

Marine Corps Base (MCB) Camp Lejeune Restoration Advisory Board (RAB) Meeting Minutes

MEETING DATE: February 15, 2023

LOCATION: Coastal Carolina Community College, Business Technology Building, Jacksonville, North Carolina

ATTENDEES: Thomas Richard/MCB Camp Lejeune Matt Louth/CH2M
Laura Spung/MCB Camp Lejeune Monica Fulkerson/CH2M
David Towler/MCB Camp Lejeune
Eric Adams/MCB Camp Lejeune
Dave Cleland/Navy
Angela Moore/NCDEQ
Jennifer Tufts/EPA
Laura Bader/RAB Co-Chair
Steve Thompson/RAB member
Brian Wheat/RAB member
Michael Curtis/RAB member
Thomas Mattison/RAB member
Rob Johnson/community member
Evan McKernan/community member

FROM: Monica Fulkerson/CH2M

DATE: March 29, 2023

I. Welcome and Introductions

Mr. Richard began the meeting and introduced the team.

II. Land Use Controls and Management

Objective: The purpose of this agenda item is to explain what land use controls (LUCs) are and how they are a part of the CERCLA process, to provide an overview of sites with LUCs, and to explain how they are managed.

Overview: A presentation was reviewed by Mr. Richard.

A LUC is any restriction or control arising from the need to protect human health and the environment, that limits the use of and/or exposure to contaminated media (e.g., soils, surface water, groundwater, soil gas). LUCs are used to minimize the potential for exposure to contamination, protect the integrity of a response action, and to limit land and/or resource use. A Memorandum of Agreement was put into place on 24 May 1999 between EPA, NCDEQ, and the DON/USMC, which established the Land Use Control Assurance Plan and the Installation Restoration (IR) and Munitions Response Programs (MRP).

A community member asked Thomas to explain what CERCLA is. Thomas explained that CERCLA is the Comprehensive Environmental Response, Compensation, and Liability Act which is a process to

investigate and remediate hazardous contamination sites. CERCLA was followed by SARA and the National Contingency Plan, which applied to federal sites. CERCLA is commonly referred to as Superfund.

The CERCLA process begins with the Preliminary Assessment / Site Investigation, during which due diligence, historic document review is completed, followed by on-site data collection. Next, the Remedial Investigation / Feasibility Study is conducted to define nature and extent of contamination along with an assessment of risk to human health and the environment and present remedial alternatives. Then, the Proposed Plan is prepared which shares the proposed remedial action with public and receives comments. This is followed by the Record of Decision (ROD), which is an agreement between partnering agencies (DON/USMC, US EPA, NC DEQ) on the selected remedial action. After the ROD, the Remedial Design/Remedial Action is conducted, which establishes technical specifications and execution of remedial implementation. This is where LUCs are formally established.

When the decision to institute a LUC is made as part of the CERCLA process, it is agreed upon by the partnering team (DON/USMC, USEPA, NC DEQ) and presented for public comment. LUCs provide risk management until 'unrestricted use and unrestricted exposure' is achieved, which means that all acceptable clean up criteria have been met. When a LUC is selected, a LUC Implementation Plan is developed for each site. The LUCs is recorded on a plat map, which is registered with Onslow County through the Register of Deeds. Mr. Richard showed an example plat map. This process ensures that LUCs transfer with the property, should use or ownership change.

There are many different types of LUCs:

- **Aquifer Use Control Boundary:** Prohibits the withdrawal and use of groundwater.
- **Non-Industrial Use Control Boundary (Soil, Groundwater, and/or Waste):** Prohibits nonindustrial land use. (ie. No residential, healthcare, schools/day care facilities)
- **Intrusive Activities Control Boundary (Soil, Groundwater, Waste, and/or Soil Gas):** Prohibits intrusive activities within the extent of soil and/or groundwater contamination and/or waste.
- **Industrial/Non-Industrial Use Control Boundary (Vapor Intrusion [VI]):** Requires VI to be evaluated by assessing multiple lines of evidence.
- **Intrusive Activities Control Boundary (Munitions):** Requires site approval and determination of need for unexploded ordnance (UXO) construction support for any intrusive activities within the LUC boundary. This LUC also requires Recognize, Retreat, Report (3R) Explosives Safety Education for all non-UXO-qualified Base personnel and contractors working within the LUC boundary.
- **Industrial/Non-Industrial Use Control Boundary (Munitions):** Requires site approval if new buildings are to be constructed or if land use changes and prohibits nonindustrial land use. (ie. No residential, healthcare, schools/day care facilities)
- **Explosives Safety Education Program:** Require 3Rs Explosives Safety Education Program for all non-UXO-qualified Base personnel and contractors

There are 27 IR sites with LUCs (IR-96 in process of finalizing LUC), 4 Base Implemented Land Use Controls, and 4 MRP Sites with LUCs (-06, -19, -22, -24). There are DOD specific safety controls at 4 active MRP sites, which are managed at the initiation of the site. There are LUCs in other programs (CERCLA-like processes) as well, including 6 LUC sites under the Resource Conservation and Recovery Act program, 84 total registered Notices of Residual Petroleum sites and 4 NRPs in progress under the UST Program. These programs total 4,214 acres of managed LUCs at MCB Camp Lejeune.

The National Environmental Policy Act (NEPA) Process requires federal projects to consider environmental impacts. Any construction or new process is evaluated as part of planning. Environmental programs review and provide comments. Any known LUCs or other concerns are

documented during this process, inclusive of active Sites (Pre-ROD) and remediation infrastructure. Data are managed via Geospatial Information Systems (GIS) and are available to facility planners and staff. Mr. Richard showed an example of the GIS output. LUCs are used to support MILCON/planning.

There is an annual Intrusive Training class for Facilities/Public Works/Planning staffs, which provides background on sites and updated maps of surficial impacts (but does not show aquifer land use controls, deep groundwater contamination, or monitoring well locations). This is an initial planning tool. MILCON support also includes design mailing list reviews and quarterly base meetings with Planning sections.

The LUC Assurance Plan includes quarterly inspections to ensure LUCs are protective. A site visit is conducted by contractor and/or Base personnel, during which Site-specific checklists are completed. The primary objective is to look for unreported construction projects. Any observed maintenance issues reported to contract repairs, including mowing, fallen trees, and sign repairs.

As part of the LUC Assurance Plan, annual notification letters are sent from Commanding General to NCDEQ and EPA to document the completion of inspections, along with any discrepancies that occurred during the year. Additional notification letters are sent to NCDEQ and EPA for notifications of planned activities in LUC boundaries and reporting any violations of LUC boundaries. Findings from quarterly inspections are also discussed during Partnering meetings. Mr. Richard shared an example notification letter.

Ms. Moore asked Mr. Richard to explain how LUCs are changed. Mr. Richard explained that demonstration of removal of the risk for which the LUC was implemented would be warranted. Ms. Moore clarified that some LUCs are not intended to be permanent and that there is a process for removing those controls if appropriate.

III. Site 89 Update

Objective: The purpose of this agenda item is to present the site history and status of the remedies in place, review supplemental investigation activities and findings, and present the path forward and schedule.

Overview: A presentation was reviewed by Ms. Fulkerson.

An overview of Site 89 was presented. The source of contamination at the site is the activity associated with the former Base motor pool and Defense Reutilization and Marketing Office, resulting in potential risks to human health from volatile organic compounds in groundwater. There is currently a remedy in place, which includes air sparging (AS), permeable reactive barriers (PRBs), and monitored natural attenuation (MNA) for groundwater, aerators and MNA for surface water, and LUCs. The constituents of concern (COCs) in groundwater are: 1,1,2,2-tetrachloroethane (1,1,2,2-PCA); 1,1,2-trichloroethane (TCA); 1,2-dichloroethane (DCA); tetrachloroethene (PCE); trichloroethene (TCE); cis-1,2-dichloroethene (DCE); trans-1,2-DCE; and vinyl chloride (VC). The COCs in surface water are 1,1,2,2-PCA, TCE, and VC. A community member asked what the ultimate breakdown product is. Ms. Fulkerson reported that the final products are ethane, ethene, and chloride.

AS is being conducted to address groundwater in the source area. Since system start-up in (2013), the system has operated approximately 81 percent of the time. COC concentrations in groundwater near the horizontal air sparging wells are stable to decreasing, with isolated areas of increasing concentrations. Vertical AS wells were turned off in 2022 because they were not functioning as intended. There are two PRBs in place to address downgradient groundwater. Concentrations are reducing as groundwater passes through the PRBs and geochemical conditions remain favorable for anaerobic biodegradation. Aerators are functioning within Edwards Creek to address contaminants in surface water. No COCs are detected above cleanup levels at the most downstream sampling location, indicating aerators are effectively treating surface water and no contamination is migrating offsite. MNA

is implemented to address areas outside of active treatment. Overall, concentrations are generally stable to decreasing in both concentration and extent.

In 2014/2015, multiple order of magnitude increases in concentration were detected in groundwater samples collected from the Castle Hayne aquifer within the source area. These concentrations were indicative of dense non-aqueous phase liquid (DNAPL). Preliminary results indicated DNAPL may have compromised the integrity of the polyvinyl chloride (PVC) well casing. These wells were abandoned and a supplemental investigation began.

Between 2017 and 2022, a supplemental investigation was conducted to refine the conceptual site model based on the discovery of DNAPL. Activities included high-resolution site characterization using membrane interface probe and hydraulic profiling tool (MIHPT), soil sampling, installation of groundwater monitoring wells, and groundwater sampling of new and existing wells.

Focusing on the surficial aquifer, MIHPT was conducted at 27 locations in 2017 and at 24 locations in 2021. The results of the MIHPT investigation in the surficial aquifer identified the highest results in lowest permeability zones and showed that the vertical extent controlled by semi-confining unit 23 to 26 feet below ground surface (bgs). Soil sampling was conducted to further evaluate the surficial aquifer, including 8 samples in 2018, 64 samples in 2021, and 5 samples in 2022. The results of soil sampling in the surficial aquifer indicated source concentrations in saturated soil, with the highest concentrations between 5 and 10 feet below ground surface (bgs). In 2018, 1 surficial aquifer and 9 Castle Hayne aquifer monitoring wells installed and in 2022, 3 Castle Hayne aquifer monitoring wells installed. Analytical results indicated stratified impacts in the Castle Hayne aquifer as follows: from 65-70 feet bgs, there is a generally delineated low concentration plume; between 105 and 110 feet bgs, COC concentrations are indicative of DNAPL and the plume is not delineated to the southwest; and between 120 and 125 feet bgs, there is a low concentration plume and the vertical gradient suggests migration from higher depths may be limited.

The supplemental investigation concluded that in the surficial aquifer, a source area is not being treated by current remedies (AS and MNA). This will serve as a continuing source of groundwater contamination. In the Castle Hayne aquifer, groundwater with DNAPL level concentrations is not being treated by current remedies (AS and MNA). DNAPL exists in higher conductivity zones than surficial aquifer.

