPE inner pipes preparing to be pulled through outer 6-inch HDPE pipe.



Photograph 4

Date:
August 22, 2023

Comments:
Entry pit at Knox Trail, directional drilling toward BEW-5

GEOSYNTEC CONSULTANTS
PHOTOGRAPHIC RECORD

Client: DE MAXIMIS, INC

Project Number: BR0090C

Site Name: NMI Superfund Site
Site Location: Concord, MA

Photograph 5

Date:
August 23, 2023

Comments:
6-inch HDPE pipe attached to steel swivel prior to being pulled back through HDD borehole from BEW-5 toward entry pit at Knox Trail.

Photograph 6

Date:
August 25, 2023

Comments:
Attempt to remove 6-inch HDPE pipe stuck in HDD borehole to BEW-5 after steel swivel broke

GEOSYNTEC CONSULTANTS

Photographic Record

Client: DE MAXIMIS, INC

Project Number: BR0090C

Site Name: NMI Superfund Site

Site Location: Concord, MA

Photograph 7

Date:
August 29, 2023

Comments:
DTI welding 6-inch HDPE pipe.

Photograph 8

Date:
September 14, 2023

Comments:
Two 2-inch and two 1-inch inner HDPE pipes installed in the 6-inch outer pipe at HDD exit pit near EW-2

GEOSYNTEC CONSULTANTS

Photographic Record

Client: DE MAXIMIS, INC

Project Number: BR0090C

Site Name: NMI Superfund Site

Site Location: Concord, MA

Photograph 9

Date:
September 14, 2023

Comments:
Inner 1-inch and 2-inch HDPE pipes installed in the 6-inch outer pipe at the HDD entry pit at Knox Trail

Photograph 10

Date:
October 10, 2023

Comments:
HDD entrance vault at Knox Trail prior to grading.

GEOSYNTEC CONSULTANTS

Photographic Record

Client: DE MAXIMIS, INC	Project Number: BR0090C

Site Name: NMI Superfund Site
Site Location: Concord, MA

Photograph 11

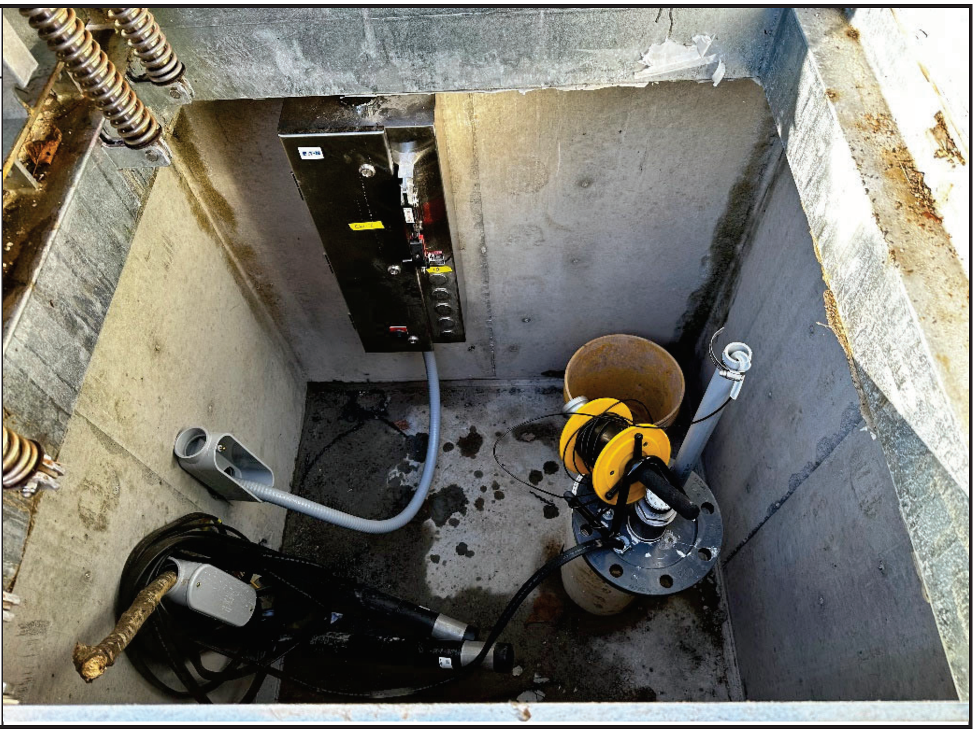
Date:
October 10, 2023

Comments:
EW-2 wellhead vault and HDD transition vault at EW-2 prior to grading and paving.

Photograph 12

Date:
October 10, 2023

Comments:
Interior of vault at EW-2



GEOSYNTEC CONSULTANTS

Photographic Record

Client: DE MAXIMIS, INC Project Number: BR0090C

Site Name: NMI Superfund Site
Site Location: Concord, MA

Photograph 13

Date:
October 10,2023

Comments:
HDD transition piping (left hand side), BEW-5 wellhead (right hand side), and concrete pad installed at BEW-5

Photograph 14

Date:
November 8, 2023

Comments:
Enclosure installed around HDD transition piping and BEW-5.

GEOSYNTEC CONSULTANTS

Photographic Record

Client: DE MAXIMIS, INC

Project Number: BR0090C

Site Name: NMI Superfund Site
Site Location: Concord, MA

Photograph 15

Date:
November 8, 2023

Comments:
EW-2 wellhead vault and HDD transition vault at EW-2 after paving

Photograph 16

Date:
November 8, 2023

Comments:
Interior of HDD transition vault near EW-2.

GEOSYNTEC CONSULTANTS

Photographic Record

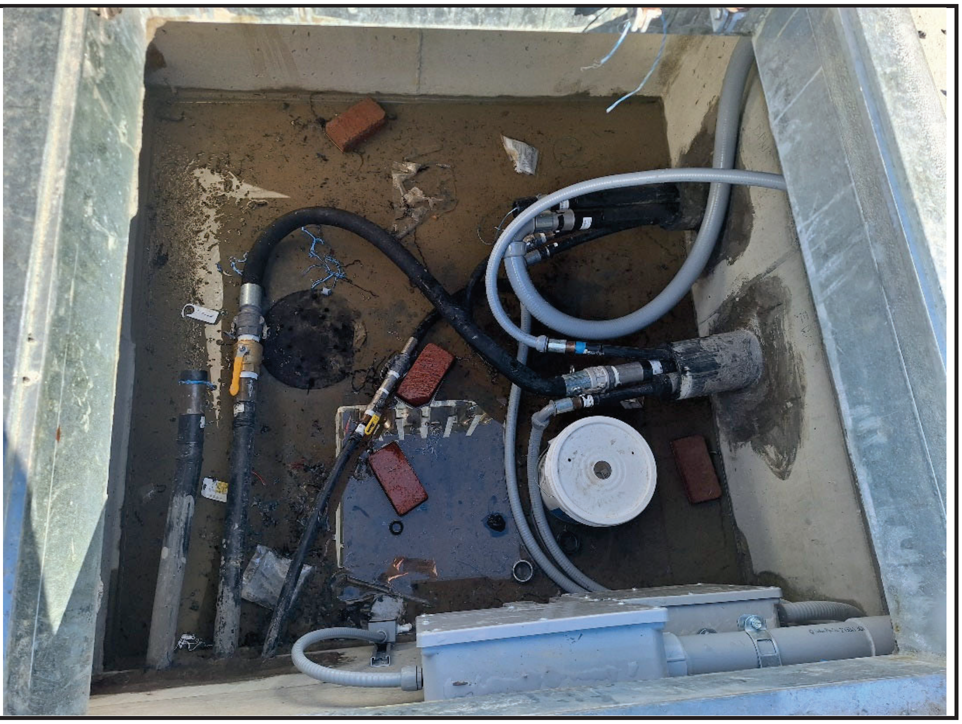
Client: DE MAXIMIS, INC	Project Number: BR0090C

Site Name: NMI Superfund Site
Site Location: Concord, MA

Photograph 17

Date:
November 8, 2023

Comments: Interior of HDD transition vault at Knox Trail.



HDD Soil Boring Log: HDD-EW-2

Boring ID: HDD-EW-2
Dates: 8/9/2023 - 8/10/2023
Drilling Co: DTI
Drilling Method: HDD
Rig Model: DitchWitch JT 2720 Mach 1
Rod Length: 10'
Hole Diameter: 8"
Locating Method: F2

Rod #	Linear Distance (ft)	Bit Depth (ft bgs)	Pitch (Bit Incliation, %)	Comment
1	10			in pit
2	20	5.83	-30	
3	30	9.42	-30	
4	40	12.34	-28	minor deflection
5	50	15.34	-30	
6	60	18.0	-34	
7	70	20.17	-36	
8	80	24.5	-38	
9	90	26.83	-34	Minor deflection
10	100	28.34	-30	
11	110	31.08	-25	
12	120	34.17	-20	
13	130	33.83	-11.5	
14	140	34.42	-7.6	Last rod w/ signal on west side of river. Deeper than design depth of 17.8 ft bgs at western bank.
15	150	River	-0.7	
16	160	River	1.1	
17	170	River	0.1	
18	180	River	1	
19	190	River	-0.7	
20	200	River	0.7	
21	210	River	0.4	
22	220	River	0	
23	230	River	0.4	
24	240	26.08	6.8	First rod w/ signal on east side of river. Deeper than design depth of 17.8 ft bgs at eastern bank
25	250	24.67	9.5	
26	260	23.5	10.5	
27	270	22.5	15.5	
28	280	22.0	21.5	
29	290	21.75	27	
30	300	21.42	27	
31	310	19.42	28	
32	320	17.5	20	
33	330	14.92	20.5	
34	340	15.25	15.5	
35	350	11.08	16.5	
36	360	8.17	18.5	
37	370			Exit pit
38	380			Exit pit
39	390			Exit pit
40	400			Exit pit

