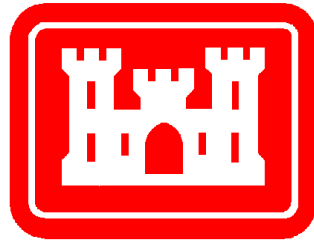


**WORK PLAN
SOIL SURVEY**

FOR

**BUXTON NAVAL FACILITY
FUDS Project Number I04NC0001-03
BUXTON, DARE COUNTY, NORTH CAROLINA**



December 2023

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**BUXTON NAVAL FACILITY
FUDS Project Number I04NC0001-03
BUXTON, DARE COUNTY, NORTH CAROLINA**

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**WORK PLAN
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1.0 OBJECTIVE STATEMENT

There have been several recent events of what has been classified as contaminated peat washing up along the shore within the Buxton Naval Facility (BNF) boundary. Peat has not been encountered on the site. However, the dune profile has change over time during extreme storm events reducing the elevation of the previously investigated areas as much as 25 feet. The proposed investigation approach is to identify depth and extent of the peat layer, if present.

2.0 BACKGROUND

2.1 Site Description and Background Information

The Buxton Naval Facility (BNF) is located within the bounds of the Cape Hatteras National Seashore (CHNS) on the North Carolina Outer Banks in the City of Buxton, Dare County, North Carolina. A site location map is included as **Figure 1**.

The US Navy utilized the site as a submarine monitoring station from 1956 to 1982. The US Coast Guard (USCG) acquired the facility after 1982 and used the site as a logistical, communication, medical, and supply support center for four area Coast Guard stations.

The Formerly Used Defense Site (FUDS) contains four areas of investigation which encompass a total area of approximately 50,000 square feet in the southeast portion of the facility.

- Area I included a former aboveground storage tank (AST) pad located south of former Building 7.
- Area II included the former Building 9 (boiler house).
- Area III included the old Oil Change Ramp (OCR) located between former Buildings 6 and 7.
- Area IV included the area east of the entrance road near the former Building 19

Based on previous reports, seven (7) ASTs and twenty-seven (27) underground storage tanks (USTs), were removed from the site in the 1990s. A pipeline discovered between an AST and Building 9 was removed in 2000. Several groundwater sampling events occurred to support further investigation at this site. Soil removal in Areas I, III, and IV and the removal of the OCR occurred in 2005.

Between November 2005 and April 2018, fifteen groundwater sampling events were conducted as part of the Remedial Action, Compliance Monitoring, and Long Term Monitoring Events. During these sampling events hydrocarbon concentrations above the North Carolina Department of Environmental Quality (NCDEQ) Groundwater Quality Standards (GWQS) were detected in samples from several site monitoring wells.

Monitoring results were mixed, initially showing a decrease in contaminant concentrations. Over the next four years concentrations fluctuated. It was unclear if degradation had stalled, if site conditions had changed, or if the monitoring well network was not adequately representing

groundwater conditions at the site. The analytical data also suggested that tidal fluctuation may play a significant role in the geometry and location of the contaminant plume.

It was determined that the monitoring well network and sampling protocol was not sufficient to understand the hydrogeologic conditions at the site. Two replacement monitoring wells and four new monitoring wells were installed in April 2019, prior to two sampling events that occurred in June and September 2019.

Following the 2019 sampling events, an injection event was conducted between June and July 2020. This included the installation of two additional monitoring wells in the dunes east of the entry road and followed by three quarterly groundwater sampling events. The results of the injections and groundwater sampling events indicated that the western most wells were successfully treated. The results indicated that the contamination was addressed on the west and north sides of the site. Two additional wells were installed east and south of the existing monitoring well network during the second injection event that occurred in late August 2021. Quarterly groundwater sampling resumed in November 2021. During this event, one monitoring well (BNF-ZMW-16) was discovered intact but with exposed casing and had to be abandoned. This monitoring well was located near the prior peak of the sand dunes. However, beach erosion has removed a large portion of the sand dunes between August and November 2021. **Figure 2** is a site map showing the location of all monitoring wells that have installed at BNF, existing, destroyed, or abandoned.