An Engineering Evaluation/Cost Analysis (EE/CA) will be conducted to evaluate removal action alternatives for addressing source areas in the surficial aquifer and DNAPL in the Castle Hayne aquifer. After completion of the EE/CA and removal action, the site-wide remedial strategy will be evaluated. The following technologies will be consider as part of EE/CA development: In situ thermal treatment, excavation, in-situ chemical reduction (ISCR) or enhanced reductive dichlorination (ERD) via soil mixing, targeted excavation with zero valent iron (ZVI) injections via fracturing, and bioelectrochemical remediation for the surficial aquifer and expanded AS, ISCR/ERD injections, groundwater extraction and treatment via air stripper and granular activated carbon, and groundwater extraction and treatment via subgrade biogeochemical reactor for the Castle Hayne aquifer. The EE/CA will consist of site characterization; identification of removal action objectives, including limits of removal action and the target treatment area; identification and analysis of removal action alternatives based on effectiveness, implementability, and cost; and a comparative analysis of removal action alternatives. Following the EE/CA, there will be a public comment period and then the recommended removal action alternative will be documented in an Action Memorandum.

The EE/CA is expected to be completed in Summer 2023. The comment period will be open for one month, during which there will be a public meeting. The Action Memorandum is expected to be finalized in Fall/Winter 2023.

A community member asked how large the target removal action areas are. Ms. Fulkerson reported that impacts in the surficial aquifer are approximately 0.3 acres and in the Castle Hayne aquifer is less than 0.1 acres. The extent is fairly limited.

IV. RAB Business

The next RAB meeting will be scheduled for May 2023 and an email with the projected date will be sent to the RAB members. Mr. Mattison talked about a program being implemented by Lions Inc. for children under 7 years old for eye screening (Lions Kidsight USA). He is targeting home-schooled children and children in daycares and appreciates any help identifying these children.



Marine Corps Installations East Marine Corps Base Camp Lejeune



Land Use Controls and Management



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Land Use Controls - Overview



- ❖ What is a Land Use Control?
- ❖ CERCLA Process
- ❖ Sites at Camp Lejeune
- ❖ Management
 - Quarterly Inspections by Base and/or Contractors
 - Annual Notification letters
 - LUC Implementation Plan/LUC Assurance Plan



Land Use Controls



❖ A Land Use Control (LUC) is any restriction or control arising from the need to protect human health and the environment, that limits the use of and/or exposure to contaminated media (e.g., soils, surface water, groundwater, soil gas).

- Minimize the potential for exposure to contamination
- Protect the integrity of a response action
- Limit land and/or resource use

❖ Memorandum of Agreement, 24 May 1999

- Between EPA, NCDEQ, DON/USMC
- Established our Land Use Control Assurance Plan
- Installation Restoration (IR) and Munitions Response Programs (MRP)





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Land Use Controls - CERCLA Process



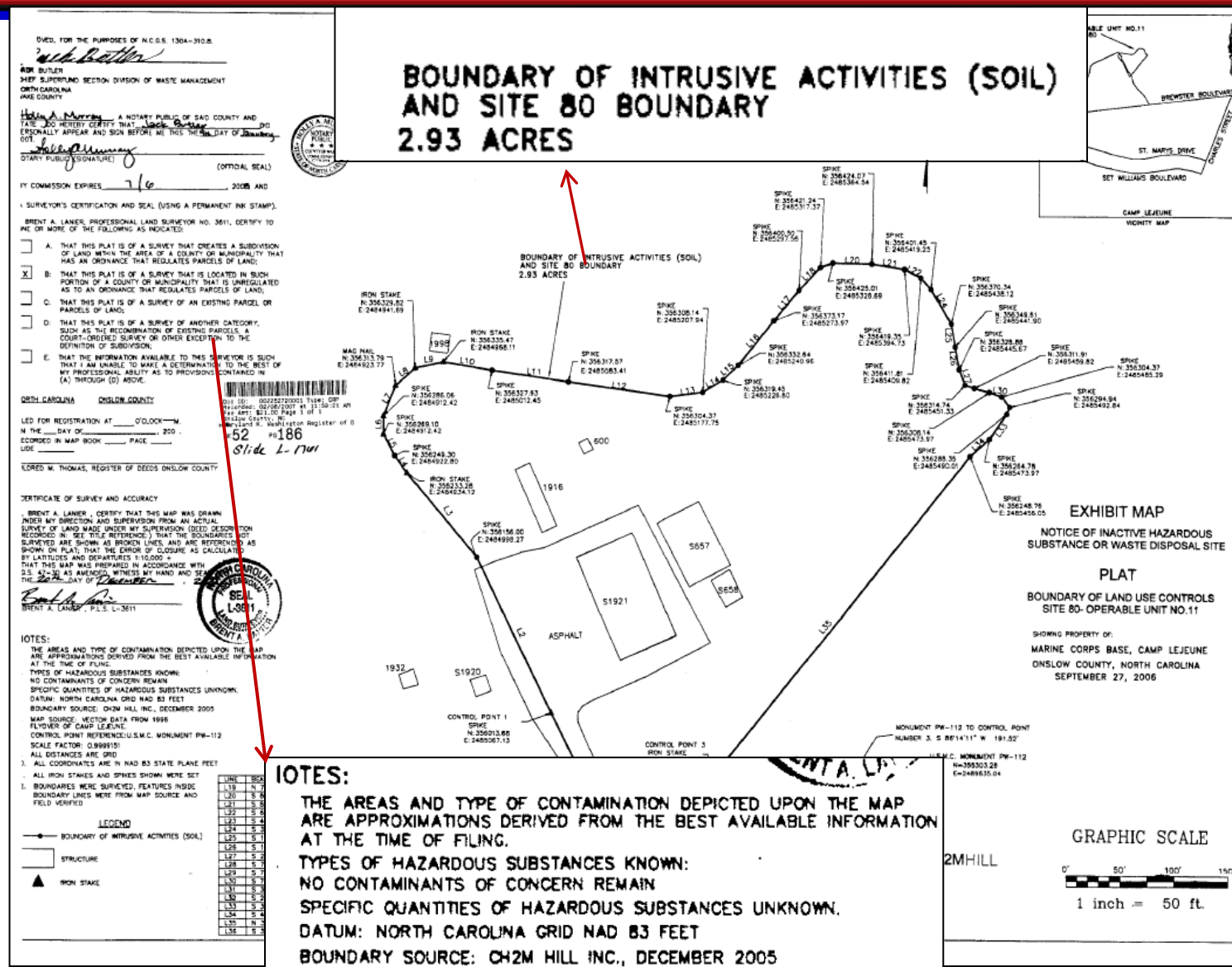
- ❖ Preliminary Assessment / Site Investigation
 - Due diligence, historic document review
 - On-site data collection
- ❖ Remedial Investigation / Feasibility Study
 - Define nature and extent of contamination along with an assessment of risk to human health and the environment
 - Present remedial alternatives
- ❖ Proposed Plan
 - Shares the proposed remedial action with public and receives comments
- ❖ Record of Decision (ROD)
 - Agreement between partnering agencies (DON/USMC, US EPA, NC DEQ)
- ❖ Remedial Design/Remedial Action
 - Establishes technical specifications and execution of remedial implementation
 - Land Use Controls (LUCs) are formally established



Land Use Controls – Plat Map



- ❖ Decision made as part of the CERCLA process
 - Decided on by partnering team (DON/USMC, USEPA, NC DEQ)
 - Presented for public comment
- ❖ Risk management until 'unrestricted use and unrestricted exposure' is achieved.
 - Meets acceptable clean up criteria
- ❖ LUC Implementation Plan for each site
- ❖ Registered with County
 - Register of Deeds
 - LUCs transfer with property





Land Use Controls – Types



- ❖ **Aquifer Use Control Boundary**
 - Prohibit the withdrawal and use of groundwater.
- ❖ **Non-Industrial Use Control Boundary (Soil, Groundwater, and/or Waste)**
 - Prohibit nonindustrial land use. (ie. No residential, healthcare, schools/day care facilities)
- ❖ **Intrusive Activities Control Boundary (Soil, Groundwater, Waste, and/or Soil Gas)**
 - Prohibit intrusive activities within the extent of soil and/or groundwater contamination and/or waste.
- ❖ **Industrial/Non-Industrial Use Control Boundary (Vapor Intrusion [VI])**
 - VI will be evaluated by assessing multiple lines of evidence.
- ❖ **Intrusive Activities Control Boundary (Munitions)**
 - Require site approval and determination of need for unexploded ordnance (UXO) construction support for any intrusive activities within the LUC boundary.
 - Require Recognize, Retreat, Report (3R) Explosives Safety Education for all non-UXO-qualified Base personnel and contractors working within the LUC boundary.
- ❖ **Industrial/Non-Industrial Use Control Boundary (Munitions) –**
 - Require site approval if new buildings are to be constructed or if land use changes
 - Prohibit nonindustrial land use. (ie. No residential, healthcare, schools/day care facilities)
- ❖ **Explosives Safety Education Program –**
 - Require 3Rs Explosives Safety Education Program for all non-UXO-qualified Base personnel and contractors.



Land Use Controls – Sites



- ❖ IR and MRP sites with LUCs monitored
 - 27 IR sites with LUCs (IR-96 in process of finalizing LUC)
 - 4 Base Implemented Land Use Controls
 - 4 MRP Sites with LUCs (-06, -19, -22, -24,)
- ❖ DOD specific safety controls
 - 4 active MRP sites
 - Managed at the initiation of the site
- ❖ Other programs (CERCLA-like processes)
 - Resource Conservation and Recovery Act corrective action LUCs
 - 6 LUC sites
 - UST Program
 - 84 total registered Notices of Residual Petroleum
 - 4 NRPs in progress
- ❖ Total of 4,214 acres of managed LUCs