HDD Soil Boring Log: HDD-BEW-5

Boring ID:	HDD-BEW-5
Dates:	8/17/2023 - 8/21/2023
Drilling Co:	DTI
Drilling Method:	HDD
Rig Model:	DitchWitch JT 4020 Mach 1
Rod Length:	15'
Hole Diameter:	8"
Locating Method:	F2

Rod #	Linear Distance (ft)	Bit Depth (ft bgs)	Pitch (Bit Incliation, %)	Comment
1	15			in pit
2	30	11.33	-38	
3	45	16.67	-36	
4	60	20.67	-30	
5	75	22.42	-30	
6	90	26.75	-30	
7	105	32.25	-30	
8	120	35.83	-25	Last rod w/ signal on western side of river. Deeper than design depth of 16.7 ft bgs at western bank.
9	135	River	-20.5	
10	150	River	-15	
11	165	River	-9.5	
12	180	River	-4.2	
13	195	River	-2.3	
14	210	33.00	30	First rod on eastern river bank. Deeper than design depth of 17.8 ft bgs at eastern bank.
15	225	33.25	4.2	
16	240	33.5	2.4	
17	255	33	2.3	
18	270	38	2.9	
19	285	37.5	6.2	
20	300	36.5	6.4	
21	315	36.08	6.4	
22	330	35.08	5.8	
23	345	35.58	4.8	
24	360	--	--	
25	375	35.67	4.2	
26	390	35.5	2.4	
27	405	34.83	3.6	
28	420	34.8	4.6	
29	435	34.34	4.2	
30	450	34.25	0.6	
31	465	34.75	2.4	
32	480	34.5	1.3	
33	495	32.58	3.4	
34	510	32.08	3.6	
35	525	31.42	2.7	
36	540	30.5	5	
37	555	29.25	4.4	
38	570	28.34	1.9	

HDD Soil Boring Log: HDD-BEW-5

Boring ID: HDD-BEW-5
Dates: 8/17/2023 - 8/21/2023
Drilling Co: DTI
Drilling Method: HDD
Rig Model: DitchWitch JT 4020 Mach 1
Rod Length: 15'
Hole Diameter: 8"
Locating Method: F2

Rod #	Linear Distance (ft)	Bit Depth (ft bgs)	Pitch (Bit Incliation, %)	Comment
39	585	27	10	starts getting cobbles
40	600	24.92	14.5	
41	615	23	8.8	
42	630	21.25	9.5	
43	645	20.67	5.4	
44	660	19.75	5.2	
45	675	19	1	
46	690	20.08	0.2	within KM easement
47	705	20.5	-0.6	approximately under KM pipeline
48	720	22.25	-0.8	within KM easement
49	735	21	2.3	
50	750	20	15	
51	765	17.67	7.8	
52	780	14.92	12	
53	795	11.92	16.5	
54	810	8.5	19.5	
55	825	6.92	19	
56	840	3.42	19.5	
57	855	--	--	

B & F WATER & SEWER SERVICES, INC.
2 INDUSTRIAL DRIVE SOUTH, UNIT 1
SMITHFIELD, RI 02917
Phone (401) 231-0007
Fax (401) 231-4410

- LIVE WATER TAPS 3/4" to 12"
- CHLORINATING
- PRESSURE TESTING
- LIVE SEWER TAPS
- SEWER MAIN TESTING
- SEWER MANHOLE VACUUM TESTING

September 19, 2023

Directional Technologies, Inc.
77 North Plains Industrial Road
Wallingford, CT 06492

RE: Knox Trail,
Action, MA

On September 8th, 2023, we filled and flushed (4) 1" SDR11 Waterlines and (4) 2" SDR11 Waterlines.

Please be advised that our company performed pressure tests at the above location on September 8th, 2023

We pressure tested 880'+/- of 1" SDR35 and 880'+/- of 2" SDR35 @ 150 PSI for one (1) hour – PASSED.

We pressure tested 1,760'+/- of 1" SDR35 @ 150 PSI for one (1) hour – PASS.

On September 14th, 2023 we pressure tested 1,760'+/- of 2" SDR35 @ 150 PSI for one (1) hour.

Feel free to contact us with any questions.

Sincerely,

John P. Fogarty

John P. Fogarty
President

APPENDIX G

Approved Submittals

Geosyntec
family of companies

289 Great Road, Suite 202
Acton, MA 01720

SUBMITTAL RESPONSE

TO: Kurt Oosterman

ADDRESS:
190 Industrial Road
Wrentham, MA 02093
Kurt.Oosterman@usecology.com

Date: 11/22/2022	**Project No.:** BR0090C
NMI Superfund Site, Concord, MA	
Knox Trail Expansion	

Submittal I.D. No. 1	Revision No. 0	Contractor Submittal No. #57 Stone
Specification Section(s) Drawing C-09		Date of Submittal 11/21/22

Description

Submittals for #57 stone to be used in the access road to BEW-5

Notations:

☒ Approved
☐ Approved with Exceptions
☐ Rejected
☐ Revise and Resubmit
☐ Submit Specified Items

Remarks

Drawing C-09 calls for topping the road to BEW-5 with 12-inches of AASHTO #57 stone. AASHTO #57 stone is crushed stone aggregate with 100% of particles less than 1.5-inch diameter and 0% of particles passing the #4 sieve.

US Ecology submitted a particle-size curve for 1.5-inch crushed stone from Powell Stone & Gravel as well as a letter certifying that the material was from a virgin and uncontaminated source (attached).

The material is acceptable for the intended purpose and approved.

However, it is noted that the gradation data indicates that the 1.5-inch stone from Powell has a up to 4% particles >1.5-inch and may have a similarly-small fraction of particles finer than the specification. These small portions of particles outside of specification are not expected to affect roadway performance.

Carl R. Elder 11/22/22

Carl Elder
Digitally signed by Carl Elder
Date: 2022.11.22 15:45:32 -05'00'

Prepared by Carl R. Elder, Ph.D., PE (MA)	**Date**	**Engineer-of-Record** Carl R. Elder, Ph.D., PE (MA)	**Date**

POWELL STONE & GRAVEL CO., INC.

Kevin Sierra
Sales Representative

Direct Line: (978) 503-9321
dirtmerchant23@comcast.net

133 Leominster-Shirley Rd.
Lunenburg, MA 01462

Material: 1 1/2" Crushed Stone

Sieve Size		% Passing	MassDOT Specification M2.01.1
Metric	US Customary		
50.0 mm	2"	100	100
37.5 mm	1 1/2"	96	95-100
25.0 mm	1"	60	35-70
19.0 mm	3/4"	25	0-25
12.5 mm	1/2"	9	
9.5 mm	3/8"	6	
0.075 mm	#200	0.4	
Physical Properties			
Bulk Specific Gravity		2.691	
SSD Specific Gravity		2.706	
Apparent Specific Gravity		2.739	
Absorption (%)		0.370	
Dry Unit Weight (lbs/ft^3)		91.2	
Sodium Soundness Loss (%)		0	
LA Abrasion Loss (%)		13	
Flat & Elongated 5:1 (%)		10	
Fractured Faces (1 / 2)		100 / 100	

Notes:

1) Testing in accordance with C-136/T-27 Sieve Analysis of Fine and Coarse Aggregate, T-85 Specific Gravity and Absorption of Coarse Aggregate, T-104 Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate, T-96 Resistance to Degredation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine, D-4791 Flat or Elongated Particles in Coarse Aggregate.
2) All testing performed under the direct supervision of NETTCP a certified Technician
3) Testing performed in P.J. Keating's laboratory meeting state specifications.
4) Additional information can be provided upon request.

Report Generated On: 11/18/2021

POWELL STONE & GRAVEL CO.
133 Leominster-Shirley Road
Lunenburg, MA 01462

November 21, 2022

US Ecology
185 Industrial Rd.
Wrentham, MA 02093

Re: Clean Stone Certification

Powell Stone & Gravel certifies that the crushed stone products we will be providing to your project at NMI Concord, MA is certified clean. It originates from a "virgin" quarry located at Lancaster St, Lunenburg MA. This "virgin" area has no known contamination and has been logged, stumped, and stripped in order to manufacture crushed stone products.

Thank you for your consideration in this matter.

Sincerely,

Steve Powell
VP
Powell Stone & Gravel
978.537.8100

S. Powell
Authorized Representative - sign

11/21/2022
Date

Geosyntec
family of companies

289 Great Road, Suite 202
Acton, MA 01720

SUBMITTAL RESPONSE

TO: Kurt Oosterman

ADDRESS: 190 Industrial Road
Wrentham, MA 02093
Kurt.Oosterman@usecology.com

Date: 11/23/2022
Project No.: BR0090C
NMI Superfund Site, Concord, MA
Knox Trail Expansion

Submittal I.D. No. 2	Revision No. 0	Contractor Submittal No. Compacted DGA
Specification Section(s) Drawing C-09		Date of Submittal Sept 1, 2022

Description

Submittals for dense grade aggregate (DGA) previously used at the site that will be used again for (1) the access road to BEW-5 and (2) beneath vaults for the Knox Trail Expansion.