Since the second injection event, eight quarterly groundwater sampling events have occurred. USACE provided the most recent report (dated March 2023) to NCDEQ, which included data collected through the December 2022 groundwater sampling event. NCDEQ concurred with the recommendations of the report, which included:

- Discontinue collection of MNA parameters.
- Discontinue sampling B-CMW-1 and B-CMW-4R.
- Reduce the polycyclic aromatic hydrocarbons (PAHs) analytes to 1-methylnaphthalene only in BNF-ZMW-9R, BNF-ZMW-10, and BNF-ZMW-12 and discontinue all PAHs in BNF-ZMW-13, BNF-ZMW-14, BNF-ZMW-15, and BNF-ZMW-17.
- Sample three to four temporary well locations east of the dunes to determine furthest extent of the contamination on the windward side of the sand dunes.
- Request discontinuation of sampling at monitoring wells meeting the requirement of four consecutive events with no exceedances.
- Reevaluate the data to determine if a third injection event would be required.

As of the last groundwater sampling event (September 2023), the following monitoring wells have had no concentrations above the NCDEQ GWQS for four (4) consecutive events:

- BNF-ZMW-10
- BNF-ZMW-11
- BNF-ZMW-14
- BNF-ZMW-15
- BNF-ZMW-17

Monitoring well, BNF-ZMW-13, currently has three consecutive groundwater sampling events with all concentrations below NCDEQ GWQS. The last two monitoring wells on the site currently being monitored are BNF-ZMW-9R and BNF-ZMW-12. A PAH (1-methylnaphthalene), C9-C18 aliphatics, and C9-C22 aromatics have been detected both monitoring wells in exceedance of the GWQS. **Figure 3** shows the detections in the monitoring wells in from the four groundwater sampling events between December 2022 and September 2023.

During the most recent event, September 2023, rounded cobble-sized (3-12 inches) pieces of peat washed up on the beach in the area bounded by the north and south edges of the current site. A strong petroleum smell was also reported. Based on this report, a sample was taken of the peat, which was analyzed for total petroleum hydrocarbon-diesel range organics (TPH-DRO). The results indicated positive detections of 36,000 mg/kg for TPH-DRO. Temporary wells were also installed during this event. The samples taken from the temporary wells were analyzed for Massachusetts Department of Environmental Protection (MADEP) Volatile Petroleum Hydrocarbons (VPH) and Extractable Petroleum Hydrocarbons (EPH). The two southern most temporary wells were installed near the old septic field outfall and the results were above the GWQS.

In October 2023, USACE personnel collected samples from two of the four completed test pits. The analytical results from the September 2023 temporary well groundwater samples and the October 2023 test pit soil samples are shown on **Figure 4**.

2.2 Purpose and Scope of Survey

The purpose of this soil survey is to determine the extent of the peat layer beneath the beach east of the sand dunes. Sampling and analysis will identify potential source of petroleum contamination.

2.3 Soil Sampling

A Soil Survey along the beach between the north and south boundaries of the site is proposed. Up to 15 DPT borings will be completed. Additional borings will be used to gather soil profile information at existing monitoring wells.

Should contaminated peat or other soils be encountered while drilling, soil samples will be collected and analyzed for limited PAHs and MADEP VPH and EPH for petroleum fingerprinting purposes. **Figure 5** shows the location of the proposed MacroCore™ borings.

2.4 Groundwater Sampling

Temporary wells may be placed in any MacroCore™ borings where suspected contamination is discovered. Groundwater samples would be analyzed for limited PAHs and MADEP VPH and EPH for petroleum fingerprinting purposes.

3.0 PROJECT ORGANIZATION

3.1 Project Coordination

A list of relevant personnel related to the project is as follows:

Project Manager – Stephen Fox, U.S. Army Corps of Engineers, Savannah District, GA,

(912) 652-6210, stephen.m.fox@usace.army.mil

Technical Manager/Field Team Lead – Tracey Tapley, U.S. Army Corps of Engineers, Savannah District, GA, (912) 652-6007, Tracey.Tapley@usace.army.mil

Drilling Supervisor – Steve Widincamp, U.S. Army Corps of Engineers, Savannah District, GA, (912) 652-5670, steven.d.widincamp@usace.army.mil

Quality Control will be the responsibility of the Geologist-on-Site, who will also serve as the Safety Officer; consistent with USACE protocol. At different times during the course of the investigation the Technical Manager (TM) may designate another Geologist to perform the field work. Any personnel chosen to be Geologist-on-Site will possess a valid HTRW certificate, current CPR/First Aid training, and will have a working knowledge of the Site Safety & Health Plan (SSHP); consistent with USACE training protocol.

The TM will be in charge of the day-to-day field operations. The progress of the field investigation, and any pertinent issues related to the job will be relayed to the Project Manager (PM) by the TM.