Land Use Controls - Management

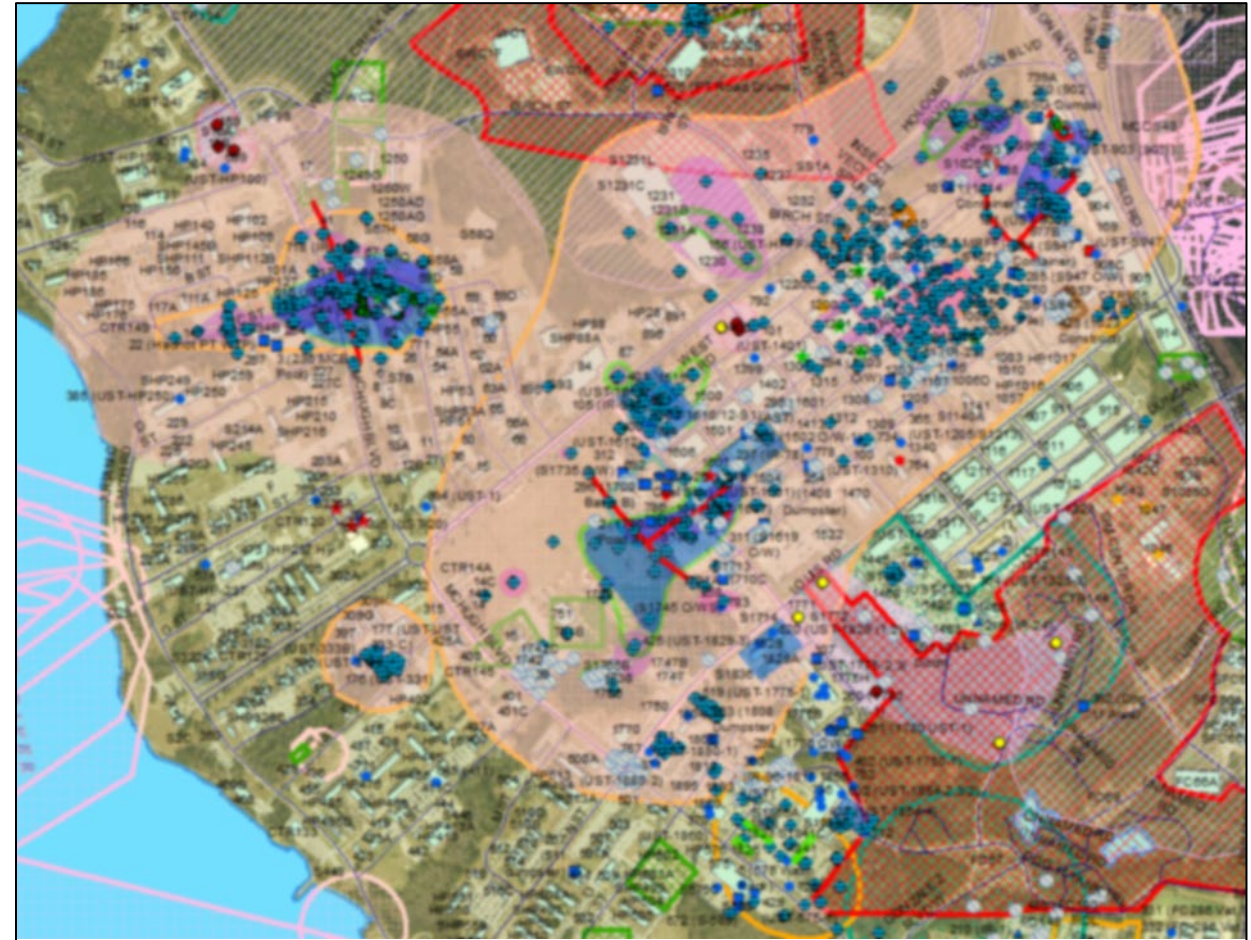


❖ National Environmental Policy Act (NEPA) Process

- NEPA requires federal projects to consider environmental impacts
- Any construction or new process is evaluated
 - Part of planning
 - Environmental programs review and provide comments
- We will document any known LUCs or other concerns
 - Active Sites (Pre-ROD)
 - Remediation infrastructure

❖ Data managed via Geospatial Information Systems

- Available to facility planners and staff





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Land Use Controls – Supporting MILCON/Planning

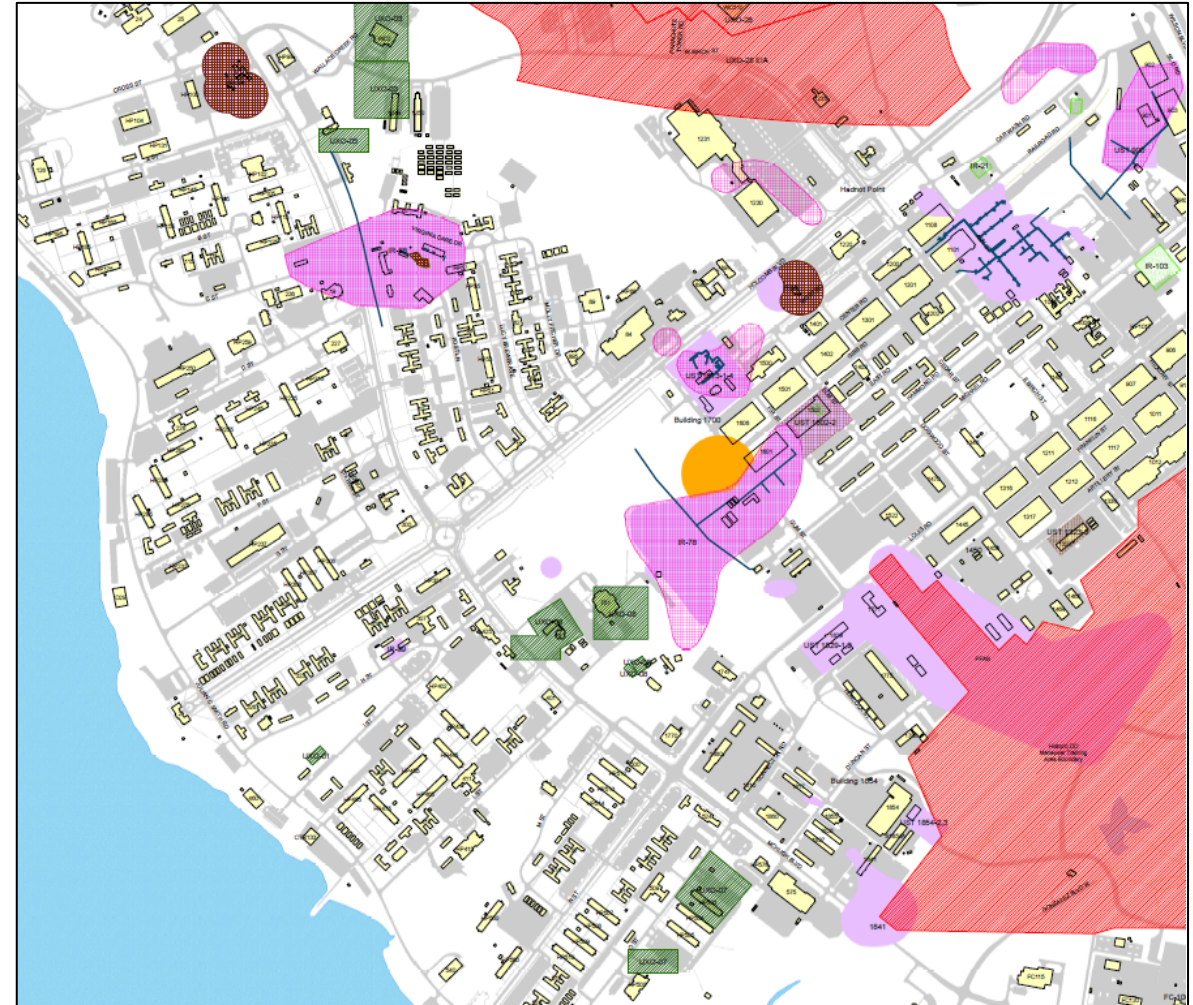


❖ Annual Intrusive Training Class

- Background on sites and contaminants
- Facilities/Public Works/Planning staffs
- Updated Maps of Surficial Impacts
 - Does not show aquifer land use controls, deep groundwater contamination, or monitoring well locations
 - Initial planning tool
 - Example shown to right

❖ Design mailing list reviews

❖ Quarterly base meetings with Planning sections





Land Use Control – Assurance Plan



❖ Quarterly Inspections

- Ensure LUCs are protective
- Site visits
 - Contractor and/or Base Personnel
 - Site specific checklists
- Looking for unreported construction projects

❖ Any observed maintenance issues reported to contract repairs

- Mowing
- Fallen Trees
- Sign repairs

MCB CAMP LEJEUNE INSPECTION CHECKLIST

Site Name: OU 11 Site 80		Date: 1/4/23			
Weather Conditions: SUNNY 70°		Inspected By: [REDACTED]			
Item	Description	Observations	Acceptable		Recommended Action
			Yes	No	
SITE 80 LAND USE CONTROLS (Quarterly)					
LUCs	Note any signs of new or planned construction and any changes to existing building use.	NONE	X		NONE
	Note any intrusive activities (human and/or non-human).	NONE	X		NONE
SITE 80 GENERAL SITE CONDITIONS					
General Site Conditions	Note any of the following: Illegal waste disposal onsite Equipment/material storage onsite	NONE	X		NONE

ADDITIONAL COMMENTS

INSPECTED BY: [REDACTED] DATE: 1/4/23
IRP MANAGER: Thomas Richard DATE: 01/27/23



Communications with Regulators




❖ Annual notification letter from Commanding General to NCDEQ and EPA

- Documents completion of inspections along with any discrepancies that occurred during the year.

❖ Additional notification letters to NCDEQ and EPA for:

- Notifications of planned activities in LUC boundaries
- Notifications of any violations of LUC boundaries

❖ Partnering discussions



UNITED STATES MARINE CORPS
MARINE CORPS INSTALLATIONS EAST-MARINE CORPS BASE
PSC BOX 20005
CAMP LEJEUNE NC 28542-0005


5090.10
G-F/BEMD
MAY 11 2022

Ms. Jennifer Tufts
US Environmental Protection Agency
Region IV
Sam Nunn Atlanta Federal Center
61 Forsyth Street SW
Atlanta, Georgia 30303

Dear Ms. Tufts:

This letter is provided in compliance with the annual reporting requirement in the Memorandum of Agreement for the Land Use Control Assurance Plan (LUCAP). In accordance with the LUCAP, quarterly inspections were completed for the period from May 2021 to April 2022. This letter certifies that all Installation Restoration Sites and Munition Response Sites with Land Use Control Implementation Plans are currently in compliance with the established land use controls.

Direct any questions to Mr. Thomas Richard, Environmental Quality Branch, Environmental Management Division, G-F, at (910)451-9641.

Sincerely,

ANDREW M. NIEBEL
Brigadier General, U.S. Marine Corps
Commanding General

Copy to:
NAVFAC (Ms. Lindsey Mills)
NAVFAC (Mr. Dave Cleland)
NCDEQ (Mr. Randy McElveen)
FILE (ODI #26913)



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Example Notification Letter



UNITED STATES MARINE CORPS
MARINE CORPS INSTALLATIONS EAST-MARINE CORPS BASE
PSC BOX 20005
CAMP LEJEUNE NC 28542-0005

5090.10
G-F/BEMD
16-Jun-2020

Ms. Jennifer Tufts
US Environmental Protection Agency
Region IV
Sam Nunn Atlanta Federal Center
61 Forsyth Street SW
Atlanta, Georgia 30303

Dear Ms. Tufts:

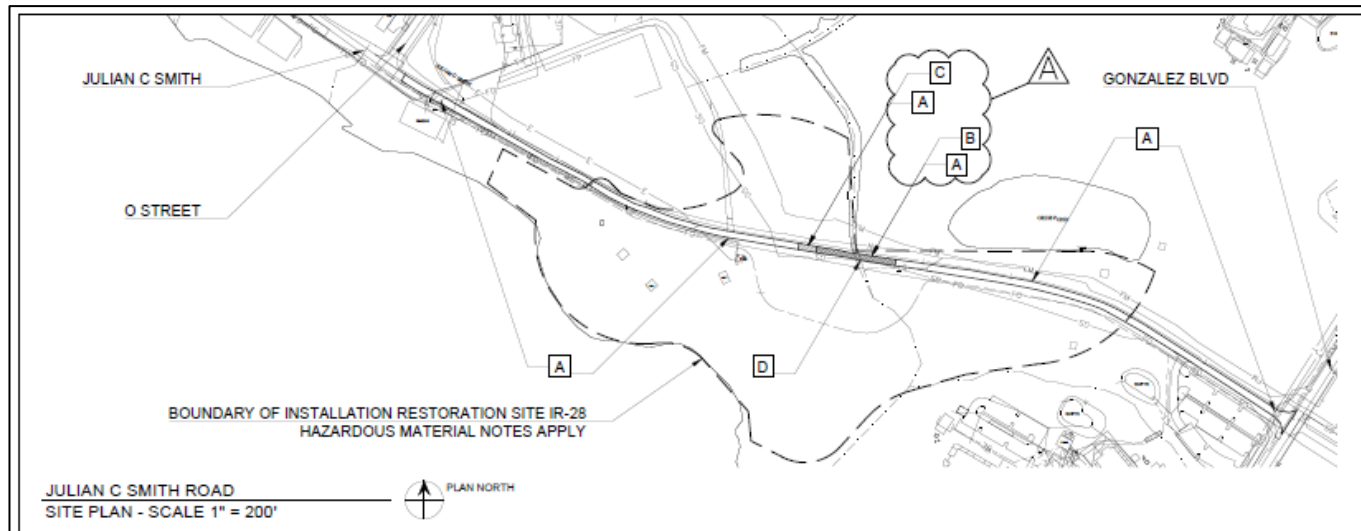
As required by the Land Use Control Assurance Plan (LUCAP), this letter is to inform you of planned intrusive activities to repair damaged sections of Julian C Smith Road within Operable Unit 7, Installation Restoration (IR) Site 28, located aboard Marine Corps Base Camp Lejeune (MCB CAMLEJ), North Carolina. The intrusive activities are described in Government Solicitation N4008520R4044, sub project 19-0161, Repair Julian C Smith Road (Enclosure 1).