Notations:

☒ Approved
☐ Approved with Exceptions
☐ Rejected
☐ Revise and Resubmit
☐ Submit Specified Items

Remarks

DGA is specified on drawing C-09 for use in the access road and on drawings C-06 and C-07 for beneath vaults. Attached is the compaction curve for DGA previously used at the site which is **approved for use on the Knox Trail Expansion project.**

Please note that compaction requirements for DGA used in the access road are very specific – read note 2 below detail 4 on sheet C-09

Carl R. Elder

11/23/22

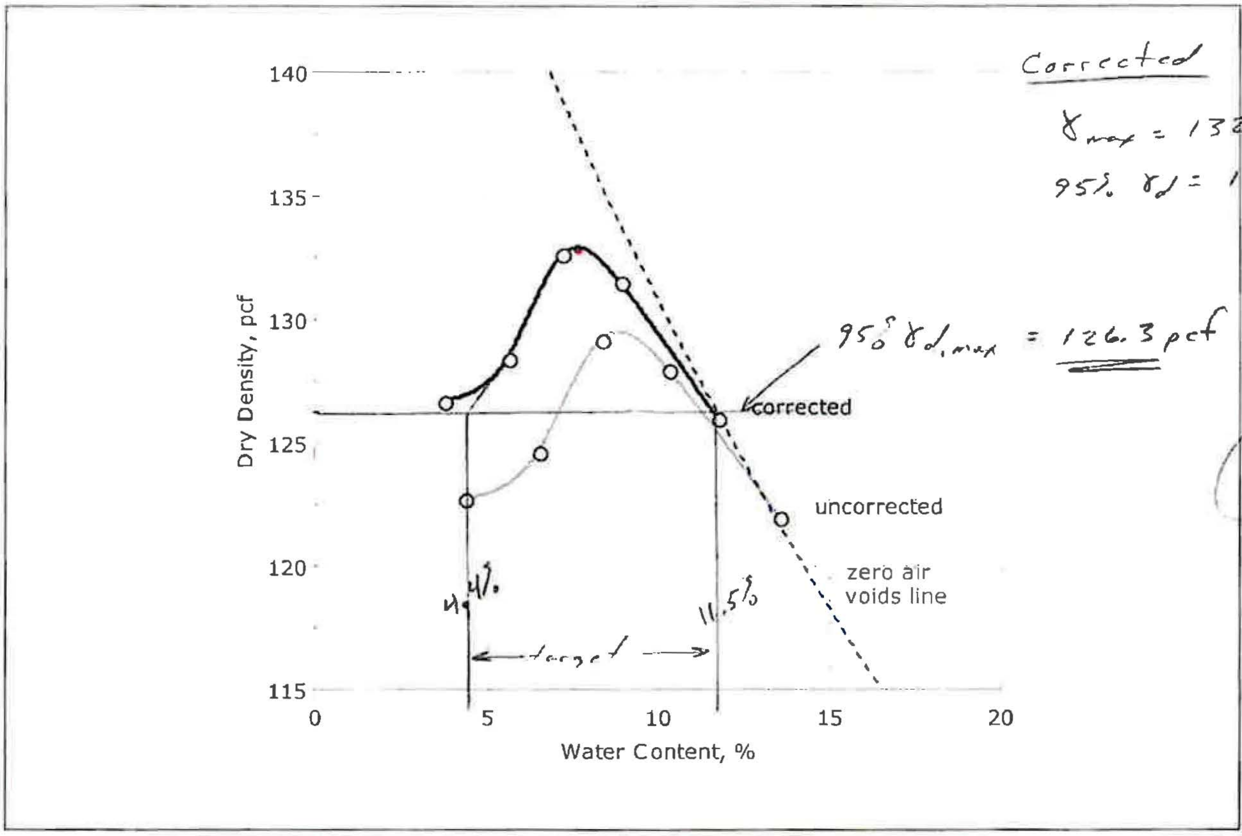
Carl Elder
Digitally signed by Carl Elder
Date: 2022.11.23 16:09:32 -05'00'

Prepared by Carl R. Elder, Ph.D., PE (MA)	**Date**	**Engineer-of-Record** Carl R. Elder, Ph.D., PE (MA)	**Date**

GeoTesting EXPRESS

Client: De Maximis, Inc.
Project: NMI
Location: Concord, MA
Project No: GTX-315636
Boring ID: ---
Sample Type: bucket
Tested By: cwd
Sample ID: TPD6A08302022
Test Date: 09/01/22
Checked By: ank
Depth : ---
Test Id: 684192
Test Comment: ---
Visual Description: Moist, brown silty sand with gravel
Sample Comment: ---

Compaction Report - ASTM D1557



Corrected

γ_{max} = 132.9 pcf

95% γ_d = 126.3 pcf

95% $\gamma_{d,max}$ = 126.3 pcf

CRB
9/1/22

Data Points	Point 1	Point 2	Point 3	Point 4	Point 5
Dry density, pcf	122.7	124.6	129.2	128.0	122.0
Moisture Content, %	4.4	6.5	8.3	10.3	13.6

Method : C
Preparation : DRY
As received Moisture :4 %
Rammer : Mechanical
Zero voids line based on assumed specific gravity of 2.65

Maximum Dry Density= 129.5 pcf
Optimum Moisture= 8.8 %

Oversize Correction (14% > 3/4 inch Sieve)

Corrected Maximum Dry Density= 132.9 pcf
Corrected Optimum Moisture= 7.6 %
Assumed Average Bulk Specific Gravity = 2.55

printed 9/1/2022 3:17:25 PM

Geosyntec
family of companies

289 Great Road, Suite 202
Acton, MA 01720

SUBMITTAL RESPONSE

TO: Kurt Oosterman
ADDRESS: 190 Industrial Road
Wrentham, MA 02093
Kurt.Oosterman@usecology.com

Date: 12/5/2022	**Project No.:** BR0090C
NMI Superfund Site, Concord, MA	
Knox Trail Expansion	

Submittal I.D. No. 3	Revision No. 0	Contractor Submittal No. 4x4 vaults at EW-2
Specification Section(s) Drawing C-06 and C-07		Date of Submittal Dec 2, 2022

Description

Submittals for 4-foot by 4-foot vaults to be used as the transition vault near EW-2 and the well vault for EW-2. These vaults are the same as used for BEW-2, 3 and 4 at the 2221 Main Street site but for having steel lids

Notations:

☒ Approved
☐ Approved with Exceptions
☐ Rejected
☐ Revise and Resubmit
☐ Submit Specified Items

Remarks

The attached shop drawings are **approved for use on the Knox Trail Expansion project**. Please be certain that these vaults are installed with the steel HS20 lids and not the aluminum lids used at the 2221 Main Street site.

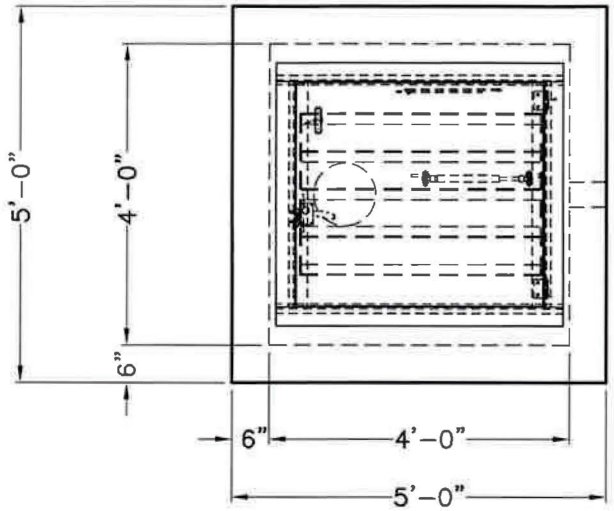
	12/2/22	Carl R. Elder	12/2/22
Prepared by Carl R. Elder, Ph.D., PE (MA)	**Date**	**Engineer-of-Record** Carl R. Elder, Ph.D., PE (MA)	**Date**

SHEA CONCRETE PRODUCTS

New England's Premier Precaster
800-696-7432 (SHEA)
www.sheaconcrete.com

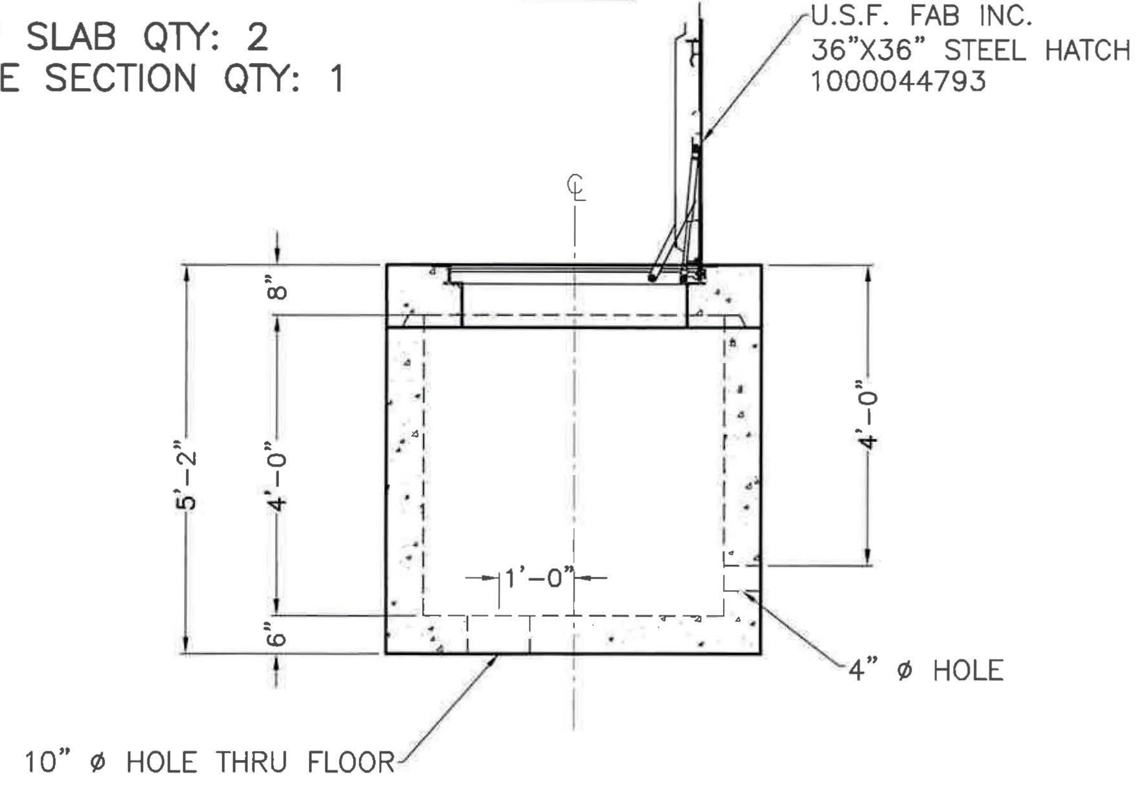
MAILING ADDRESS: 87 HAVERHILL RD AMESBURY, MA 01913

NMI SUPERFUND SITE
EXTRACTION WELL VAULT
4' X 4' X 4' ID W/ STEEL HATCH



PLAN

TOP SLAB QTY: 2
BASE SECTION QTY: 1



ELEVATION

NOTES:

1. CONCRETE: 5,000 PSI MINIMUM AFTER 28 DAYS.
2. DESIGN LOADING: AASHTO HS20-44.
3. STEEL REINFORCEMENT CONFORMS TO ASTM A615, GRADE 60.