4.0 FIELD ACTIVITIES

4.1 Daily Quality Control Reports

During the field investigation progress reports will be submitted on a daily basis by the TM, or other personnel designated by the TM. The contents of the daily reports will include:

- Equipment on-site
- Personnel on-site
- Summary of work conducted during the day
- Problems encountered during the day

A logbook will be kept by the Geologist-on-Site which will record the daily events of the field personnel, in addition to a record of daily progress.

4.2 Safety

Each morning the TM will conduct a safety briefing with the field personnel. The subject of this safety briefing will rotate on a daily basis but will focus on safety concerns which are specific to the job site. At the conclusion of the safety briefing all field personnel will sign and date the Site Safety & Health Plan, acknowledging that they have received the training. Copies of the signature sheets from the SSHP will be kept by the TM.

4.3 Sampling and Field Methods

All samples will be shipped on ice in laboratory approved coolers via FedEx to the contract laboratory.

4.3.1 Soil Boring Installation

The goal of the soil survey event is to determine the location of a potential peat layer underlying the beach. Should the peat be encountered and it is determined to be possibly contaminated, a soil sample shall be collected at that location and analyzed for limited PAHs and MADEP VPH and EPH for petroleum fingerprinting purposes.

Soil sampling will be performed using a Geoprobe® 7822DT Direct-Push Drill Rig using Macro-Core® polyvinyl chloride (PVC) liners. The sampling tube assembly consists of a PVC liner inserted into a sample tube with a piston head and cutting shoe at the bottom. A piston rod inserted into sampling tube and PVC liner holds the piston rod in place with a drive head and stop pin. Once the assembled sample tube is driven to the top of the sample depth the stop pin is removed with extension rods. As the assembly is driven to the bottom of the sample depth, the piston head is pushed into the sampling tube by the soil. The assembly is then extracted from the soil boring, and the PVC liner filled with soil is removed. The PVC liner is cut open and the soil is scanned for volatiles and collected for analysis. The soil is then classified and returned to the borehole. The soil samples are collected in laboratory supplied sampling bottles which are then stored in coolers to be preserved in ice.

Classification of the soils encountered, time and depth of soils samples collected, and QA/QC sampling performed will be annotated in the site logbook.

4.3.2 Groundwater Sampling

As part of the quarterly groundwater sampling events, groundwater samples will be collected from the existing monitoring wells on site and analyzed for 1-meythlnaphthalene, a PAH, using EPA Method 8270D and MADEP VPH and MADEP EPH in accordance with NCDEQ Table 5, Assessment and Corrective Action for UST releases.

Additional groundwater samples may be collected from temporary wells installed in locations where contaminated peat was encountered and analyzed for limited PAHs and MADEP VPH and EPH for petroleum fingerprinting purposes.

All samples will be placed in laboratory provided containers immediately after collection. The sample containers will then immediately be stored on ice prior to shipment to the analytical laboratory. The Geologist-on-Site will use a new pair of nitrile gloves between each sample. All groundwater sample procedures will be consistent with *U.S. Environmental Protection Agency, Region 4, SESD, Operating Procedure, Groundwater Sampling, March 6, 2013*.

5.0 REPORTING


Once the analytical results are received from the laboratory, USACE personnel will produce an assessment report. The report will include a summary of the field and analytical data collected as part of this investigation. All laboratory data will be validated by a USACE Chemist.

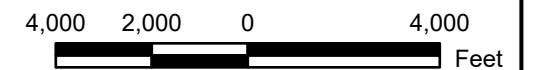
6.0 ATTACHEMENTS

- Figure 1: Site Map
- Figure 2: Monitoring Well Location Map
- Figure 3: Analytical Results Map - December 2022 through September 2023
- Figure 4: Analytical Results Map - September 2023 and October 2023
- Figure 5: Proposed Soil Survey Map