General Scope of Work:

- The first excavation is to conduct subgrade repairs below Julian C Smith Road. This excavation will cover 265 feet of the roadway and will extend 2 feet into the road subgrade. Approximately 314 cubic yards of assumed native material will be disturbed.
- The second excavation is to conduct subgrade repairs below Julian C Smith Road. This excavation will cover 60 feet of the roadway and will extend 5 feet into the road subgrade. Approximately 178 cubic yards of assumed native material will be excavated.
- For both excavations, all excavated material will have a toxicity characteristic leaching procedure (TCLP) analysis conducted and manifested before being transported to the MCB CAMLEJ permitted landfill.
- Once all the material has been excavated, new aggregate base course will be used to fill the excavations and act as the new subgrade. A new asphalt wearing course will then be installed to repair the roadway.

Site specific precautions to be taken are as follows:

- Because the project is located within the boundaries of IR-28, a former burn dump, there is the potential for buried debris, such as oxidized metal, glass, bricks, wire, and wood, to be found during intrusive activities. Previous site assessment activities have concluded there are no unacceptable risks to workers from exposure to site soil. However, due to the presence of buried debris, all individuals that enter the construction site once



HAZARDOUS MATERIALS

1. THE PROJECT IS LOCATED WITHIN THE BOUNDARIES OF INSTALLATION RESTORATION SITE IR-28, A FORMER BURN DUMP. THERE IS THE POTENTIAL FOR BURIED DEBRIS, SUCH AS OXIDIZED METAL, GLASS, BRICKS, WIRE, AND WOOD, TO BE FOUND DURING EXCAVATION ACTIVITIES. PREVIOUS SITE ASSESSMENT ACTIVITIES HAVE CONCLUDED THERE ARE NO UNACCEPTABLE RISKS TO WORKERS FROM EXPOSURE TO SITE SOIL. HOWEVER, DUE TO TO POTENTIAL PRESENCE OF BURIED DEBRIS, HAZWOPER TRAINING IS REQUIRED FOR ALL CONSTRUCTION WORKERS WHO MAY COME INTO CONTACT WITH THE BURIED WASTE.

2. ALL EXCAVATED DEBRIS MUST BE PROPERLY DISPOSED OFF-SITE IN ACCORDANCE WITH ALL STATE AND FEDERAL REGULATIONS. IT CANNOT BE REBURIED ON-SITE. ON-SITE MEANS WITHIN THE BOUNDARIES OF IR-28. EXCAVATED SOILS SHALL BE TRANSPORTED TO THE MCB CLNC LANDFILL. EXCAVATED SOILS WILL REQUIRE TCLP ANALYSIS AND MANIFESTING. IR-28 IS ALSO A SUSPECT PFAS SITE. MATERIALS LEAVING IR-28 MUST BE LABELED AS "MAY CONTAIN PFAS" PER DON 2017 PFAS GUIDANCE. COORDINATE THE TESTING AND TRANSPORTATION OF EXCAVATED SOILS WITH MCB CLNC ENVIRONMENTAL MANAGEMENT DIVISION (END) AND THE LANDFILL.

3. IF EVIDENCE OF CONTAMINATION IS FOUND (I.E., STAINED SOILS NOT FROM THE KNOWN BURNED DEBRIS, BURIED DRUMS, ODORS, ETC), STOP WORK AND CONTACT EMD FOR FURTHER INSTRUCTION (910-451-5003).

4. BECAUSE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)-ENFORCEABLE LAND USE CONTROLS ARE IN PLACE AT THIS SITE TO RESTRICT DIGGING INTO THE SOIL, OFFICIAL NOTIFICATION BY LETTER OF PROPOSED CONSTRUCTION ACTIVITIES AND THE PRECAUTIONS TO BE TAKEN MUST BE SENT A MINIMUM OF 60 DAYS PRIOR TO START OF WORK. THE LETTER WILL BE SENT BY THE BASE INSTALLATION RESTORATION PROGRAM, BUT THEY MUST BE NOTIFIED A MINIMUM 60 DAYS PRIOR TO START OF WORK OF WHAT SAFETY PRECAUTIONS ARE BEING TAKEN AND WHERE DEBRIS WILL BE DISPOSED. CONTACT THE IR PROGRAM MANAGER AT LEJEUNE_IR_PROGRAM@USMC.MIL, OR 910-451-5003.



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Land Use Controls



MCB

CAMLEJ

Questions?



Installation Restoration Section
MCB CAMLEJ



CAMP LEJEUNE

HOME OF
EXPEDITIONARY
FORCES IN READINESS



Site 89 Update

MCB Camp Lejeune
Restoration Advisory Board Meeting
February 15, 2023

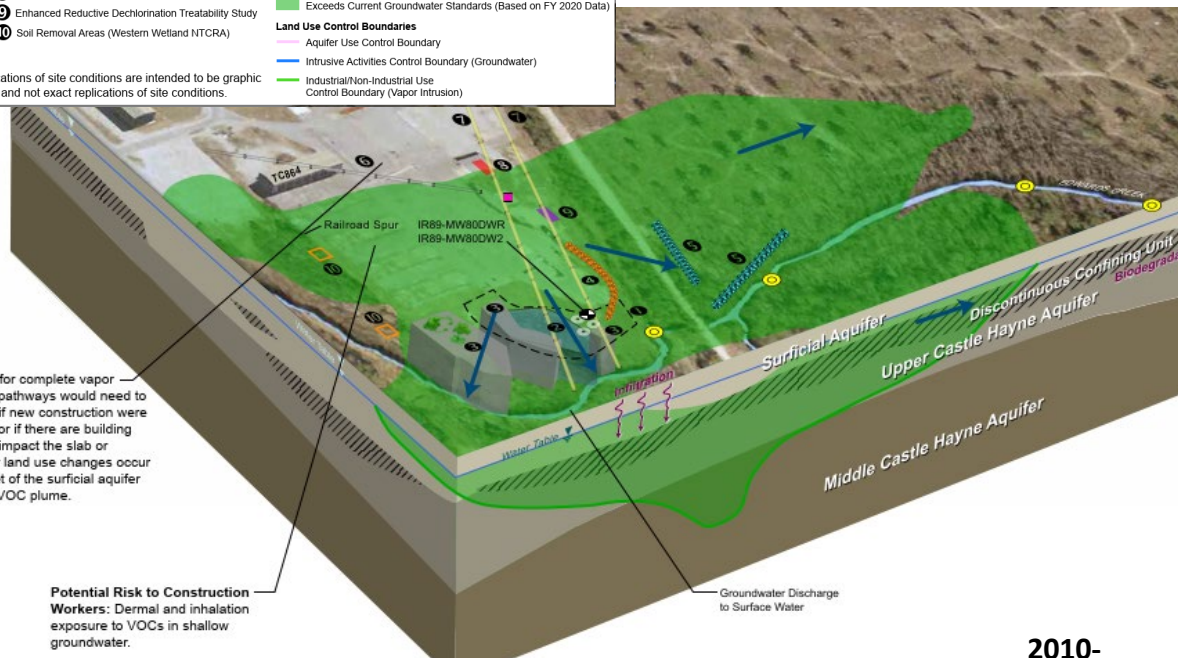
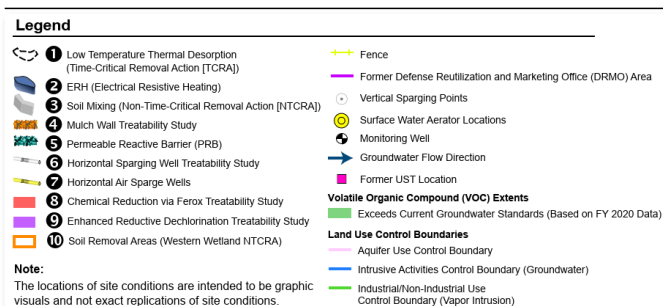


Objectives

- Present site history and status remedies in place
- Review supplemental investigation activities and findings
- Present path forward and schedule



Site 89 – Former Base Motor Pool (DRMO)



- **Source**
 - Base motor pool and Defense Reutilization and Marketing Office
- **Potential Risks**
 - Human health risks from volatile organic compounds in groundwater
- **Current Status**
 - Remedy-in-place
 - Groundwater:
 - Air sparging
 - Permeable Reactive Barriers (PRBs)
 - Monitored Natural Attenuation (MNA)
 - Surface water:
 - Aerators
 - MNA
 - Land Use Control (LUCs)



Remedies in Place

Constituents of Concern (COCs)

Groundwater: VOCs (1,1,2,2-tetrachloroethane [1,1,2,2-PCA]; 1,1,2-trichloroethane [TCA]; 1,2-dichloroethane [DCA]; tetrachloroethene [PCE]; trichloroethene [TCE]; cis-1,2-dichloroethene [DCE]; trans-1,2-DCE; vinyl chloride [VC])

Surface water: VOCs (1,1,2,2-PCA; TCE; VC)

- AS (Source Area)
 - Since system start-up in (2013), the system has operated ~81 percent of the time
 - COC concentrations in groundwater near the horizontal air sparging wells are stable to decreasing, with isolated areas of increasing concentrations
 - Vertical air sparging wells were turned off in 2022 because they were not functioning as intended
- PRB (Downgradient Area)
 - Concentrations are reducing as groundwater passes through the PRBs
 - Geochemical conditions remain favorable for anaerobic biodegradation
- Aerators (Surface Water)
 - No COCs detected above cleanup levels at the most downstream sampling location, indicating aerators are effectively treating surface water and no contamination is migrating offsite
- MNA
 - Overall, concentrations outside of active treatment areas are generally stable to decreasing in both concentration and extent