SHEA PRODUCT ID: MH-444	FILE NAME: EXTRACTION WELL 4X4X4 - STEEL		
WEIGHT (LBS): 9,450	DRAWN BY: L.P.	DATE: 8/26/2022	PAGE: 1 OF 1

NPCA CERTIFIED PLANT

Geosyntec
family of companies

289 Great Road, Suite 202
Acton, MA 01720

SUBMITTAL RESPONSE

TO: Kurt Oosterman
ADDRESS: 190 Industrial Road
Wrentham, MA 02093
Kurt.Oosterman@usecology.com

Date: 12/2/2022	**Project No.:** BR0090C
NMI Superfund Site, Concord, MA	
Knox Trail Expansion	

Submittal I.D. No. 4	Revision No. 0	Contractor Submittal No. 6x6 vaults at Treatment Bld.
Specification Section(s) Drawing G-03 and C-07		Date of Submittal Dec 2, 2022

Description

Submittals for 6-foot by 6-foot vaults to be used as the transition vault near the treatment building.

Notations:

☒ Approved
☐ Approved with Exceptions
☐ Rejected
☐ Revise and Resubmit
☐ Submit Specified Items

Remarks

The attached shop drawing is **approved for use on the Knox Trail Expansion project.**

This vault is designed with a sump. The sump is not required but acceptable to include.

It's not stated, but I assume US Ecology will core holes for piping in/out of the vault which is acceptable.

Carl R. Elder

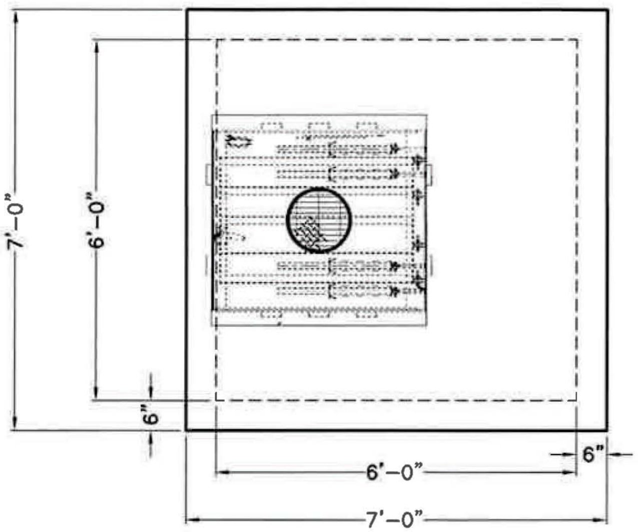
	12/2/22		12/2/22
Prepared by Carl R. Elder, Ph.D., PE (MA)	**Date**	**Engineer-of-Record** Carl R. Elder, Ph.D., PE (MA)	**Date**

SHEA CONCRETE PRODUCTS

New England's Premier Precaster
800-696-7432 (SHEA)
www.sheaconcrete.com

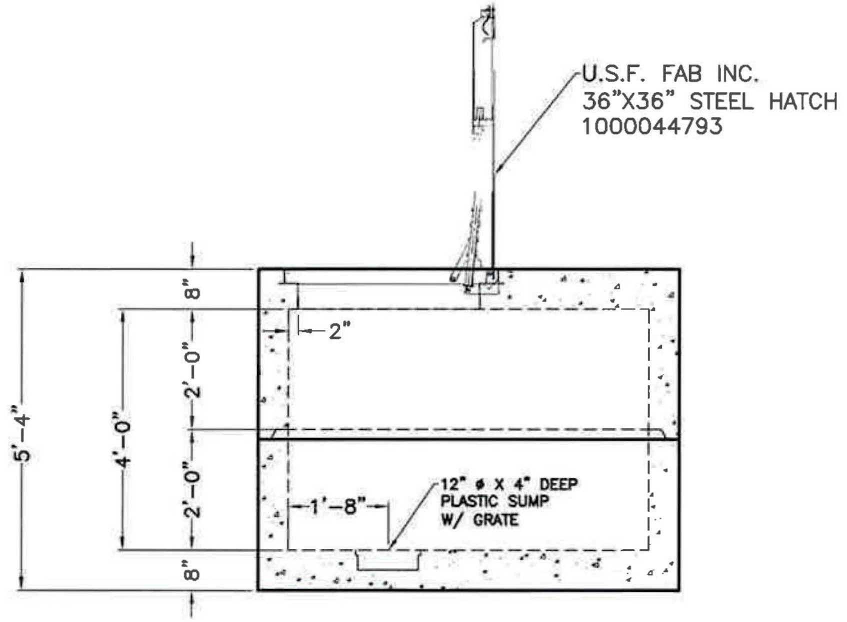
MAILING ADDRESS: 87 HAVERHILL RD AMESBURY, MA 01913

NMI SUPERFUND SITE
KNOX TRAIL VAULT
6' X 6' X 4' ID W/ STEEL HATCH



PLAN

QTY: 1



U.S.F. FAB INC.
36"X36" STEEL HATCH
1000044793

12" ø X 4" DEEP
PLASTIC SUMP
W/ GRATE

ELEVATION

NOTES:

1. CONCRETE: 5,000 PSI MINIMUM AFTER 28 DAYS.
2. DESIGN LOADING: AASHTO HS20-44.
3. STEEL REINFORCEMENT CONFORMS TO ASTM A615, GRADE 60.

SHEA PRODUCT ID: MH-667
FILE NAME: KNOX TRAIL 6X6 – STEEL
WEIGHT (LBS): 17,000
DRAWN BY: L.P.
DATE: 8/31/2022
PAGE: 1 OF 1

NPCA CERTIFIED PLANT

773 Salem Street–Wilmington, MA | 153 Cranberry Hwy–Rochester, MA | 87 Haverhill Road–Amesbury, MA | 160 Old Turnpike Rd–Nottingham, NH

Specifications subject to change without notice

Geosyntec
family of companies

289 Great Road, Suite 202
Acton, MA 01720

SUBMITTAL RESPONSE

TO: Kurt Oosterman

ADDRESS:
190 Industrial Road
Wrentham, MA 02093
Kurt.Oosterman@usecology.com

Date: 12/2/2022 **Project No.:** BR0090C
NMI Superfund Site, Concord, MA
Knox Trail Expansion

Submittal I.D. No. 5	Revision No. 0	Contractor Submittal No.	Geotextile for road.
Specification Section(s) Drawing C-09		Date of Submittal	Dec 2, 2022

Description

Geotextile used for the road between native soils and #57 stone or DGA

Notations:

☒ Approved
☐ Approved with Exceptions
☐ Rejected
☐ Revise and Resubmit
☐ Submit Specified Items

Remarks

Drawings call for a 32 oz/yd^2 geotextile between native soils and imported structural materials. US Ecology has proposed a <u>double layer</u> of the attached 16 oz/yd^2 geotextile as an equivalent

The proposed equivalent material is **approved for use on the Knox Trail Expansion project**.

It is noted that geotextile rolls are 15-feet wide whereas the road is 10-feet wide resulting in extra fabric (except where the roadway is elevated over the gas line). Geotextile must underlay the full width of the road but excess geotextile may not be left at the ground surface. US Ecology may trim the excess material or procure 10-foot-wide rolls. Alternatively, it is acceptable to place a portion of the excess up excavation sidewalls where the road in constructed in a 1-foot cut into the native soils, and/or fold the geotextile so that excess material is below the roadway.

Carl R. Elder

	12/2/22		12/2/22
Prepared by Carl R. Elder, Ph.D., PE (MA)	**Date**	**Engineer-of-Record** Carl R. Elder, Ph.D., PE (MA)	**Date**

U S C F

US CONSTRUCTION FABRICS LLC

8 Ledge Rd, Windham, NH 03087 (603) 893-5480, Fax (603) 893-2154

www.usconstructionfabrics.com

Wholesale Distribution ***CONSTRUCTION FABRICS, LINERS, & ENVIRONMENTAL PRODUCTS***

SKAPS

Geotextile Product Description Sheet

SKAPS GT-116
Nonwoven Geotextile

SKAPS GT-116 is a needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, which are formed into a random network for dimensional stability. SKAPS GT-116 resists ultraviolet deterioration, rotting, biological degradation, naturally encountered basics and acids. Polypropylene is stable within a pH range of 2 to 13. SKAPS GT-116 conforms to the physical property values listed below:

PROPERTY	TEST METHOD	UNIT	M.A.R.V. (Minimum Average Roll Value)
Weight (Typical)	ASTM D 5261	oz/yd^2 (g/m^2)	16.0 (542)
Grab Tensile	ASTM D 4632	lbs (kN)	380 (1.69)
Grab Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	lbs (kN)	145 (0.644)
CBR Puncture Resistance	ASTM D 6241	lbs (kN)	1080 (4.82)
Permittivity*	ASTM D 4491	sec^{-1}	0.7
Water Flow*	ASTM D 4491	gpm/ft^2 (l/min/m^2)	50 (2035)
AOS*	ASTM D 4751	US Sieve (mm)	100 (0.150)
UV Resistance	ASTM D 4355	%/hrs	70/500

PACKAGING	
Roll Dimensions (W x L) – ft	15 x 150
Square Yards Per Roll	250
Estimated Roll Weight – lbs	250

* At the time of manufacturing. Handling may change these properties.

Made in U.S.A.