Legend

 Buxton Naval Facility



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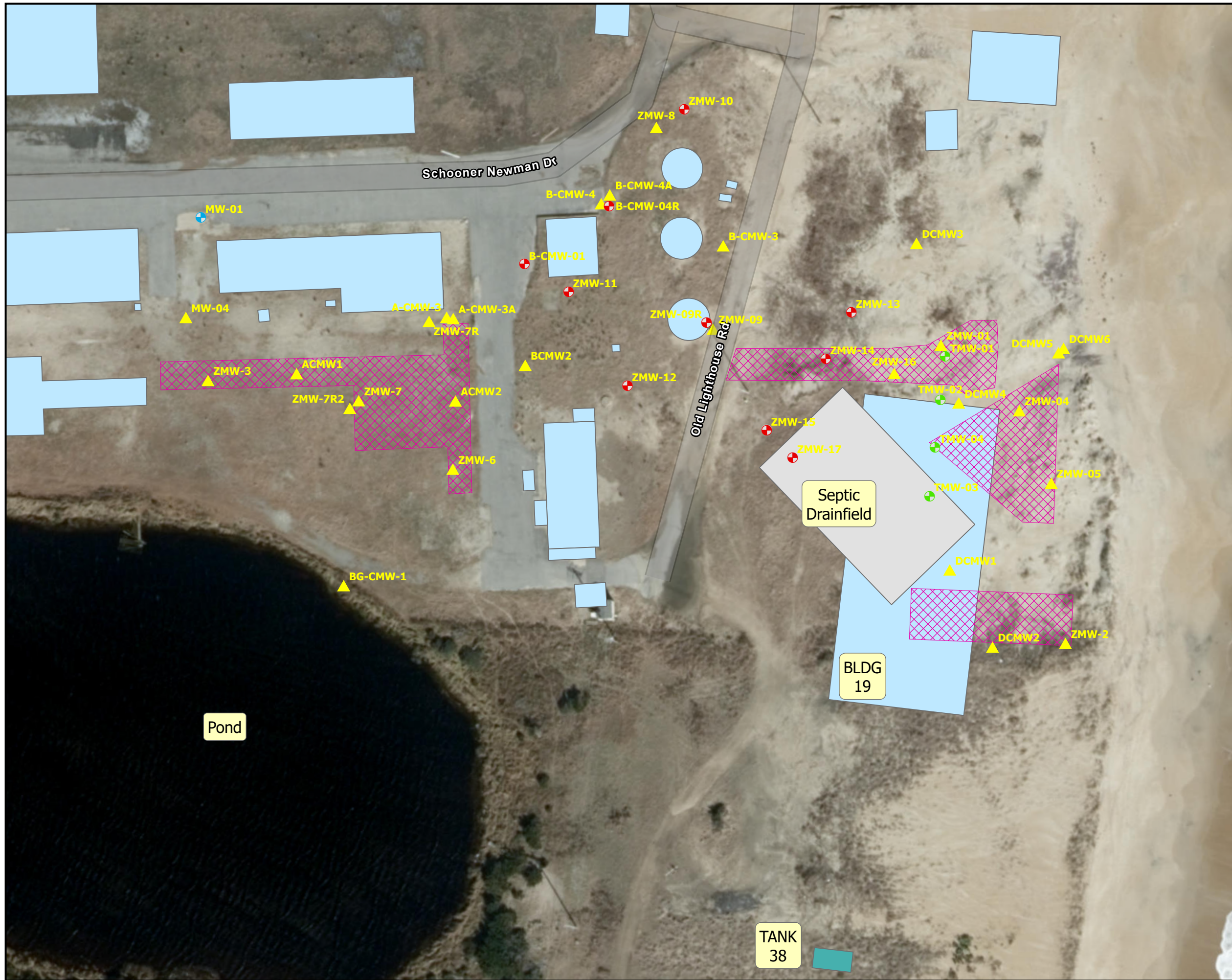
Buxton Naval Facility

SITE
MAP

Buxton, NC

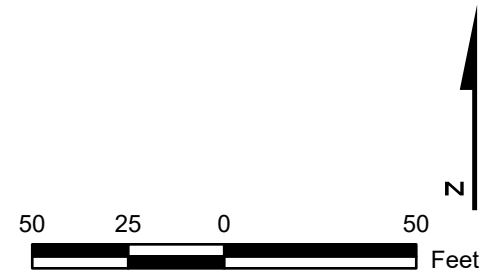
DECEMBER 2023

FIGURE 1



Legend

- Active (Sampled) Monitoring Well(s)
- Inactive Monitoring Well(s)
- Temporary Monitoring Well(s)
- Abandoned Monitoring Well(s)
- Tank 38 (Approximate Location)
- Excavated Soil (2005 Soil Cleanup)
- Abandoned Buildings
- Septic Drainfield Area