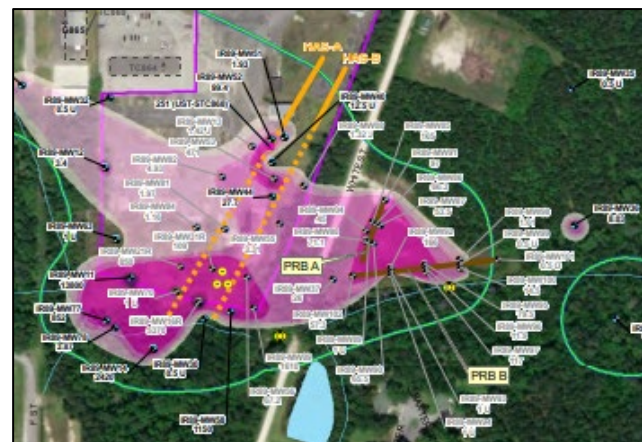
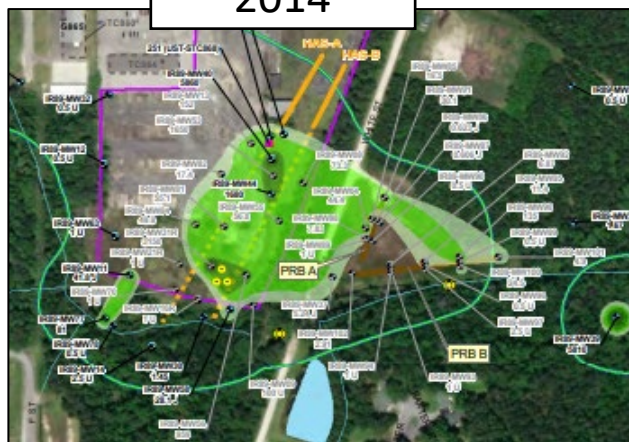
Surficial Aquifer Trends

- MK not Performed
- Decreasing Trend by MK
- Increasing Trend by MK
- Stable by MK
- No Significant Trend by MK

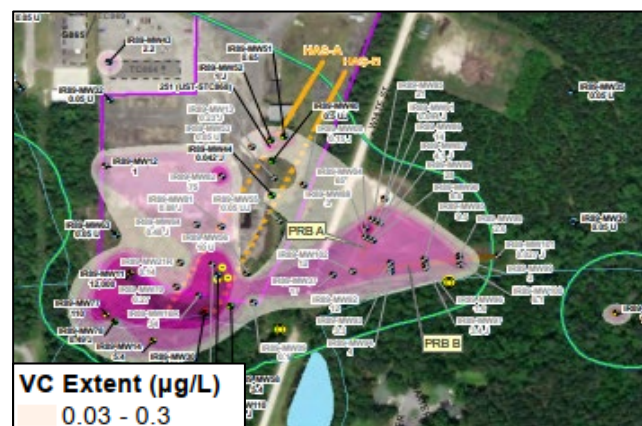
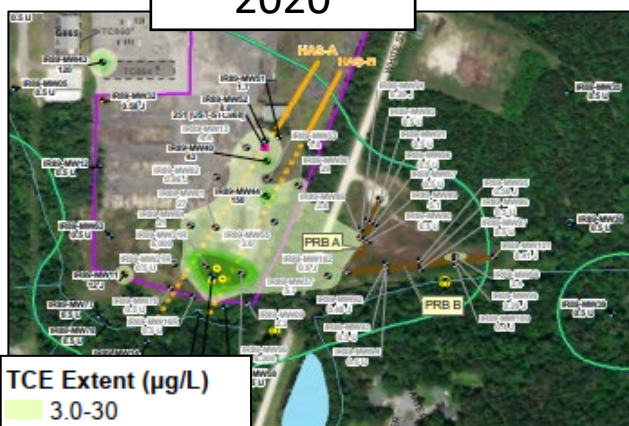
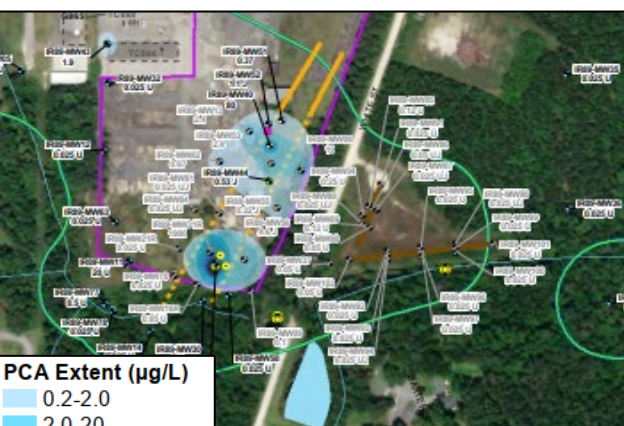
MK: Mann Kendall

A statistical test used to assess whether a set of data values is increasing over time or decreasing over time.

2014



2020



PCA Extent (µg/L)

- 0.2-2.0
- 2.0-20
- 20-200
- 200-2000
- 2000-200000
- 20000-200000
- 200000-2000000

TCE Extent (µg/L)

- 3.0-30
- 30-300
- 300-3000
- 3000-30000
- 30000-300000
- 300000-3000000

VC Extent (µg/L)

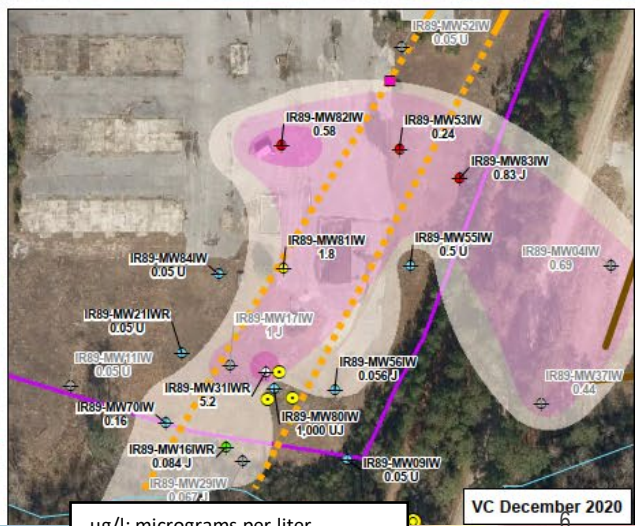
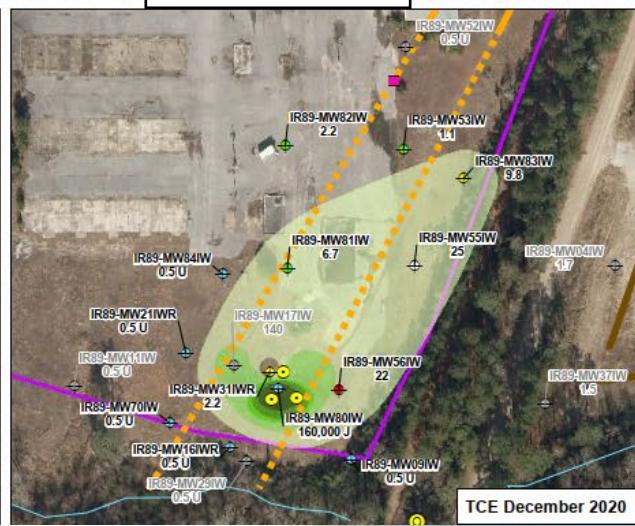
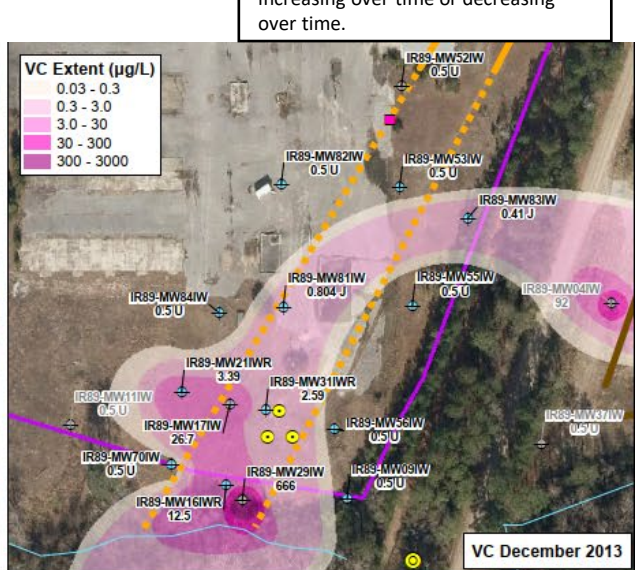
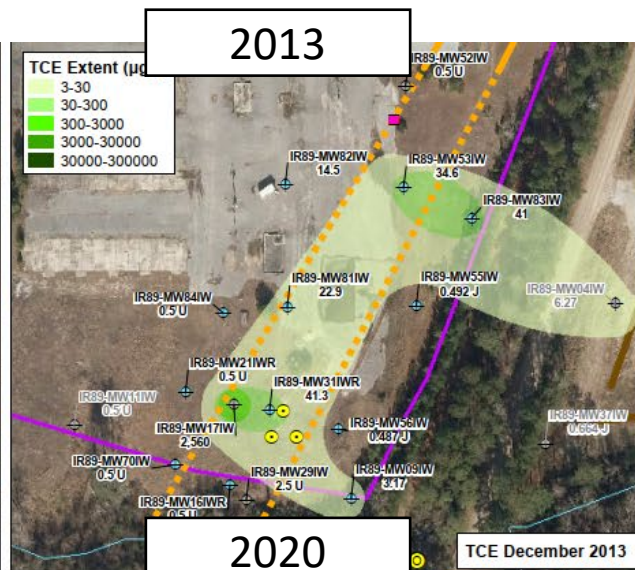
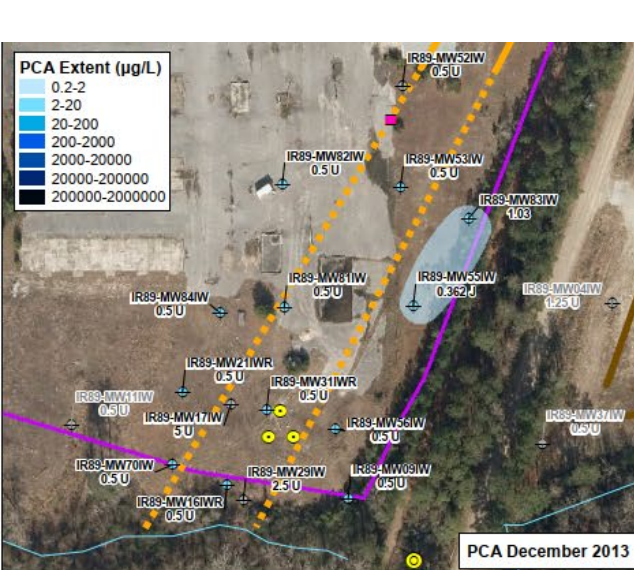
- 0.03 - 0.3
- 0.3 - 3
- 3 - 30
- 30 - 300
- 300 - 3000
- 3000 - 30000

µg/L: micrograms per liter

Castle Hayne Aquifer Trends

- MK not Performed
- Decreasing Trend by MK
- Increasing Trend by MK
- Stable by MK
- No Significant Trend by MK

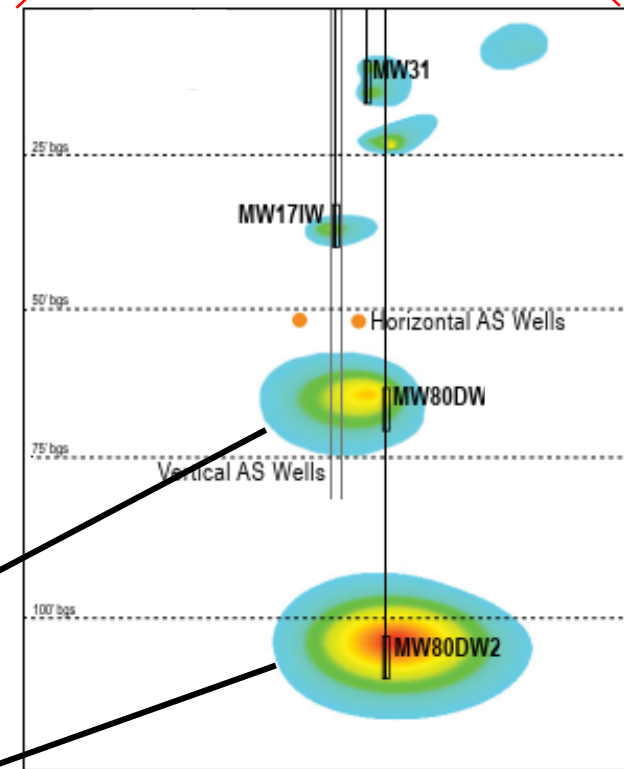
MK: Mann Kendall
A statistical test used to assess whether a set of data values is increasing over time or decreasing over time.