12/23/09

Carl Elder

From: Carl Elder
Sent: Friday, September 1, 2023 9:28 AM
To: Donald Bond; Rob Danckert
Cc: David Adilman; Dariusz Chlebica; George Wanjiru; Matt Osterberg; Carl Elder
Subject: RE: NMI: EW-2 installation
Attachments: sand spec sheet pg 1.pdf

Thanks Don and Rob,

Looking at the particle sizes for the Holliston sands on the sheet provided (and re-attached), and given we have a 20-slot (0.7 mm) screen, construct the well using:

- **0S for the filter sand around the screen**
- **000S for the chocker sand**

I have instructed George on this.

Also, do not use the 00S sand.

Carl

From: Donald Bond <DBond@cascade-env.com>
Sent: Friday, September 1, 2023 9:16 AM
To: Rob Danckert RDanckert@cascade-env.com; Carl Elder CElder@Geosyntec.com
Cc: David Adilman DAdilman@Geosyntec.com; Dariusz Chlebica DChlebica@Geosyntec.com; George Wanjiru <GWanjiru@Geosyntec.com>; Matt Osterberg <mosterberg@cascade-env.com>
Subject: RE: NMI: EW-2 installation

Hello,
That is the sand that I ordered. Didn't have an indication it was different mfg from our supplies..... They just sent me the sand curve- attached.

Groundwater Supply Co., Inc.
"The Drill Store"
Phone: (978)-422-3209 Fax: (978)-422-6055

SAMPLE PRODUCT DATA SHEET - 6/13/2007

PRODUCT NAME

MM	US Sieve Number	000S % Retained	000S % Passed	00S % Retained	00S % Passed	0S % Retained	0S % Passed	1S % Retained	1S % Passed	2S % Retained	2S % Passed	3S % Retained	3S % Passed
	1/2												
	3/8												
6.300	1/4												100.00
4.750	4										100.00	0.70	99.30
3.350	6									0.80	99.20	13.70	85.60
2.360	8								100.00	2.20	97.00	44.10	41.50
1.700	12						100.00	6.20	93.80	40.90	56.10	34.30	7.20
1.180	16				100.00	5.20	94.80	58.50	35.30	45.90	10.20	5.80	1.40
0.850	20	0.00	100.00	3.10	96.90	45.70	49.10	31.50	3.80	8.40	1.80		
0.600	30	2.00	98.00	49.90	47.00	42.10	7.00	2.50	1.30	0.10	1.70		
0.425	40	23.60	74.40	41.90	5.10	5.85	1.15						
0.300	50	37.50	36.90	4.50	0.60								
0.212	70	24.30	12.60										
0.150	100	9.80	2.80										
Effective Size:		~ 0.20		~ 0.50		~ 0.60		~ 0.90		~ 1.20		~1.7	
Uniformity Coefficient:		~ 2.0		~ 1.50		~ 1.50		~ 1.50		~ 1.50		~ 1.50	

Choker Sand

Filter Pack

APPENDIX H

Knox Trail Treatment System Start-up Analytical Sampling Results

Knox Trail Treatment System Sampling Results - General Chemistry
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

		Location	**EFF**		**BVAN**	**AVAN**		**JIMV**		**ACARB**		**EFF**		**JIME**	
		Sample Date	**12/20/2023**		**01/24/2024**	**01/24/2024**		**01/24/2024**		**01/24/2024**		**01/24/2024**		**01/24/2024**	
Parameter	**Total (T) or Dissolved (D)**	**Test Method**													
General Chemistry (ug/L)															
Petroleum Hydrocarbons C10-C36	T	EPA 1664B	< 4000	U	--	--		--		--		--		--	
Total Dissolved Solids	D	SM 2540C	470000		--	--		--		--		--		--	
Total Organic Carbon	T	SM 5310C	--		546	305	J	313	J	220	J	588		479	J
Total Suspended Solids (TSS)	T	SM 2540D	< 5000	U	--	--		--		--		--		--	

		Location	**BEW-5**		**EW-1**		**EW-2**		**BVAN**		**AVAN**		**EFF**		**BVAN**		**AVAN**		**ACARB**		**EFF**	
		Sample Date	**01/30/2024**		**01/30/2024**		**01/30/2024**		**01/30/2024**		**01/30/2024**		**01/30/2024**		**01/31/2024**		**01/31/2024**		**01/31/2024**		**01/31/2024**	
Parameter	**Total (T) or Dissolved (D)**	**Test Method**																				
General Chemistry (ug/L)																						
Petroleum Hydrocarbons C10-C36	T	EPA 1664B	--		--		--		--		--		--		--		--		--		--	
Total Dissolved Solids	D	SM 2540C	--		--		--		--		--		--		--		--		--		--	
Total Organic Carbon	T	SM 5310C	157	J	< 500	U	121	J	< 500	U	112	J	171	J	< 500	U	< 500	U	< 500	U	< 500	U
Total Suspended Solids (TSS)	T	SM 2540D	--		--		--		--		--		--		--		--		--		--	

Notes:

1) The data is not validated

-- = Not analyzed
J = Estimated value. Analyte detected at a level less than the reporting limit and greater than or equal to the method detection limit. This data is of limited reliability.
U = Analyte not detected at or above the reporting limit.
DUP = QA/QC - Duplicate Sample
EFF = Effluent of Treatment System
INF = Influent of Treatment System
BVAN = Knox Trail Before Vanox
AVAN = Knox Trail After Vanox
BCARB = Knox Trail Before Carbon
ACARB = Knox Trail After Carbon
JIMV = Knox Trail After Vanox Duplicate (Duplicate of AVAN)
JIME = Knox Trail Effluent Duplicate (Duplicate of EFF)
BEW5 = Extraction well BEW5
EW1 = Extraction well EW1
EW2 = Extraction well EW2

Knox Trail Treatment System Sampling Results - Metals
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

		Location	**EFF**		**INF**		**AVAN**		**ACARB**		**EFF**	
		Sample Date	**12/20/2023**		**01/17/2024**		**01/17/2024**		**01/17/2024**		**01/17/2024**	
Metals (ug/L)												
Parameter	**Total or Dissolved**	**Test Method**										
Arsenic	D	EPA 200.8	--		0.7	J	0.5	J	0.4	J	0.4	J
Arsenic	T	EPA 200.8	< 1.00	U	1.22		0.48	J	0.58	J	0.56	J
Beryllium	D	EPA 200.8	--		< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U
Beryllium	T	EPA 200.8	--		< 1.00	U	< 1.00	U	< 1.00	U	< 1.00	U
Calcium	D	EPA 200.7	--		51400		49200		48900		48100	
Calcium	T	EPA 200.7	--		52700		51300		51800		52900	
Chromium	D	EPA 200.8	--		< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U
Chromium	T	EPA 200.8	< 1.00	U	0.85	J	0.81	J	0.96	J	0.88	J
romium, Hexaval	D	SW-846 7196A	< 10	U	--		--		--		--	
Copper	T	EPA 200.8	< 1.00	U	--		--		--		--	
Iron	D	EPA 200.8	--		1185		< 50.0	U	< 50.0	U	< 50.0	U
Iron	T	EPA 200.8	< 50.00	U	2016		< 50.00	U	< 50.00	U	< 50.00	U
Lead	D	EPA 200.8	--		< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U
Lead	T	EPA 200.8	< 1.00	U	< 1.00	U	< 1.00	U	< 1.00	U	< 1.00	U
Manganese	D	EPA 200.8	--		439.1		0.6	J	< 1.0	U	< 1.0	U
Manganese	T	EPA 200.8	< 1.00	U	465.0		< 1.00	U	< 1.00	U	< 1.00	U
Nickel	D	EPA 200.8	--		3.7		0.9	J	< 2.0	U	< 2.0	U
Nickel	T	EPA 200.8	--		4.22		4.10		< 2.00	U	< 2.00	U
Sodium	D	EPA 200.8	--		26400		66400		59770		62820	
Sodium	T	EPA 200.8	--		26860		63870		70690		69800	
Uranium	T	CALC	--		--		--		--		--	
Uranium-235	T	SW-846 6020	--		--		--		--		--	
Uranium-238	T	SW-846 6020	--		--		--		--		--	

Notes:

1) The data is not validated

-- = Not analyzed
J = Estimated value. Analyte detected at a level less than the reporting limit and greater than or equal to the method detection limit. This data is of limited reliability.
U = Analyte not detected at or above the reporting limit.
EFF = Effluent of Treatment System
INF = Influent of Treatment System
AVAN = Knox Trail After Vanox
ACARB = Knox Trail After Carbon

Knox Trail Treatment System Sampling Results - Volatile Organic Compounds (VOCs)_November Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