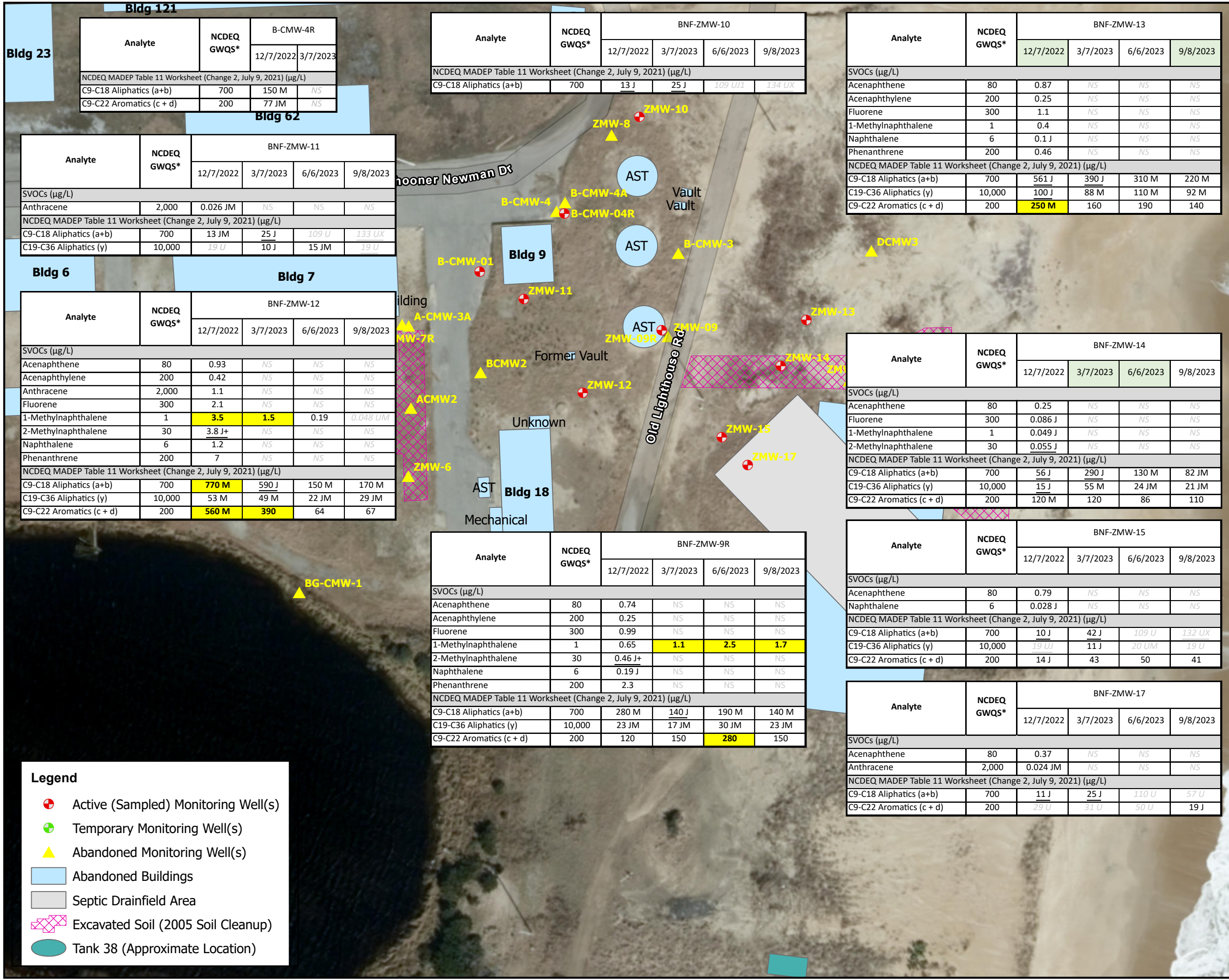
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Buxton Naval Facility
**MONITORING WELL
LOCATION MAP**

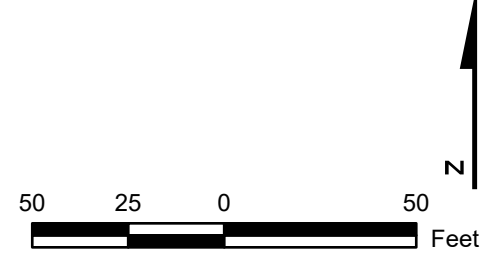
Buxton, NC

DECEMBER 2023

FIGURE 2



- NOTES:**
- SVOCs, MADEP VPH, and MADEP EPH detections are provided in the tables for the following events: December 7, 2022; March 7, 2023; June 6, 2023; September 8, 2023.
 - Results were below laboratory detections in B-CMW-1 during the December event; table not provided. Not sampled after December.
 - * - 15A NCAC 02L .0202 Groundwater Standards (effective April 1, 2022).
 - J/(J) - The analyte was positively identified; the quantitation is an estimation with the +/- symbol denoting high or low bias, respectively.
 - Underlined values have been qualified by USACE Chemist (see Appendix 5).
 - U - Not detected (below the Reporting Detection Limit).
 - Yellow Highlighted Bold Text - Positive results above detection limit and exceeding NCDEQ GWQS.
 - Green Highlighted dates represent duplicate location; highest value shown.
 - M - Sample manually integrated.
 - X - The The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria.