µg/L: micrograms per liter

Castle Hayne Aquifer Trends

- In 2014/2015, multiple order of magnitude increases in concentration were detected, indicative of dense non-aqueous phase liquid (DNAPL)
- Preliminary results indicated DNAPL may have compromised the integrity of the polyvinyl chloride (PVC) well casing
- Wells were abandoned and supplemental investigation began



µg/l: micrograms per liter

MW80DW	3/22/12	6/25/15
1,1,2,2-PCA (µg/L)	63 J	220,000
TCE (µg/L)	370	572,000

MW80DW2	3/22/12	6/25/15
TCE (µg/L)	1 U	595,000

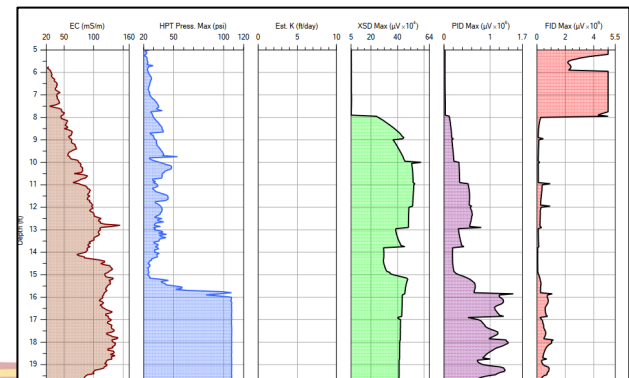
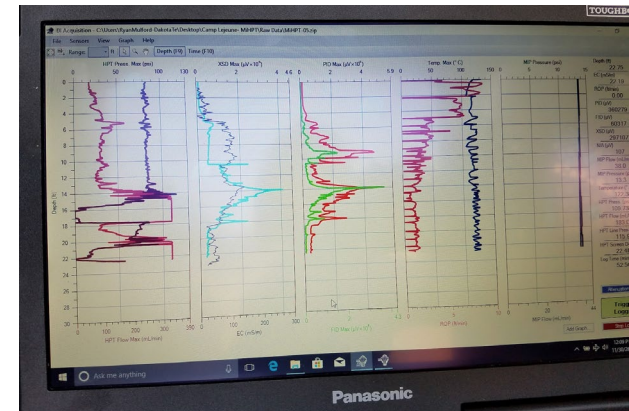
Supplemental Investigation 2017 - 2022

- Objective: Refine the conceptual site model based on the discovery of DNAPL
- Activities:
 - High-resolution site characterization using membrane interface probe and hydraulic profiling tool (MIHPT)
 - Soil sampling
 - Installation of groundwater monitoring wells
 - Groundwater sampling of new and existing wells



Surficial Aquifer MIHPT

- 2017: 27 locations
- 2021: 24 locations

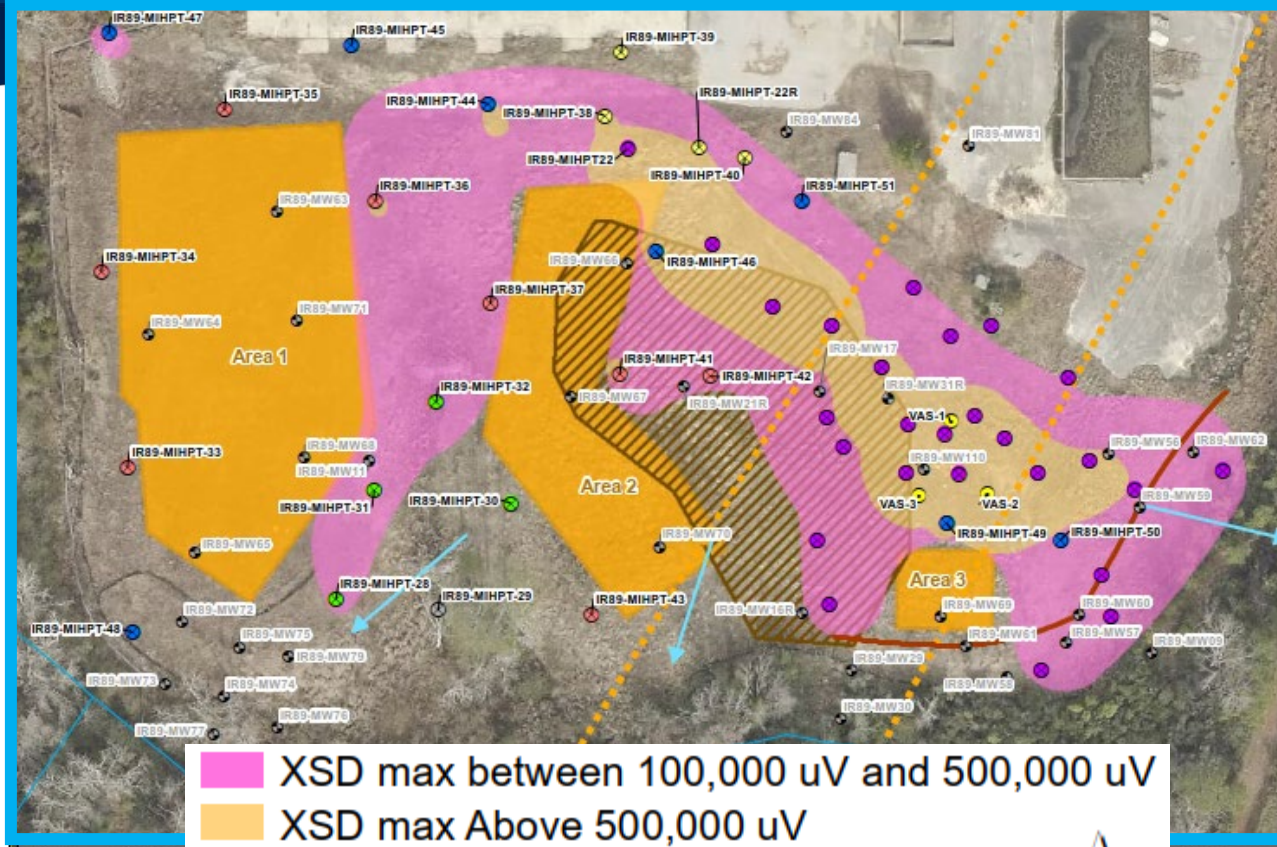


Surficial Aquifer MIHPT Results

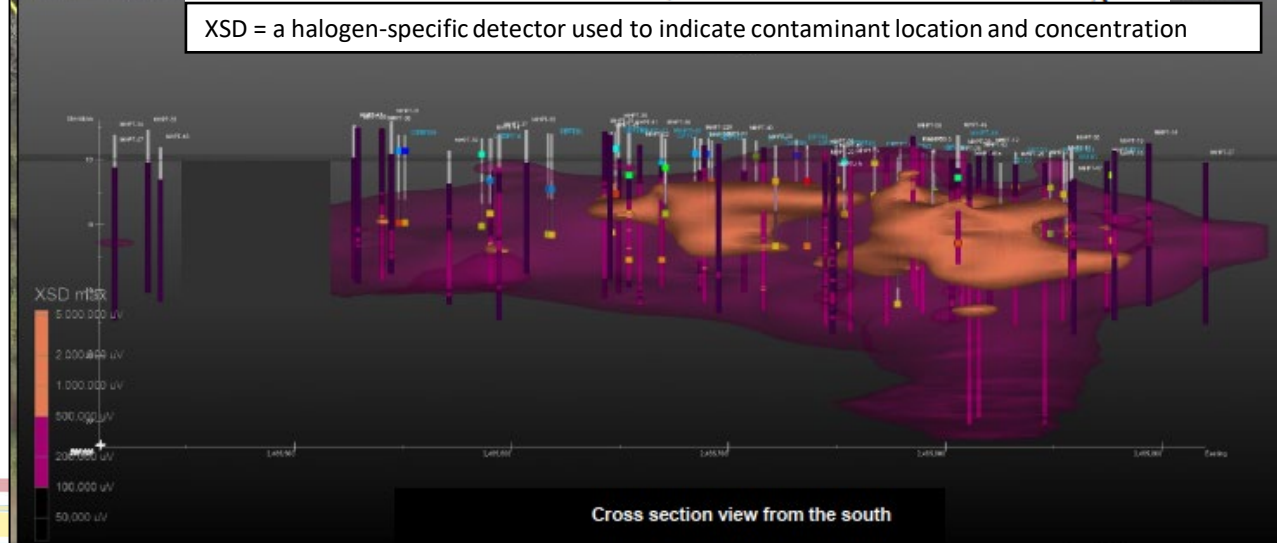
- Highest results in lowest permeability zones
- Vertical extent controlled by semi-confining unit 23 to 26 feet below ground surface (bgs)



- Legend**
- 2017 MIHPT Locations
 - Initial MIHPT Points around MW11
 - Initial MIHPT Points around MIHPT 22
 - Initial MIHPT Points around soil mixing zones
 - Step Out MIHPT Point
 - Surficial Aquifer Monitoring Well
 - Vertical Sparging Points
 - Groundwater Flow Direction
 - PRB
 - Horizontal Air Sparging Wells
 - Surface Water
 - ▨ ERH Treatment Area
 - ▨ Soil Mixing Treatment Areas



XSD = a halogen-specific detector used to indicate contaminant location and concentration



