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FINAL MEMORANDUM AQUIFER PERFORMANCE TEST WORK PLAN SITE 47 NSWC INDIAN HEAD MD

09/02/2011

CH2M HILL

Aquifer Performance Test Work Plan, Site 47, NSF-IH, Indian Head, Maryland

TO: Joe Rail/NAVFAC Washington
Gunarti Coghlan/NAVFAC Washington
Nicholas Carros/NSH-IH
Dennis Orenshaw/EPA Region III
Curtis DeTore/MDE

COPIES: Margaret Kasim/CH2M HILL
John Tomik/CH2M HILL
John Mason/CH2M HILL

FROM: Mark Strong/CH2M HILL

DATE: September 2, 2011

1.0 Introduction

This technical memorandum Work Plan presents the proposed approach to conduct an aquifer performance test at Site 47 at the Naval Support Facility Indian Head (NSF-IH), Indian Head, Maryland. A site location map is attached as Figure 1. This work plan supplements and references the documents cited in Section 8.0 of this memorandum.

2.0 Rationale and Objective

Based on results of the pilot study conducted in 2009, full scale application of *in situ* chemical oxidation (ISCO) at Site 47 could be accomplished through a combination of existing vertical injection wells and new horizontal wells (CH2M HILL, May 2011; herein referred to as "pilot study"). The layout of the horizontal wells will be designed based on subsurface flow modeling, which requires an accurate assessment of the transmissivity[1] and storativity of the shallow aquifer. Previous estimates of hydraulic conductivity based on slug tests conducted during the Remedial Investigation (CH2M HILL, 2003), while adequate for characterization, are less reliable for estimating for flow modeling. Accordingly, an aquifer performance test is recommended, the objective of which will be to obtain sufficient data to estimate shallow aquifer parameters accurately and also calibrate the flow model. The data will be obtained through the injection of potable water at a constant rate for a period of 8 hours, with subsequent monitoring of recovery in adjacent wells. Injection, rather than extraction, of water was selected for the test, to eliminate the need for generation and disposal of a large volume of potentially contaminated groundwater.

[1] Transmissivity being defined as the hydraulic conductivity multiplied by the thickness of the water bearing zone

3.0 Scope of Work

Activities and Procedures

The following activities will be conducted:

- Mobilization/demobilization
- Field activities
- Decontamination of equipment
- Investigation-derived waste handling

These activities are discussed in detail below.

Mobilization/Demobilization

Because of ongoing site operations, the Navy will verify the accessibility of the site. Utility clearing will not be necessary for field operations because there are no plans to install new monitoring wells. The test will be conducted using existing monitoring and injection wells. Mobilization includes coordination with the Navy and site orientation for field staff. Before mobilization occurs, CH2M HILL field personnel will review this Work Plan. Demobilization will consist of following proper decontamination procedures for personnel and equipment and making sure that the site is left in the condition it was before mobilization.

Field Activities

Description of Test Area

The source area of the groundwater plume at Site 47 is defined as the area with carbon tetrachloride (CT) concentrations exceeding 500 µg/L, as shown in Figure 2. The source area is divided into two areas: 1) the North Area, which is the inferred DNAPL area, has CT concentrations exceeding 10,000 µg/L, and 2) the South Area, which is the dissolved plume, containing CT concentrations ranging from 500 µg/L to 10,000 µg/L. The pilot study was conducted within the inferred DNAPL zone (the North Area).

For ease in referencing wells, groups of wells in the Pilot Study Area are subdivided into the Northern Cluster and Southern Cluster, respectively (Figure 2).

Selection of Injection Wells and Injection Rate

Existing wells IS47IW03D and IS47IW13D will be used for the tests, located in the Northern Cluster and Southern Cluster, respectively. These wells were installed and used for persulfate injections during the 2009 pilot study (CH2M HILL, 2011). Wells IS47IW03D and IS47IW13D are separated by at least 50 feet, to minimize the potential for overlapping cones of recharge during testing. The anticipated radius of influence associated with groundwater mounding around each well is 25 to 30 feet. Based on observations made during the pilot study, a target injection flow rate of three gallons per minute (gpm) per well is planned, to prevent injected water from daylighting to ground surface.