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Buxton Naval Facility
ANALYTICAL RESULTS MAP
DEC 2022 through SEP 2023
Buxton, NC

Analyte	NCDEQ GWQS*	B-CMW-4R	
		12/7/2022	3/7/2023
NCDEQ MADEP Table 11 Worksheet (Change 2, July 9, 2021) (µg/L)			
C9-C18 Aliphatics (a+b)	700	150 M	NS
C9-C22 Aromatics (c + d)	200	77 JM	NS

Analyte	NCDEQ GWQS*	BNF-ZMW-10			
		12/7/2022	3/7/2023	6/6/2023	9/8/2023
NCDEQ MADEP Table 11 Worksheet (Change 2, July 9, 2021) (µg/L)					
C9-C18 Aliphatics (a+b)	700	13 J	25 J	109 U1	134 UX

Analyte	NCDEQ GWQS*	BNF-ZMW-13			
		12/7/2022	3/7/2023	6/6/2023	9/8/2023
SVOCs (µg/L)					
Acenaphthene	80	0.87	NS	NS	NS
Acenaphthylene	200	0.25	NS	NS	NS
Fluorene	300	1.1	NS	NS	NS
1-Methylnaphthalene	1	0.4	NS	NS	NS
Naphthalene	6	0.1 J	NS	NS	NS
Phenanthrene	200	0.46	NS	NS	NS
NCDEQ MADEP Table 11 Worksheet (Change 2, July 9, 2021) (µg/L)					
C9-C18 Aliphatics (a+b)	700	561 J	390 J	310 M	220 M
C19-C36 Aliphatics (y)	10,000	100 J	88 M	110 M	92 M
C9-C22 Aromatics (c + d)	200	250 M	160	190	140

Analyte	NCDEQ GWQS*	BNF-ZMW-11			
		12/7/2022	3/7/2023	6/6/2023	9/8/2023
SVOCs (µg/L)					
Anthracene	2,000	0.026 JM	NS	NS	NS
NCDEQ MADEP Table 11 Worksheet (Change 2, July 9, 2021) (µg/L)					
C9-C18 Aliphatics (a+b)	700	13 JM	25 J	109 U	133 UX
C19-C36 Aliphatics (y)	10,000	19 U	10 J	15 JM	19 U

Analyte	NCDEQ GWQS*	BNF-ZMW-12			
		12/7/2022	3/7/2023	6/6/2023	9/8/2023
SVOCs (µg/L)					
Acenaphthene	80	0.93	NS	NS	NS
Acenaphthylene	200	0.42	NS	NS	NS
Anthracene	2,000	1.1	NS	NS	NS
Fluorene	300	2.1	NS	NS	NS
1-Methylnaphthalene	1	3.5	1.5	0.19	0.048 UM
2-Methylnaphthalene	30	3.8 J+	NS	NS	NS
Naphthalene	6	1.2	NS	NS	NS
Phenanthrene	200	7	NS	NS	NS
NCDEQ MADEP Table 11 Worksheet (Change 2, July 9, 2021) (µg/L)					
C9-C18 Aliphatics (a+b)	700	770 M	590 J	150 M	170 M
C19-C36 Aliphatics (y)	10,000	53 M	49 M	22 JM	29 JM
C9-C22 Aromatics (c + d)	200	560 M	390	64	67

Analyte	NCDEQ GWQS*	BNF-ZMW-9R			
		12/7/2022	3/7/2023	6/6/2023	9/8/2023
SVOCs (µg/L)					
Acenaphthene	80	0.74	NS	NS	NS
Acenaphthylene	200	0.25	NS	NS	NS
Fluorene	300	0.99	NS	NS	NS
1-Methylnaphthalene	1	0.65	1.1	2.5	1.7
2-Methylnaphthalene	30	0.46 J+	NS	NS	NS
Naphthalene	6	0.19 J	NS	NS	NS
Phenanthrene	200	2.3	NS	NS	NS
NCDEQ MADEP Table 11 Worksheet (Change 2, July 9, 2021) (µg/L)					
C9-C18 Aliphatics (a+b)	700	280 M	140 J	190 M	140 M
C19-C36 Aliphatics (y)	10,000	23 JM	17 JM	30 JM	23 JM
C9-C22 Aromatics (c + d)	200	120	150	280	150