Surficial Aquifer Soil Sampling

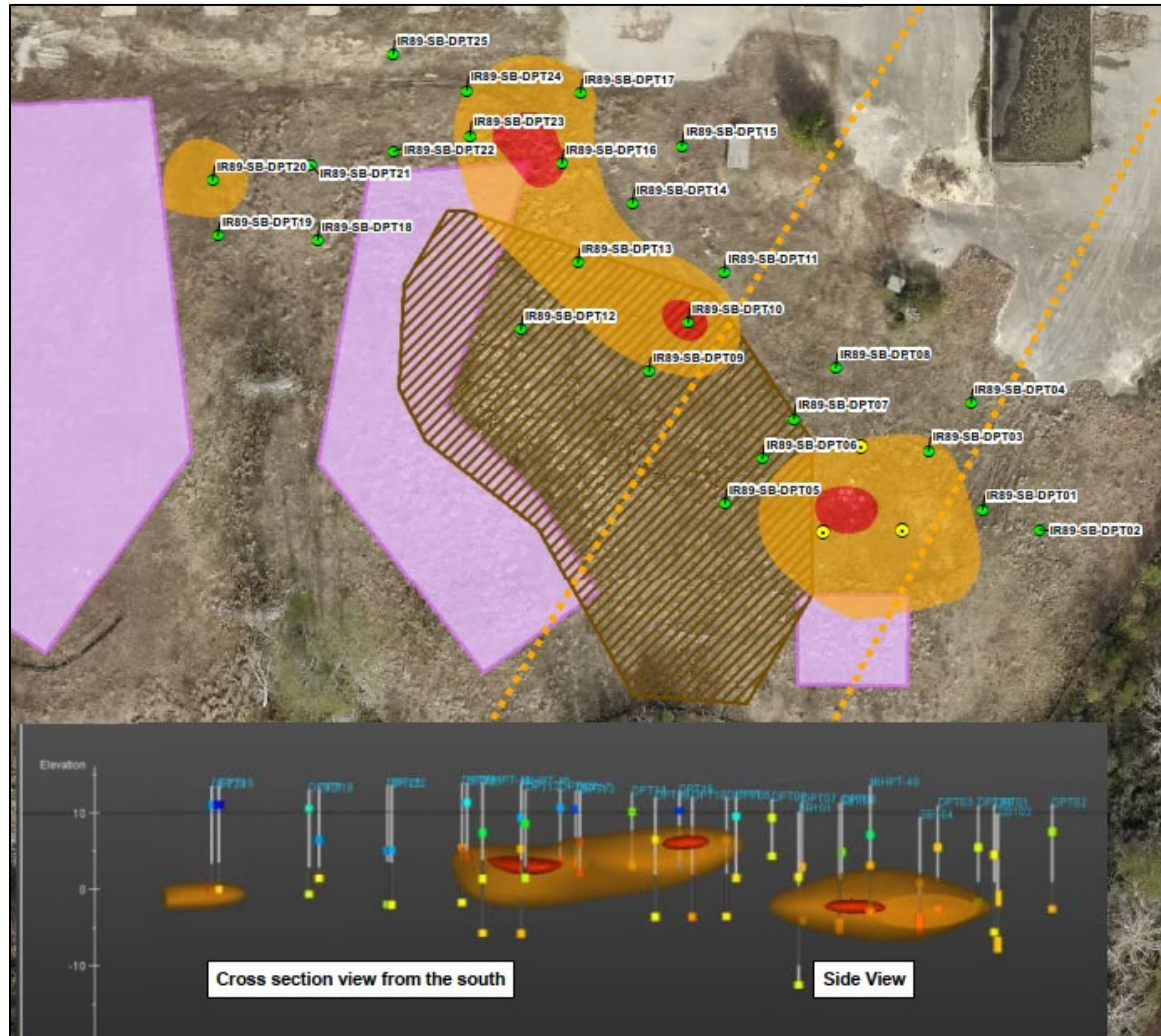
- 2018: 8 samples collected
- 2021: 64 samples collected
- 2022: 5 samples collected



Source area defined as total CVOCs above 100,000 µg/kg
 Total CVOCs Above 1,000,000 µg/kg

Surficial Aquifer Soil Results

- Source concentrations identified in saturated soil
- Highest concentrations 5 to 10 feet bgs



Total CVOCs (µg/kg)	Chemical Mass (kilograms)	Impacted area (square feet)	Soil Volume (cubic yards)
> 100,000	1,010	13,230	2,450
> 1,000,000	95	1,189	54

µg/kg: micrograms per kilogram

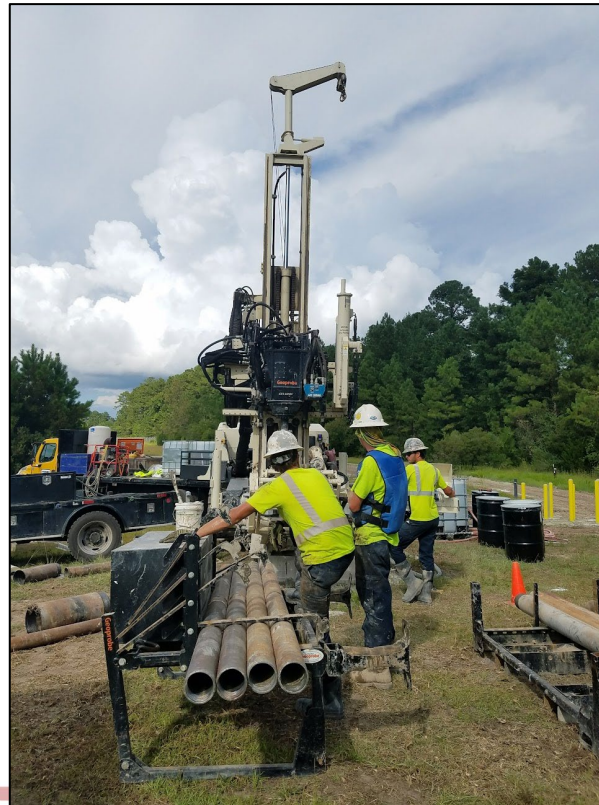
CVOCs: chlorinated volatile organic compounds

Legend

- Phase 2 Soil Sampling Locations
- Vertical Sparging Points
- ⊙ Aerator Locations
- Horizontal Air Sparging Wells
- Surface Water
- ▨ ERH Treatment Area
- ▭ Soil Mixing Treatment Areas

Groundwater Monitoring Well Installation

- 2018: 1 surficial aquifer and 9 Castle Hayne aquifer monitoring wells installed
- 2022: 3 Castle Hayne aquifer monitoring wells installed

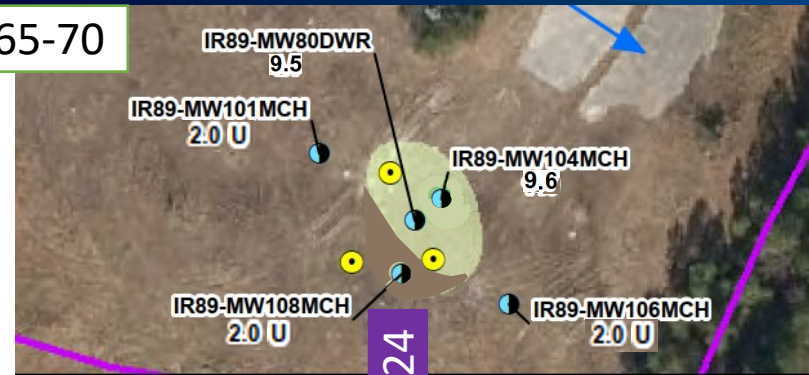


Castle Hayne Aquifer Groundwater Results

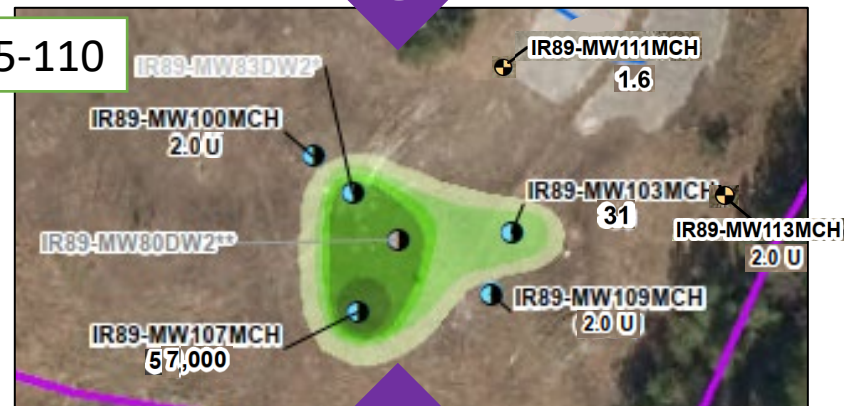
- 65-70 ft bgs
 - Low concentration plume
 - Generally delineated
- 105-110 ft bgs
 - DNAPL-level concentrations
 - Plume not delineated to the southwest
- 120-125 ft bgs
 - Low concentration plume
 - Vertical gradient indicates migration from higher depths may be limited



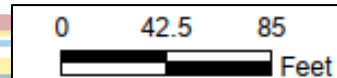
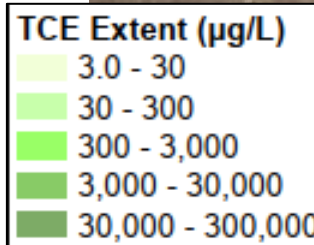
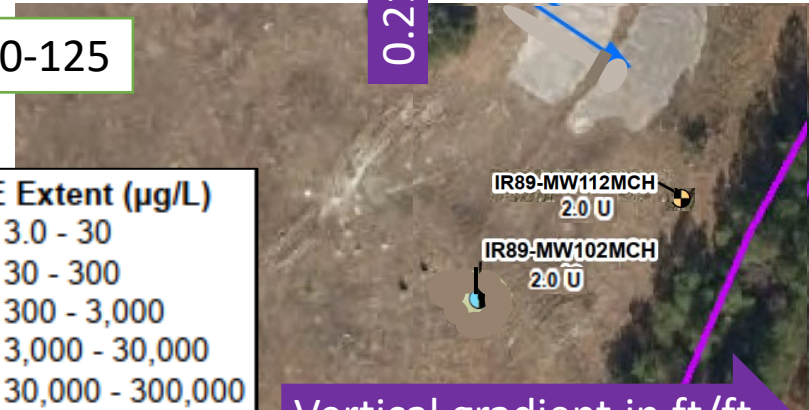
65-70



105-110



120-125



µg/L: micrograms per liter

Legend

- 1 Low Temperature Thermal Desorption (TCRA)
- 2 ERH (Electrical Resistive Heating)
- 3 Soil Mixing (NTCRA)
- 4 Mulch Wall Treatability Study
- 5 PRB
- 6 Horizontal Sparge Well Treatability Study
- 7 Horizontal Air Sparge Wells
- 8 Chemical Reduction via Ferox Treatability Study
- 9 Enhanced Reductive Dechlorination Treatability Study
- 10 Soil Removal Areas (Western Wetland NTCRA)
- Vertical Sparging Points
- Surface Water Aerator Locations
- Monitoring Well