	Location	BEW-5-INF		EFF-PHASE 1		BEW-5		EFF-PHASE 1		EW-2		INF		EFF	
	Sample Date	11/06/2023		11/06/2023		11/20/2023		11/20/2023		11/27/2023		11/27/2023		11/27/2023	
Parameter	Test Method														
Volatile organic compounds (VOCs) (ug/L)															
1,1,1,2-Tetrachloroethane	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
1,1,1-Trichloroethane	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
1,1,2,2-Tetrachloroethane	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
1,1,2-Trichloroethane	SW-846 8260D	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U
1,1-Dichloroethane	SW-846 8260D	1.7		< 0.75	U	1.2		< 0.75	U	0.28	J	< 0.75	U	< 0.75	U
1,1-Dichloroethene	SW-846 8260D	1.1		< 0.50	U	1.1		< 0.50	U	0.62		0.45	J	< 0.50	U
1,1-Dichloropropene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
1,2,3-Trichlorobenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
1,2,3-Trichloropropane	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U
1,2,4-Trichlorobenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
1,2,4-Trimethylbenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
1,2-Dibromo-3-chloropropane	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
1,2-Dibromoethane	SW-846 8260D	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U
1,2-Dichlorobenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
1,2-Dichloroethane	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
1,2-Dichloroethene	SW-846 8260D	--		--		--		--		--		--		--	
1,2-Dichloropropane	SW-846 8260D	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U
1,3,5-Trimethylbenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
1,3-Dichlorobenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
1,3-Dichloropropane	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
1,3-Dichloropropene, Total	SW-846 8260D	--		--		--		--		--		--		--	
1,4-Dichlorobenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
1,4-Dichlorobutane	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U
1,4-Dioxane	SW-846 8260D	--		--		--		--		--		--		--	
2,2-Dichloropropane	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
2-Chlorotoluene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
2-Hexanone	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U
4-Chlorotoluene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
4-Isopropyltoluene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
4-Methyl-2-Pentanone	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U
Acetone	SW-846 8260D	30		5.6		< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	4.1	J
Acrylonitrile	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U
Benzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
Bromobenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
Bromochloromethane	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
Bromodichloromethane	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
Bromoform	SW-846 8260D	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U
Bromomethane	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	0.31	J
Carbon disulfide	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U
Carbon tetrachloride	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
Chlorobenzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
Chloroethane	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U
Chloroform	SW-846 8260D	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	1.2		0.58	J	< 0.75	U
Chloromethane	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
cis-1,2-Dichloroethene	SW-846 8260D	4.1		< 0.50	U	2.0		< 0.50	U	0.25	J	0.32	J	< 0.50	U
cis-1,3-Dichloropropene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
Dibromochloromethane	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
Dibromomethane	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U
Dichlorodifluoromethane	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U
Diethyl ether	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
Ethanol	SW-846 8260D	< 250	U	< 250	U	< 250	U	< 250	U	< 250	U	< 250	U	< 250	U
Ethyl Methacrylate	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U
Ethyl tert-butyl ether	SW-846 8260D	--		--		--		--		--		--		--	
Ethylbenzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
Hexachlorobutadiene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
Isopropyl Ether	SW-846 8260D	--		--		--		--		--		--		--	
Isopropylbenzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
m-&p-Xylenes	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U
Methyl Ethyl Ketone	SW-846 8260D	41		2.5	J	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U
Methyl tert-butyl ether	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U
Methylene Chloride	SW-846 8260D	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U
Naphthalene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
N-Butylbenzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
N-Propylbenzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
o-Xylene	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U
Sec-Butylbenzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
Styrene	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U
tert-Amyl methyl ether	SW-846 8260D	--		--		--		--		--		--		--	
Tert-Butylbenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
Tetrachloroethene	SW-846 8260D	< 0.50	U	< 0.50	U	0.48	J	< 0.50	U	0.33	J	< 0.50	U	< 0.50	U
Tetrahydrofuran	SW-846 8260D	120		< 5.0	U	0.85	J	< 5.0	U	2.1	J	0.96	J	< 5.0	U
Toluene	SW-846 8260D	0.34	J	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U
trans-1,2-Dichloroethene	SW-846 8260D	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U
trans-1,3-Dichloropropene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
trans-1,4-Dichloro-2-butene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
Trichloroethene	SW-846 8260D	3.2		< 0.50	U	4.9		< 0.50	U	2.0		1.5		< 0.50	U
Trichlorofluoromethane	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U
Vinyl Acetate	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U
Vinyl Chloride	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U
Xylenes (total)	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U

Notes:

1) The data is not validated

-- = Not analyzed

J = Estimated value. Analyte detected at a level less than the reporting limit and greater than or equal to the method detection limit. This data is of limited reliability.

U = Analyte not detected at or above the reporting limit.

DUP = QA/QC - Duplicate Sample
EFF = Effluent of Treatment System
INF = Influent of Treatment System
BEW5 = Extraction well BEW5
EW1 = Extraction well EW1
EW2 = Extraction well EW2

Knox Trail Treatment System Sampling Results - Volatile Organic Compounds (VOCs)_December Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

	Location	EW-2		INF		EFF		BEW-5		EW-1		EW-2		INF		EFF		BEW-5		EW-1		EW-2		INF		EFF	
	Sample Date	12/04/2023		12/04/2023		12/04/2023		12/12/2023		12/12/2023		12/12/2023		12/12/2023		12/12/2023		12/20/2023		12/20/2023		12/20/2023		12/20/2023		12/20/2023	
Parameter	Test Method																										
Volatile organic compounds (VOCs) (ug/L)																											
1,1,1,2-Tetrachloroethane	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
1,1,1-Trichloroethane	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
1,1,2,2-Tetrachloroethane	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
1,1,2-Trichloroethane	SW-846 8260D	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	--	
1,1-Dichloroethane	SW-846 8260D	0.25	J	< 0.75	U	< 0.75	U	1.3		< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	1.2		0.22	J	< 0.75	U	< 0.75	U	--	
1,1-Dichloroethene	SW-846 8260D	0.53		0.28	J	< 0.50	U	0.78		0.43	J	0.24	J	0.19	J	< 0.50	U	1.0		0.59		0.32	J	0.18	J	< 0.50	U
1,1-Dichloropropene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
1,2,3-Trichlorobenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
1,2,3-Trichloropropane	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	--	
1,2,4-Trichlorobenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
1,2,4-Trimethylbenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
1,2-Dibromo-3-chloropropar	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
1,2-Dibromoethane	SW-846 8260D	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	--	
1,2-Dichlorobenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
1,2-Dichloroethane	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
1,2-Dichloroethene	SW-846 8260D	--		--		--		--		--		--		--		--		--		--		--		--		--	
1,2-Dichloropropane	SW-846 8260D	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U	< 1.8	U	--	
1,3,5-Trimethylbenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
1,3-Dichlorobenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
1,3-Dichloropropane	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
1,3-Dichloropropene, Total	SW-846 8260D	--		--		--		--		--		--		--		--		--		--		--		--		--	
1,4-Dichlorobenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
1,4-Dichlorobutane	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	--	
1,4-Dioxane	SW-846 8260D	--		--		--		--		--		--		--		--		--		--		--		--		--	
2,2-Dichloropropane	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
2-Chlorotoluene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
2-Hexanone	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	--	
4-Chlorotoluene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
4-Isopropyltoluene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
4-Methyl-2-Pentanone	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	--	
Acetone	SW-846 8260D	< 5.0	U	2.3	J	< 5.0	U	3.6	J	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	1.6	J	--	
Acrylonitrile	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	--	
Benzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
Bromobenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
Bromochloromethane	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
Bromodichloromethane	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
Bromoform	SW-846 8260D	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	--	
Bromomethane	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	0.28	J	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	--	
Carbon disulfide	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	--	
Carbon tetrachloride	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
Chlorobenzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
Chloroethane	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	--	
Chloroform	SW-846 8260D	1.3		0.53	J	0.25	J	< 0.75	U	< 0.75	U	1.1		0.43	J	< 0.75	U	< 0.75	U	< 0.75	U	0.99		0.34	J	--	
Chloromethane	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
cis-1,2-Dichloroethene	SW-846 8260D	0.24	J	0.23	J	< 0.50	U	2.4		0.47	J	< 0.50	U	0.38	J	< 0.50	U	1.9		0.58		0.19	J	0.31	J	--	
cis-1,3-Dichloropropene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
Dibromochloromethane	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
Dibromomethane	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	--	
Dichlorodifluoromethane	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	--	
Diethyl ether	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
Ethanol	SW-846 8260D	30	J	35	J	35	J	< 250	U	< 250	U	< 250	U	< 250	U	< 250	U	< 250	U	< 250	U	< 250	U	< 250	U	--	
Ethyl Methacrylate	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	--	
Ethyl tert-butyl ether	SW-846 8260D	--		--		--		--		--		--		--		--		--		--		--		--		--	
Ethylbenzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
Hexachlorobutadiene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
Isopropyl Ether	SW-846 8260D	--		--		--		--		--		--		--		--		--		--		--		--		--	
Isopropylbenzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
m-&p-Xylenes	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	--	
Methyl Ethyl Ketone	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	--	
Methyl tert-butyl ether	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	--	
Methylene Chloride	SW-846 8260D	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U	< 3.0	U	--	
Naphthalene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
N-Butylbenzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
N-Propylbenzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
o-Xylene	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	--	
Sec-Butylbenzene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
Styrene	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	--	
tert-Amyl methyl ether	SW-846 8260D	--		--		--		--		--		--		--		--		--		--		--		--		--	
Tert-Butylbenzene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
Tetrachloroethene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	0.51		0.19	J	0.21	J	< 0.50	U	< 0.50	U	0.56		0.18	J	< 0.50	U	< 0.50	U	< 0.50	U
Tetrahydrofuran	SW-846 8260D	< 5.0	U	1.4	J	< 5.0	U	7.0		< 5.0	U	< 5.0	U	1.2	J	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	1.1	J	--	
Toluene	SW-846 8260D	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	--	
trans-1,2-Dichloroethene	SW-846 8260D	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	< 0.75	U	--	
trans-1,3-Dichloropropene	SW-846 8260D	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U	--	
trans-1,4-Dichloro-2-butene	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
Trichloroethene	SW-846 8260D	1.6		0.97		< 0.50	U	4.4		1.6		1.2		1.0		< 0.50	U	5.1		2.0		1.3		1.0		< 0.50	U
Trichlorofluoromethane	SW-846 8260D	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	< 2.5	U	--	
Vinyl Acetate	SW-846 8260D	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	< 5.0	U	--	
Vinyl Chloride	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U
Xylenes (total)	SW-846 8260D	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	< 1.0	U	--	

Notes:
1) The data is not validated

-- = Not analyzed
J = Estimated value. Analyte detected at a level less than the reporting limit and greater than or equal to the method detection limit. This data is of limited reliability.

U = Analyte not detected at or above the reporting limit.