Aquifer Performance Test

The Navy has approved the use of potable water from Building 856. The water will be pumped to wells IS47IW03D and IS47IW13D using a skid-mounted jet pump, rated for up to 30 gpm at 35 pounds per square inch (psi); expected injection pressures are less than 20

psi. An equalization basin, consisting of a 500-gallon poly tank, will be used to normalize flow from the potable water source. A backflow preventer will also be used.

Eight vented datalogging transducers (In-Situ Level Troll700 or equivalent) will be installed in the two injection wells, IS47IW03D and IS47IW13D, as well as six wells in the immediate vicinity (Figure 2)—IS47IW02S, IS47IW03S, IS47IWMW19in the Northern Cluster and IS47MW24, IS47IW10S, and IS47IW13S in the Southern Cluster. Other wells in the vicinity will be manually gauged using conventional water level meters: IS47IW01S, IS47IW02D, IS47IW04S, IS47IW04D, IS47MW03, and IS47MW21 in the Northern Cluster and IS47IW09S, IS47IW10D, IS47IW12D, and IS47IWMW22 in the Southern Cluster.

All of the aforementioned wells will be gauged for depth to water before starting the test, to establish baseline conditions. Water levels will also be collected from a background monitoring well (IS47MW01) upgradient of the test area. Subsequently, datalogging transducers will be installed in all eight wells at a depth of several feet below static water level. An eight-channel Hermit datalogger will be used to record water level data simultaneously from all eight datalogging transducers at pre-programmed logarithmic time intervals. A laptop computer will be connected to the Hermit datalogger and used to view the data in real time. After the 8-hour test is completed, recovery will be monitored for an additional 8 hours.

Decontamination of Equipment

Decontamination procedures are presented in the SOP SA-7.1 provided in the Master Plans (TetraTech NUS, Inc., 2009).

4.0 Data Quality Objectives

Data quality objectives (DQOs) are pre-established goals for helping to monitor and assess the progress of the project. They provide the benchmarks against which the quality of fieldwork and the quality of resulting analytical data are evaluated.

DQOs specify the data type, quality, and quantity, and how the data are used to support project decisions. Data gathered during the aquifer performance test at Site 47 will be used to perform subsurface flow modeling. Consequently, the quality and quantity of the data must be sufficient to complete this work. The investigation-specific DQOs for in this Work Plan were developed following the seven-step process outlined in EPA (2000) protocol. The site-specific DQOs are summarized below.

Step 1: State the Problem

The existing hydraulic conductivity value for the shallow aquifer is based on slug test data obtained in 2001. An accurate assessment of hydraulic parameters is critical to design of the full-scale remedy, which may consist of injection or recirculation of a reagent for treating chlorinated volatile organic compounds in the shallow groundwater. Slug test data are less reliable for determining aquifer parameters.

Step 2: Identify the Decision

An aquifer performance test will be conducted to estimate the transmissivity and storativity of the shallow aquifer. Values for these parameters will subsequently be used to refine and calibrate the aquifer flow model. The flow model will subsequently be used to simulate

potential reagent recirculation system scenarios for the North Area and South Area, as follows:

- North Area Scenario 1: Reagent injection into existing vertical injection wells at the center of the area, and extraction from two new horizontal wells at the periphery of the area.
- North Area Scenario 2: Reagent injection into two new horizontal wells at the periphery of the area and extraction from existing vertical wells at the center of the area.
- South Area Scenario 1: Reagent injection into a single new horizontal well at the center of the area and extraction from two new horizontal wells at the periphery of the area.
- South Area Scenario 2: Reagent injection into two new horizontal wells at the periphery of the area and extraction from one new horizontal well at the center of the area.