VOC Extents exceeding current groundwater standards

Surficial
Source Area

Former IR89-MW80DW
and IR89-MW80DW2

0 to 25 ft bgs
Surficial Aquifer

25 to 75 ft bgs
UCH Aquifer

75 to 105 ft bgs
MCH Aquifer

105 to 125 ft bgs
MCH Aquifer

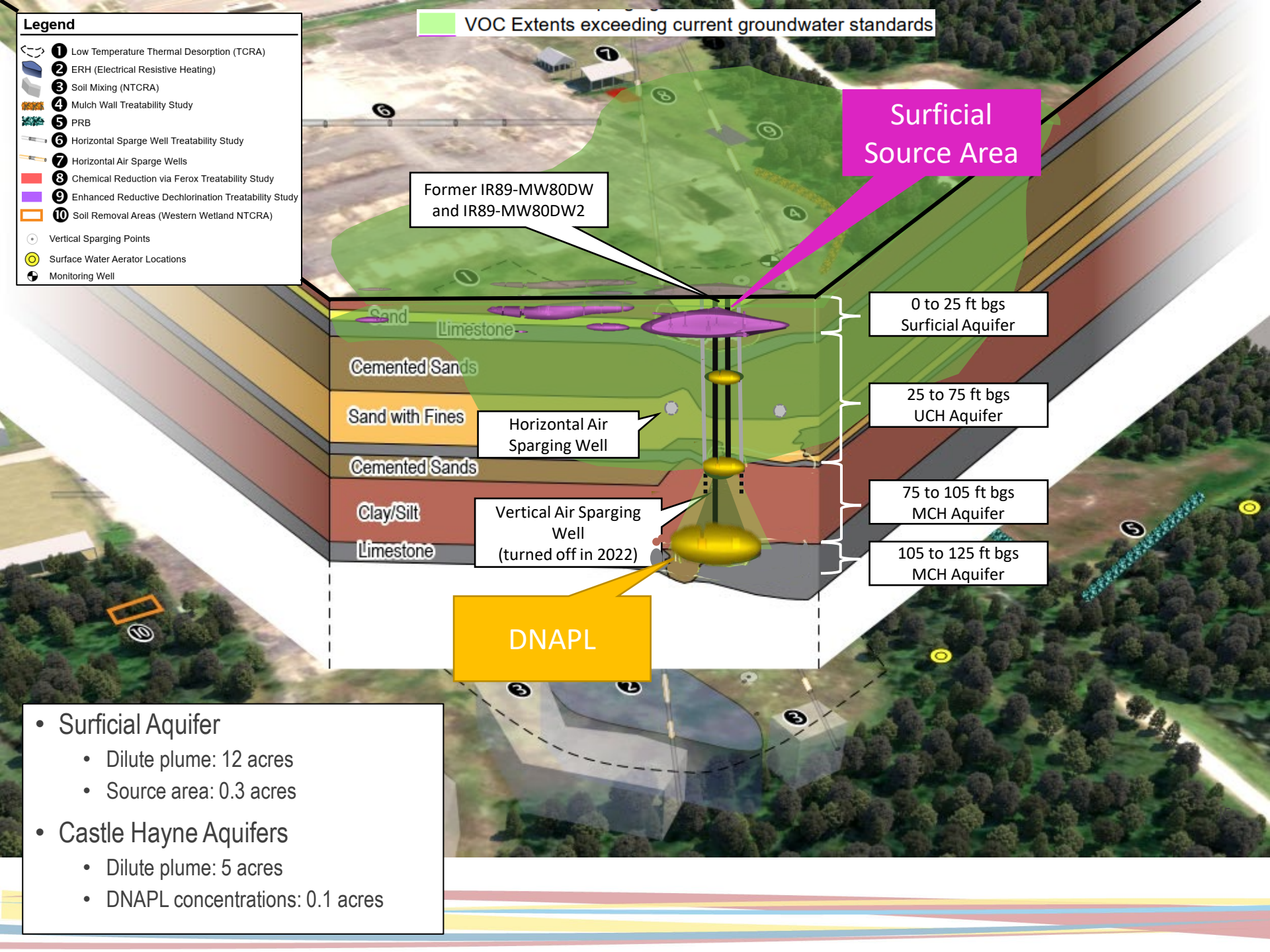
DNAPL

• Surficial Aquifer

- Dilute plume: 12 acres
- Source area: 0.3 acres

• Castle Hayne Aquifers

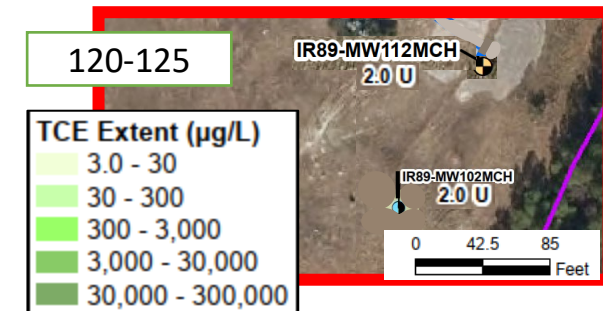
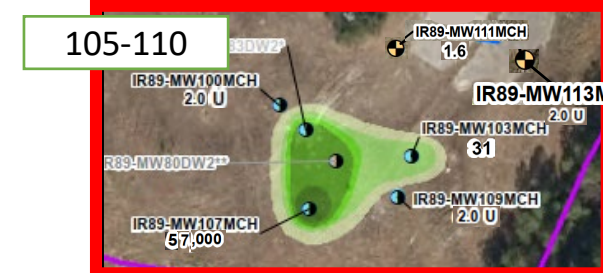
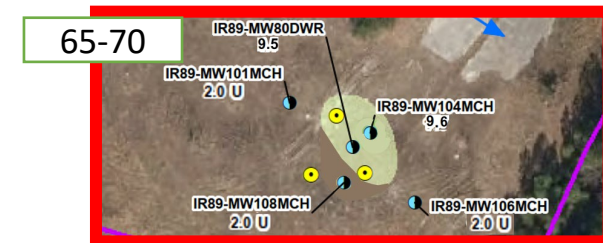
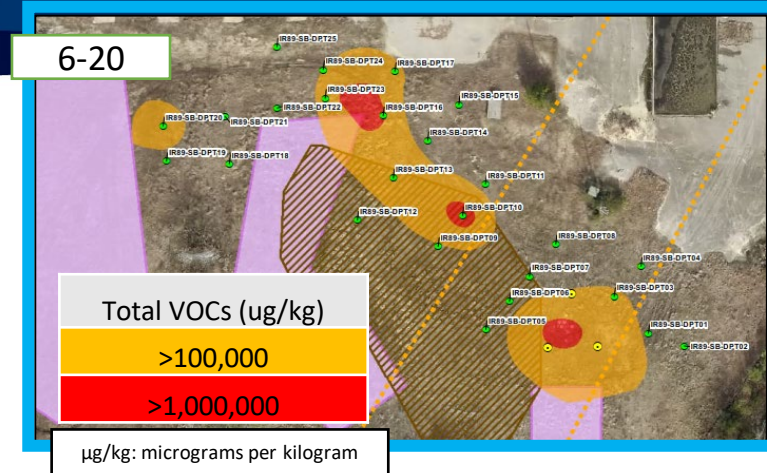
- Dilute plume: 5 acres
- DNAPL concentrations: 0.1 acres



Remedy Implications



- Surficial Aquifer
 - Surficial source area not being treated by current remedies (AS and MNA)
 - Continuing potential source of groundwater contamination
- Castle Hayne Aquifer
 - DNAPL level concentrations not being treated by current remedies (AS and MNA)
 - DNAPL in higher conductivity zones than surficial aquifer
- Path Forward
 - Complete an Engineering Evaluation/Cost Analysis (EE/CA) to evaluate removal action alternatives for addressing source areas in the surficial aquifer and DNAPL in the Castle Hayne aquifer
 - After completion of the EE/CA and removal action, evaluate the site-wide remedial strategy



µg/l: micrograms per liter

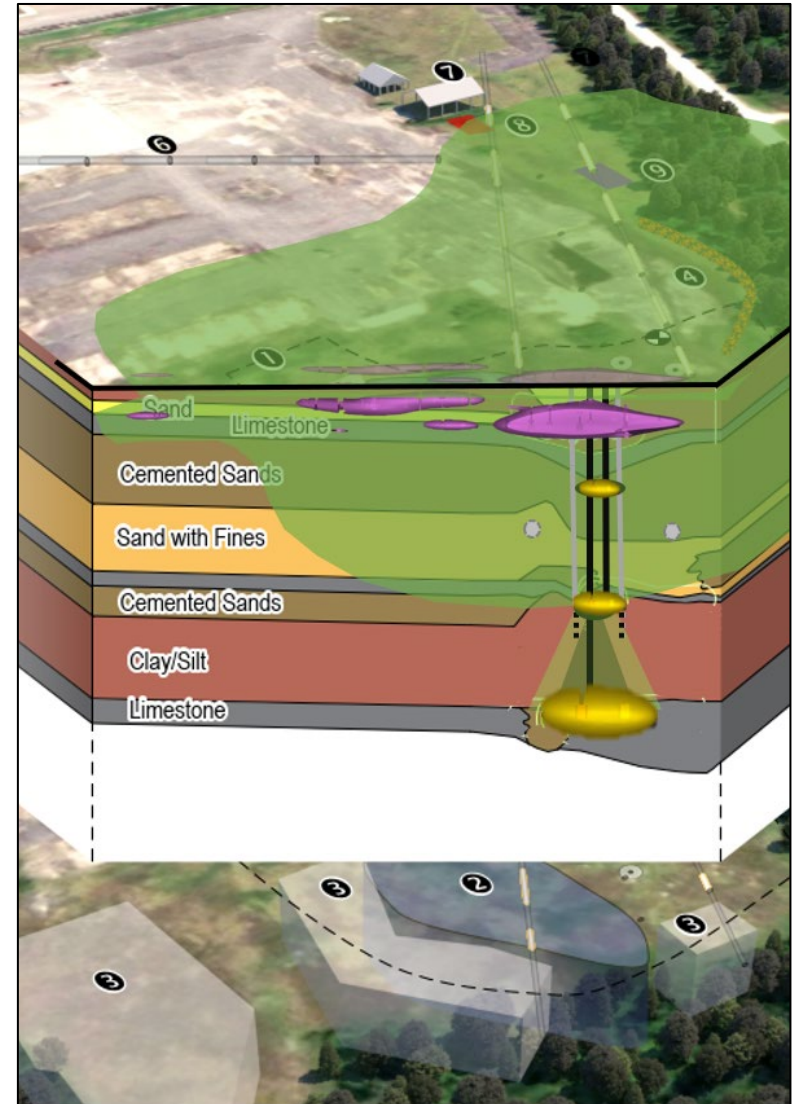
Technologies for Consideration

- Surficial Aquifer
 - In situ thermal treatment
 - Excavation
 - In-situ chemical reduction (ISCR) or enhanced reductive dichlorination (ERD) via soil mixing
 - Targeted excavation with zero valent iron (ZVI) injections via fracturing
 - Bioelectrochemical remediation
- Castle Hayne Aquifer
 - Expanded Air Sparging
 - ISCR/ERD Injections
 - Groundwater extraction and treatment via air stripper and granular activated carbon (GAC)
 - Groundwater extraction and treatment via subgrade biogeochemical reactor (SBGR)



Path Forward

- EE/CA Components
 - Site Characterization
 - Identification of Removal Action Objectives
 - Limits of removal action
 - Target treatment area
 - Identification and Analysis of Removal Action Alternatives
 - Effectiveness
 - Implementability
 - Cost
 - Comparative Analysis of Removal Action Alternatives
- Public Comment Period
- Documentation of Recommended Removal Action Alternative in Action Memorandum



Schedule

- EE/CA – Summer 2023
- Public Meeting – Summer 2023
- Comment Period – Open for 1 month
- Action Memo – Fall/Winter 2023