DUP = QA/QC - Duplicate Sample
EFF = Effluent of Treatment System
INF = Influent of Treatment System
BEW5 = Extraction well BEW5
EW1 = Extraction well EW1
EW2 = Extraction well EW2

Knox Trail Treatment System Sampling Results - Wet Chemistry
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

		Location	**EFF**		**INF**	**AVAN**	**ACARB**	**EFF**
		Sample Date	**12/20/2023**		**01/17/2024**	**01/17/2024**	**01/17/2024**	**01/17/2024**
Wet Chemistry (ug/L)								
Parameter	**Total (T) or Not applicable (N)**	**Test Method**						
Chloride	T	SM 4500-Cl--E	90000		84000	82000	88000	89000
Chlorine, Total Residual	T	SM 4500-Cl-D	--		--	--	--	--
Cyanide	T	SM 4500-CN-E	< 5.0	U	--	--	--	--
Nitrogen, Nitrate as NO3	T	SM 4500-NO3-F	468		--	--	--	--
Nitrogen, Nitrite as NO2	T	SM 4500-NO3-F	< 50	U	--	--	--	--
Nitrogen, Kjeldahl	T	SM 4500-NH3-H	188	J	--	--	--	--
Perchlorate	N	EPA 331.0	--		--	--	--	--
Sulfate	T	SM 4500-SO4-E	120000		--	--	--	--
Sulfate	T	SW-846 9038	--		78000	110000	140000	130000

Notes:

1) The data is not validated

-- = Not analyzed

J = Estimated value. Analyte detected at a level less than the reporting limit and greater than or equal to the method detection limit. This data is of limited reliability.

U = Analyte not detected at or above the reporting limit.

EFF = Effluent of Treatment System
INF = Influent of Treatment System
AVAN = Knox Trail After Vanox
ACARB = Knox Trail After Carbon

Knox Trail Treatment System Sampling Results - Semi-Volatile Organic Compounds (SVOCs)
Nuclear Metals, Inc. Superfund Site
Concord, Massachusetts

	Location	BEW-5-INF	EFF-PHASE 1	INF	EFF	EFF	EFF	BEW-5	EFF-PHASE 1	EW-2	INF	EFF
	Sample Date	11/06/2023	11/06/2023	11/15/2023	11/15/2023	11/15/2023	11/17/2023	11/20/2023	11/20/2023	11/27/2023	11/27/2023	11/27/2023
Parameter	Test Method											
Semi-volatile organic compounds (SVOCs) (ug/L)												
1,4-Dioxane	SW-846 8270E SIM	59.9	0.621	8.75	1.01	1.15	0.654	48.2	1.16	6.37	5.27	0.315
bis(2-Ethylhexyl) Phthalate	SW-846 8270E	--	--	--	--	--	--	--	--	--	--	--

	Location	EW-2	INF	EFF	INF	EFF	BEW-5	EW-1	EW-2	INF	EFF		BEW-5	EW-1	EW-2	INF	EFF	
	Sample Date	12/04/2023	12/04/2023	12/04/2023	12/08/2023	12/08/2023	12/12/2023	12/12/2023	12/12/2023	12/12/2023	12/12/2023		12/20/2023	12/20/2023	12/20/2023	12/20/2023	12/20/2023	
Parameter	Test Method																	
Semi-volatile organic compounds (SVOCs) (ug/L)																		
1,4-Dioxane	SW-846 8270E SIM	5.08	4.78	0.627	4.22	0.261	53.2	4.40	4.69	8.20	< 0.144	U	48.3	4.52	4.68	7.91	0.604	
bis(2-Ethylhexyl) Phthalate	SW-846 8270E	--	--	--	--	--	--	--	--	--	--		--	--	--	--	< 3.0	U

	Location	BVAN	AVAN	BCARB	ACARB	EFF	BEW-5	EW-1	EW-2	INF	AVAN	EFF	BVAN	AVAN	JIMV	ACARB	EFF	JIME	BVAN	AVAN	EFF	BVAN	AVAN	ACARB	EFF
	Sample Date	01/08/2024	01/08/2024	01/08/2024	01/08/2024	01/08/2024	01/17/2024	01/17/2024	01/17/2024	01/17/2024	01/17/2024	01/17/2024	01/24/2024	01/24/2024	01/24/2024	01/24/2024	01/24/2024	01/24/2024	01/30/2024	01/30/2024	01/30/2024	01/31/2024	01/31/2024	01/31/2024	01/31/2024
Parameter	Test Method																								
Semi-volatile organic compounds (SVOCs) (ug/L)																									
1,4-Dioxane	SW-846 8270E SIM	8.04	1.09	1.04	1.10	1.13	43.8	4.34	4.86	7.70	0.379	0.885	6.96	0.454	0.473	0.596	0.604	0.586	7.04	0.311	0.577	6.84	0.274	0.542	0.567
bis(2-Ethylhexyl) Phthalate	SW-846 8270E	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

1) The data is not validated

-- = Not analyzed
U = Analyte not detected at or above the reporting limit.

DUP = QA/QC - Duplicate Sample
EFF = Effluent of Treatment System
INF = Influent of Treatment System
BVAN = Knox Trail Before Vanox
AVAN = Knox Trail After Vanox
BCARB = Knox Trail Before Carbon
ACARB = Knox Trail After Carbon
JIMV = Knox Trail After Vanox Duplicate (Duplicate of AVAN)
JIME = Knox Trail Effluent Duplicate (Duplicate of EFF)
BEW5 = Extraction well BEW5
EW1 = Extraction well EW1
EW2 = Extraction well EW2

APPENDIX I

Knox Trail Groundwater Pump & Treatment System
Optimization Report (July 2024)

O&M, Inc.
Environmental Solutions

Date: July 25, 2024

To : Bruce Thompson – de maximis, inc.

From : Garrett Fuerst – O&M, Inc.

Subject: Nuclear Metals, Inc. Superfund Site Optimization Plan Report, Revision 1

The purpose of this Knox Trail treatment system optimization plan report is to summarize and present findings during the optimization of the Vanox unit operations for long-term efficiency. This plan was designed to adjust the key system variables on a step wise basis to identify the optimum settings to achieve the required 1,4-dioxane discharge criteria.

Since completion of startup, the Vanox successfully achieved the 1,4-dioxane discharge treatment levels. With the recent introduction of two (2) new extraction wells, EW-2 and BEW-5, influent 1,4-dioxane concentrations have increased from an average of 3.5 µg/L to 5.9 µg/L. This concentration reflects the blended flow from EW-1, EW-2 and BEW-5. Since adding the two (2) new extraction wells there were issues achieving the required 1,4-dioxane discharge criteria.

The following testing provided the data required to determine:

- If the persulfate feed rate should be increased to address potential natural oxidant demand from the two (2) new wells and to what level.
- If a fourth reactor should be utilized to increase the residence time in the reactor vessels.

Optimization Testing and Results

Step 1 & 2 sampling was completed on March 6th, 2024 following the approval of the optimization plan by the EPA on March 4th, 2024. Analytical results from steps 1 & 2 were reported on March 13th, 2024, which initiated step 3. The steps carried out are listed below:

- Step 1- Collect samples for sulfate, 1,4-dioxane and TOC at the following locations:
    - BVAN (before Vanox)
    - MVAN (after Vanox/before discharge tank)
- Step 2- Measure the pH and conductivity with handheld meters at the following locations:
    - BVAN (before Vanox)
    - MVAN (after Vanox/before discharge tank)
    - Persulfate feed tank

- Step 3- Use this information to determine the efficiency of the reaction across the Vanox unit.

The sample results from step 1 and 2 along with the Vanox parameters at time of sampling are shown in the table 1:

Table 1 - Step 1 System Setting/Results
Three Reactors

Vanox Settings		Analytical Results (3/6/2024)				Calculations	
Lamp Intensity (%)	Sodium Persulfate Injection Rate (ml/min)	INF 1,4-Dioxane (ug/L)	EFF 1,4-Dioxane (ug/L)	BVAN Sulfate (mg/L)	AVAN Sulfate (mg/L)	Persulfate Activation (%)	1,4-Dioxane Removal (%)
85	35.5	5.38	0.164	63.5	135	61	97%

Table 2 - Step 2 System Results
Three Reactors

Measured	Sample Location (3/6/2024)			
	INF	BVAN	MVAN	Persulfate Tank
pH	6.92	7.6	6.55	5.87
Conductivity	285	390	595	Not Measured

Upon completion of optimization plan steps 1-3, the decision to skip steps 4A and 4B was made. Persulfate activation percentage was below desired levels however the Vanox was still achieving 1,4-Dioxane discharge requirements of <0.46 ug/L.

Removed steps 4A and 4B. If the data indicates that additional persulfate dosing will be effective, a new persulfate solution feed rate will be calculated and tested. Adjust the persulfate feed rate as calculated and operate the Vanox with the new feed rate.

- REMOVED: Step 4 A - Collect samples for sulfate, 1,4-dioxane and TOC at the following locations:
  - BVAN (before Vanox)
  - MVAN (after Vanox/before discharge tank)
- REMOVED: Step 4 B - Measure the pH and conductivity with handheld meters at the following locations:
  - BVAN (before Vanox)
  - MVAN (after Vanox/before discharge tank)
  - Persulfate feed tank
- REMOVED: Evaluate the data, repeat the testing with different doses until optimized.

Step 3 evaluation of data indicated that an increase in persulfate dosing would not be effective in optimizing for long-term efficiency. The need for longer residence time by addition of a fourth reactor was determined to be the necessary optimization step to overcome this issue. The fourth reactor was brought online Monday April 15th, 2024. Following a full day of observation and optimization, the system ran at a balanced-steady state. Treatment system samples were collected on Tuesday April 16th, 2024. A new sample location, MIDVANC, was created to capture the Vanox combined effluent of all 4 reactors. The Vanox settings along with analytical results are presented in table 3, with confirmatory sample results seen in Table 4. Step 5B did not take place as pH and conductivity was not needed to determine optimization set points.

- Step 5 – Reconfigure the Vanox to four reactors. Readjust all settings to optimize the flow through four reactors.
- Step 5 A - Collect samples for sulfate, 1,4-dioxane and TOC at the following locations:
    - BVAN (before Vanox)
    - MVANC (after Vanox/before discharge tank)
- REMOVED: Step 5 B - Measure the pH and conductivity with handheld meters at the following locations:
    - BVAN (before Vanox)
    - MVANC (after Vanox/before discharge tank)
    - Persulfate feed tank
- Evaluate the data, adjust the system operating parameters until optimized.