Step 3: Identify Inputs to the Decision

The current hydraulic conductivity value was obtained from 2001 slug tests. Values for transmissivity and storativity of the shallow aquifer will be determined from the aquifer performance test and used as input parameters for the subsurface flow model.

Step 4: Define the Boundaries of the Study

The investigation area encompasses the following areas: (1) locations of wells IS47IW03D and IS47IW13D locations, into which water will be injected; (2) locations of the wells in which water levels will be observed with datalogging transducers (IS47IW02S, IS47IW03S, IS47IWMW19 in the north area and IS47MW24, IS47IW10S, and IS47IW13S in the south area) or water level meters (IS47IW01S, IS47IW02D, IS47IW04S, IS47IW04D, IS47MW03, and IS47MW21 in the north area and IS47IW09S, IS47IW10D, IS47IW12D, and IS47IWMW22 in the south area); and (3) zone of influence of the injected water, which is anticipated to be up to 30 feet from each injection well.

Step 5: Develop a Decision Rule

The hydraulic conductivity values obtained from the aquifer performance test in the Northern Cluster and Southern Cluster will be used in the modeling to layout the injection and extraction wells and determine optimum spacing. Input to the model will be based on hydraulic conductivity results, as follows:

- If the hydraulic conductivity values for the Northern Cluster and Southern Cluster wells are different by one order of magnitude or higher, the value for each cluster will be used individually in the model, which will result in lower and upper bounds.
- If the hydraulic conductivity values for the Northern Cluster and Southern Cluster wells are similar (i.e. a difference of less than one order of magnitude), then an average of both values will be used in the model.

Step 6: Specify Limits on Decision Errors

Decision errors will be minimal because the test will be performed in the field with equipment that will be validated before use, and data will be collected in each injection well and surrounding wells as the test is performed in the 8-hour period.

Step 7: Optimize the Design

This investigation is part of an overall phased approach to data collection that is designed to ensure that all appropriate data are collected for the design of the full-scale remedy. The data collection and evaluation process presented in this Work Plan are part of the optimization process.

5.0 Data Analysis

Time- and distance-drawdown (water table rise) graphs will be prepared to assess the influence of the cone of recharge in observation wells at various distances from the pumping well. The data will provide: 1) an understanding of the effect of the long- term injections on the surficial aquifer, 2) accurate estimates of aquifer parameters, and 3) reliable calibration of the subsurface flow model.

6.0 Health and Safety

CH2M HILL will prepare a Health and Safety Plan specific to this work that will be followed during the field activities.

7.0 Schedule

Field implementation of the aquifer performance test is tentatively scheduled for the weekend of September 10-11, with test setup beginning the morning of the 10th, test execution during the day on the 10th, recovery monitoring overnight, and demobilization on the 11th. The final project schedule is subject to receipt of appropriate approvals, field conditions, site access, and subcontracting activities. The schedule will be adjusted and finalized based on these factors once approvals to proceed are received.

8.0 References

CH2M HILL. 2003. *Final Remedial Investigation, Site 47 – Mercuric Nitrate Disposal Site, Indian Head, Maryland.*