Analyte	NCDEQ GWQS*	BNF-ZMW-14			
		12/7/2022	3/7/2023	6/6/2023	9/8/2023
SVOCs (µg/L)					
Acenaphthene	80	0.25	NS	NS	NS
Fluorene	300	0.086 J	NS	NS	NS
1-Methylnaphthalene	1	0.049 J	NS	NS	NS
2-Methylnaphthalene	30	0.055 J	NS	NS	NS
NCDEQ MADEP Table 11 Worksheet (Change 2, July 9, 2021) (µg/L)					
C9-C18 Aliphatics (a+b)	700	56 J	290 J	130 M	82 JM
C19-C36 Aliphatics (y)	10,000	15 J	55 M	24 JM	21 JM
C9-C22 Aromatics (c + d)	200	120 M	120	86	110

Analyte	NCDEQ GWQS*	BNF-ZMW-15			
		12/7/2022	3/7/2023	6/6/2023	9/8/2023
SVOCs (µg/L)					
Acenaphthene	80	0.79	NS	NS	NS
Naphthalene	6	0.028 J	NS	NS	NS
NCDEQ MADEP Table 11 Worksheet (Change 2, July 9, 2021) (µg/L)					
C9-C18 Aliphatics (a+b)	700	10 J	42 J	109 U	132 UX
C19-C36 Aliphatics (y)	10,000	19 U	11 J	20 UM	19 U
C9-C22 Aromatics (c + d)	200	14 J	43	50	41

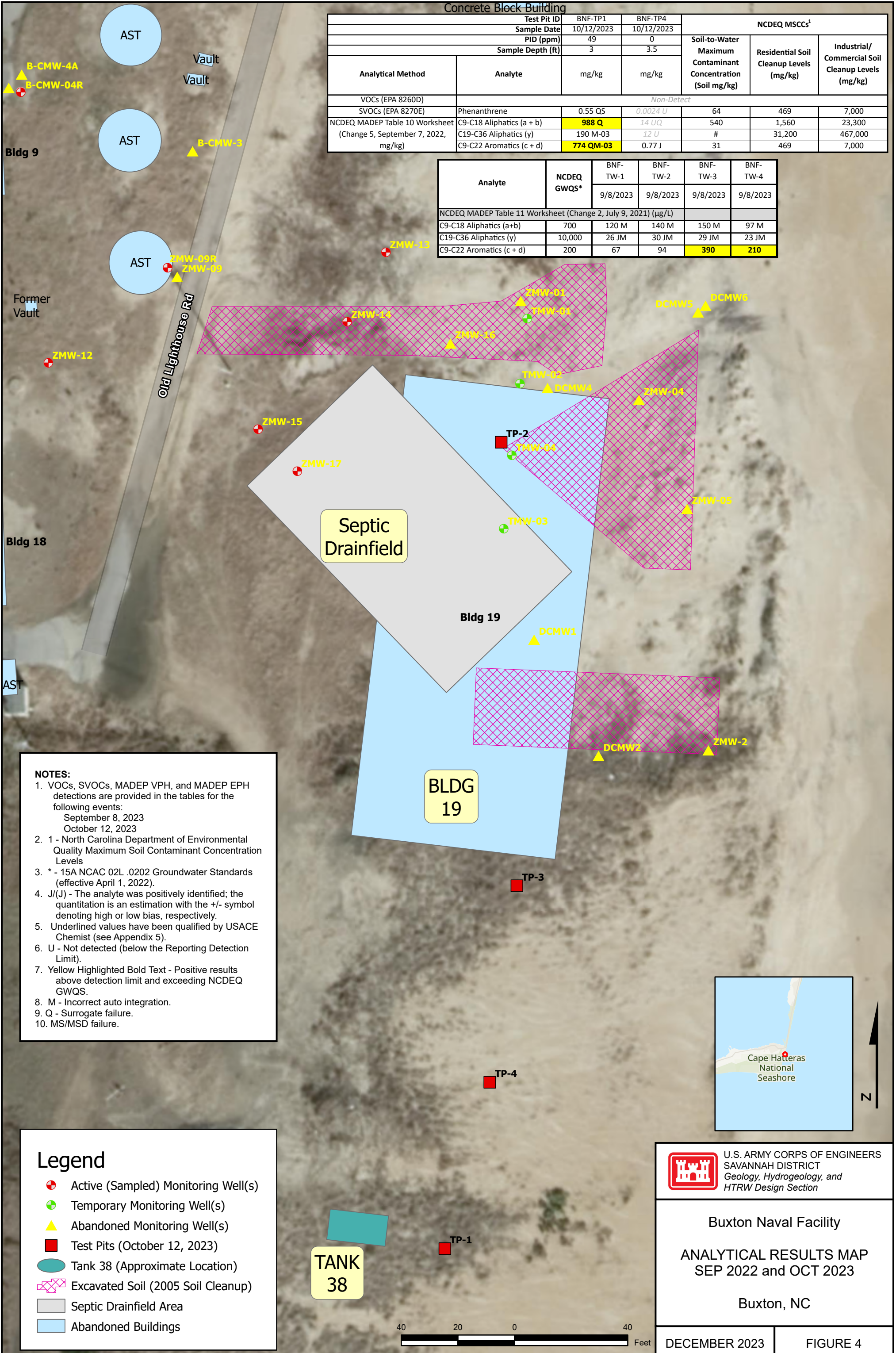
Analyte	NCDEQ GWQS*	BNF-ZMW-17			
		12/7/2022	3/7/2023	6/6/2023	9/8/2023
SVOCs (µg/L)					
Acenaphthene	80	0.37	NS	NS	NS
Anthracene	2,000	0.024 JM	NS	NS	NS
NCDEQ MADEP Table 11 Worksheet (Change 2, July 9, 2021) (µg/L)					
C9-C18 Aliphatics (a+b)	700	11 J	25 J	110 U	57 U
C9-C22 Aromatics (c + d)	200	29 U	31 U	50 U	19 J