Table 3 - Step 5 System Setting/Results
Four Reactors

Vanox Settings		Analytical Results (4/16/2024)				Calculations	
Lamp Intensity (%)	Sodium Persulfate Injection Rate (ml/min)	INF 1,4-Dioxane (ug/L)	EFF 1,4-Dioxane (ug/L)	BVAN Sulfate (mg/L)	AVAN Sulfate (mg/L)	Persulfate Activation (%)	1,4-Dioxane Removal (%)
85	35.5	5.24	0.2	64	110	75	97%

Table 4 - Step 5 System Setting/Results Confirmatory
Four Reactors

Vanox Settings		Analytical Results (4/29/2024)				Calculations	
Lamp Intensity (%)	Sodium Persulfate Injection Rate (ml/min)	INF 1,4-Dioxane (ug/L)	EFF 1,4-Dioxane (ug/L)	BVAN Sulfate (mg/L)	AVAN Sulfate (mg/L)	Persulfate Activation (%)	1,4-Dioxane Removal (%)
85	35.5	5.93	0.105	63	100	80	98%

Conclusion

In conclusion, the optimization study was effective at identifying settings to achieve optimum unit operations of the Vanox for long-term efficiency. Through this process it was found the ideal settings for optimal operation were the addition of a fourth reactor, lamp intensity of 85% and 35.5 ml/min sodium persulfate dosage. Attached below are graphs showing treatment system 1,4-Dioxane concentrations over the optimization process, as well as sodium persulfate activation vs. effluent 1,4-Dioxane concentrations. The below results show a greater activation percentage of sodium persulfate results in a decrease in effluent 1,4-Dioxane concentrations. The treatment system will be continually monitored to assure optimal operations are achieved.

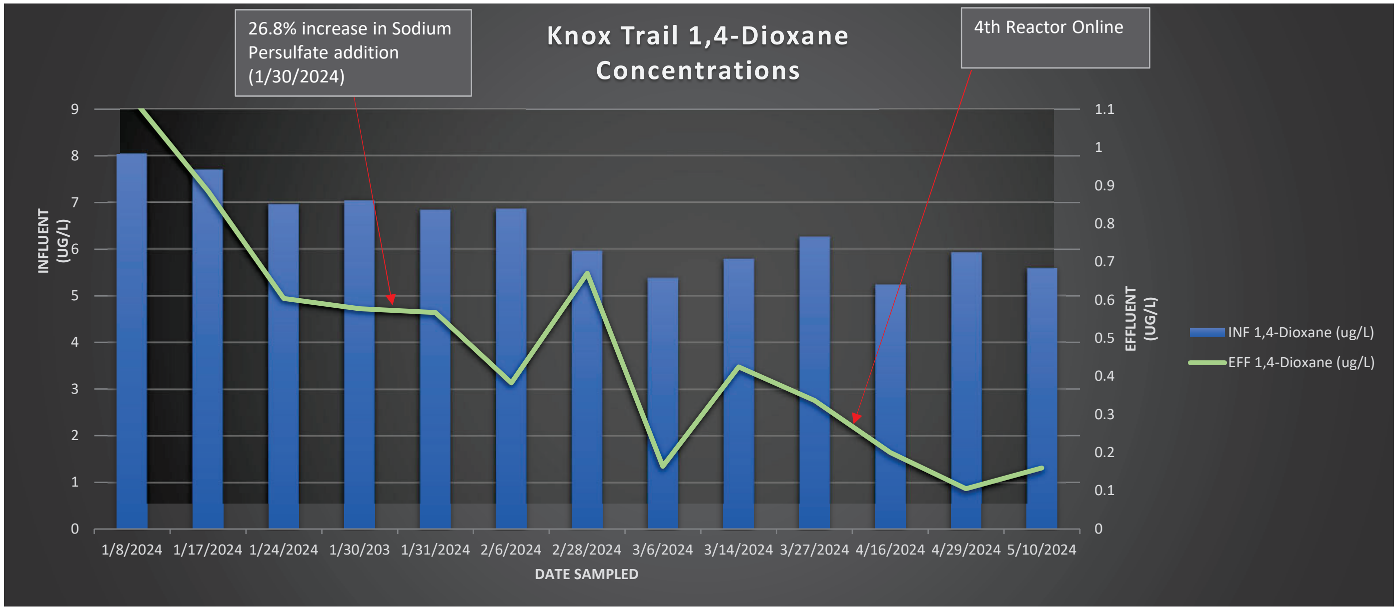
If you have any questions, please contact me at 865-293-6664.

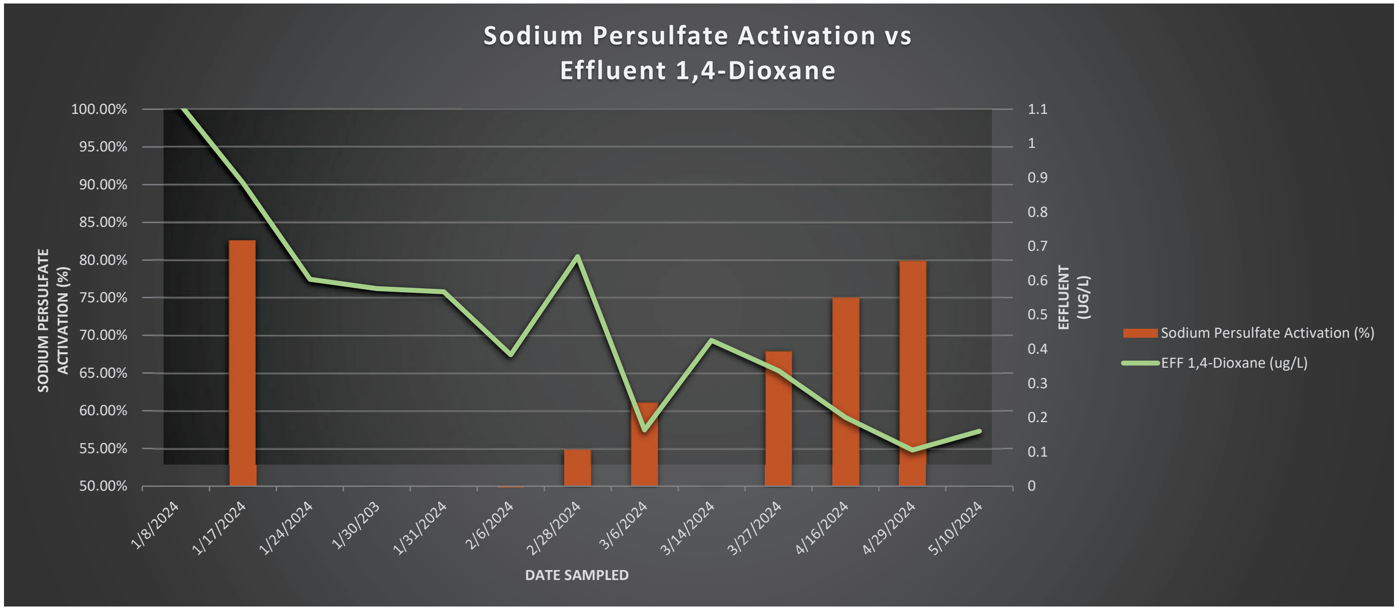
Sincerely,

Garrett Fuerst

Garrett Fuerst
Project Engineer
O&M, Inc.

CC: Christine Taddonio
Keith Robinson


Knox Trail 1,4-Dioxane Concentrations
26.8% increase in Sodium Persulfate addition (1/30/2024)
4th Reactor Online
INFLUENT (UG/L)
9
8
7
6
5
4
3
2
1
0
EFFLUENT (UG/L)
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1/8/2024
1/17/2024
1/24/2024
1/30/203
1/31/2024
2/6/2024
2/28/2024
3/6/2024
3/14/2024
3/27/2024
4/16/2024
4/29/2024
5/10/2024
DATE SAMPLED
INF 1,4-Dioxane (ug/L)
EFF 1,4-Dioxane (ug/L)


Sodium Persulfate Activation vs Effluent 1,4-Dioxane
SODIUM PERSULFATE ACTIVATION (%)
100.00%
95.00%
90.00%
85.00%
80.00%
75.00%
70.00%
65.00%
60.00%
55.00%
50.00%
EFFLUENT (UG/L)
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1/8/2024
1/17/2024
1/24/2024
1/30/203
1/31/2024
2/6/2024
2/28/2024
3/6/2024
3/14/2024
3/27/2024
4/16/2024
4/29/2024
5/10/2024
DATE SAMPLED
Sodium Persulfate Activation (%)
EFF 1,4-Dioxane (ug/L)

Analytical Chart Data

Sample Date	1/8/2024	1/17/2024	1/24/2024	1/30/2024	1/31/2024	2/6/2024	2/28/2024	3/6/2024	3/14/2024	3/27/2024	4/16/2024	4/29/2024	5/10/2024
BVAN Sulfate Concentration (mg/L)	-	78	-	-	-	-	57	63.5	-	71	64	63	-
AVAN Sulfate Concnetration (mg/L)	-	110	-	-	-	-	140	135	-	130	110	100	-
Sodium Persulfate Concentration (20%)	-	228.1	-	-	-	-	228.1	228.1	-	228.1	228.1	228.1	-
Atomic Mass Ratio	-	0.807	-	-	-	-	0.807	0.807	-	0.807	0.807	0.807	-
Sodium Persulfate Activation (%)	-	83%	-	-	-	-	55%	61%	-	68%	75%	80%	-
INF 1,4-Dioxane (ug/L)	8.04	7.7	6.96	7.04	6.84	6.86	5.96	5.38	5.79	6.26	5.24	5.93	5.59
EFF 1,4-Dioxane (ug/L)	1.13	0.885	0.604	0.577	0.567	0.383	0.67	0.164	0.425	0.337	0.2	0.105 J	0.16

Notes:

1. The INF analytical result for 1/8/2024 was collected before the Vanox at the BVAN location and is representative of an influent sample.
2. J = Estimated value. Analyte detected at a level less than the reporting limit and greater than or equal to the method detection limit. This data is of limited reliability.