- Legend**
- Active (Sampled) Monitoring Well(s)
 - Temporary Monitoring Well(s)
 - Abandoned Monitoring Well(s)
 - Abandoned Buildings
 - Septic Drainfield Area
 - Excavated Soil (2005 Soil Cleanup)
 - Tank 38 (Approximate Location)

Concrete Block Building

Test Pit ID	BNF-TP1	BNF-TP4	NCDEQ MSCCs ¹			
Sample Date	10/12/2023	10/12/2023	Soil-to-Water Maximum Contaminant Concentration (Soil mg/kg)	Residential Soil Cleanup Levels (mg/kg)	Industrial/Commercial Soil Cleanup Levels (mg/kg)	
PID (ppm)	49	0				
Sample Depth (ft)	3	3.5				
Analytical Method	Analyte	mg/kg	mg/kg			
VOCs (EPA 8260D)	Non-Detect					
SVOCs (EPA 8270E)	Phenanthrene	0.55 QS	0.0024 U	64	469	7,000
NCDEQ MADEP Table 10 Worksheet (Change 5, September 7, 2022, mg/kg)	C9-C18 Aliphatics (a + b)	988 Q	14 UQ	540	1,560	23,300
	C19-C36 Aliphatics (y)	190 M-03	12 U	#	31,200	467,000
	C9-C22 Aromatics (c + d)	774 QM-03	0.77 J	31	469	7,000

Analyte	NCDEQ GWQS*	BNF-TW-1	BNF-TW-2	BNF-TW-3	BNF-TW-4
		9/8/2023	9/8/2023	9/8/2023	9/8/2023
NCDEQ MADEP Table 11 Worksheet (Change 2, July 9, 2021) (µg/L)					
C9-C18 Aliphatics (a+b)	700	120 M	140 M	150 M	97 M
C19-C36 Aliphatics (y)	10,000	26 JM	30 JM	29 JM	23 JM
C9-C22 Aromatics (c + d)	200	67	94	390	210



NOTES:

- VOCs, SVOCs, MADEP VPH, and MADEP EPH detections are provided in the tables for the following events:
 - September 8, 2023
 - October 12, 2023
- 1 - North Carolina Department of Environmental Quality Maximum Soil Contaminant Concentration Levels
- * - 15A NCAC 02L .0202 Groundwater Standards (effective April 1, 2022).
- J/(J) - The analyte was positively identified; the quantitation is an estimation with the +/- symbol denoting high or low bias, respectively.
- Underlined values have been qualified by USACE Chemist (see Appendix 5).
- U - Not detected (below the Reporting Detection Limit).
- Yellow Highlighted Bold Text - Positive results above detection limit and exceeding NCDEQ GWQS.
- M - Incorrect auto integration.
- Q - Surrogate failure.
- MS/MSD failure.

Legend

- Active (Sampled) Monitoring Well(s)
- Temporary Monitoring Well(s)
- Abandoned Monitoring Well(s)
- Test Pits (October 12, 2023)
- Tank 38 (Approximate Location)
- Excavated Soil (2005 Soil Cleanup)
- Septic Drainfield Area
- Abandoned Buildings



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Buxton Naval Facility
ANALYTICAL RESULTS MAP
SEP 2022 and OCT 2023
Buxton, NC

DECEMBER 2023 FIGURE 4