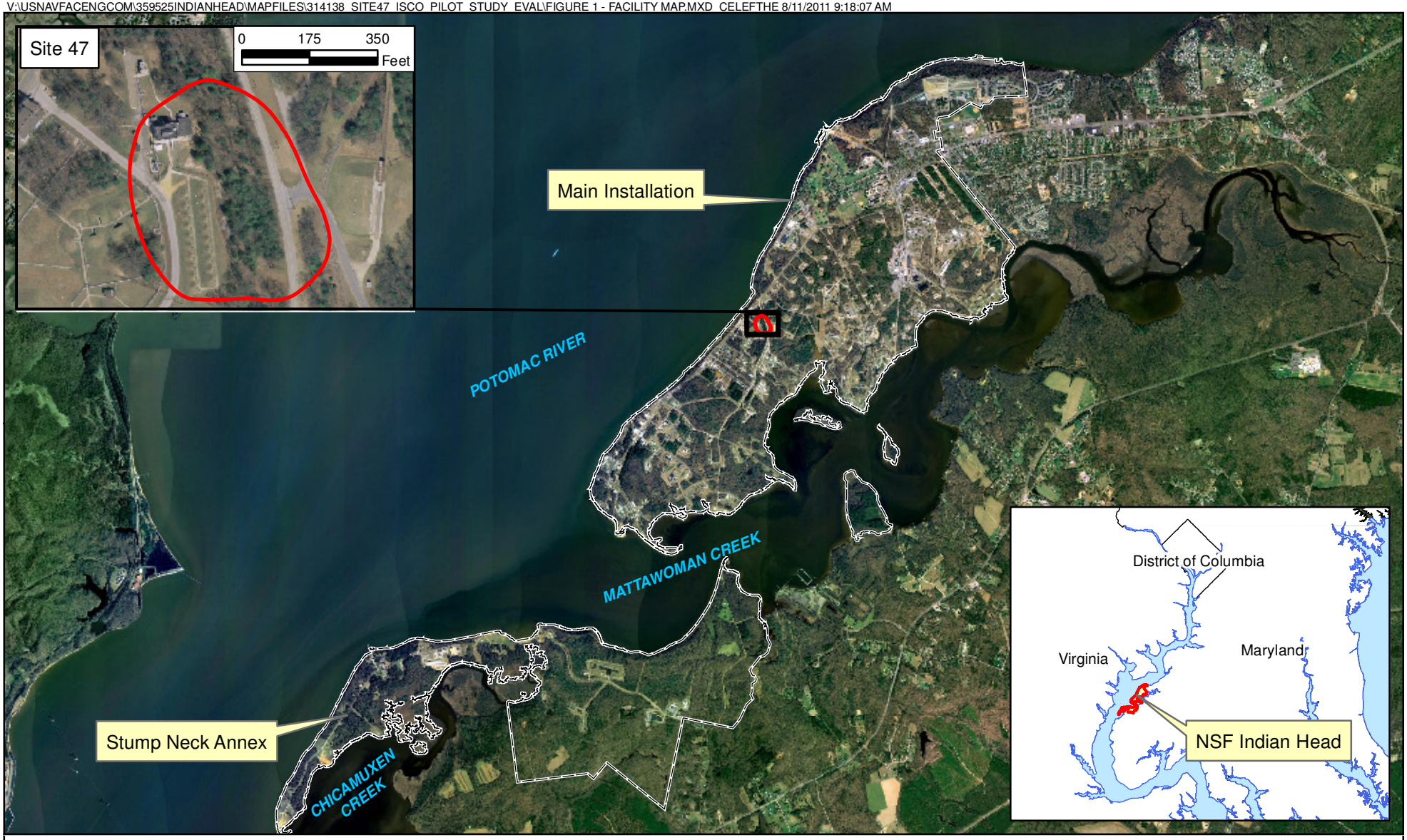
CH2M HILL. 2011. *Draft Site 47 In Situ Chemical Oxidation Pilot Study Technology Performance Evaluation, Naval Support Facility Indian Head, Indian Head, Maryland.* May.

Tetra Tech NUS, Inc. 2009. *Final Master Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) for Installation Restoration Program and Munitions Response Program Environmental Investigations, Naval Support Facility Indian Head, Indian Head, Maryland*

EPA. 2000. *Data Quality Objectives Process for Hazardous Waste Site Investigations (EPA QA/G-4HW,* EPA/600/R-00/007.

Figures

V:\USNAVFACENGCOM\359525INDIANHEAD\MAPFILES\314138_SITE47_ISCO_PILOT_STUDY_EVAL\FIGURE 1 - FACILITY MAP.MXD CELEFTHE 8/11/2011 9:18:07 AM



Legend

IR Site Boundary

Installation Boundary

N
W E
S

0 2,250 4,500
Feet

Figure 1
Site Location Map
Site 47 Aquifer Performance Test
NSF-IH, Indian Head, Maryland

Imagery Source:Google Earth Pro

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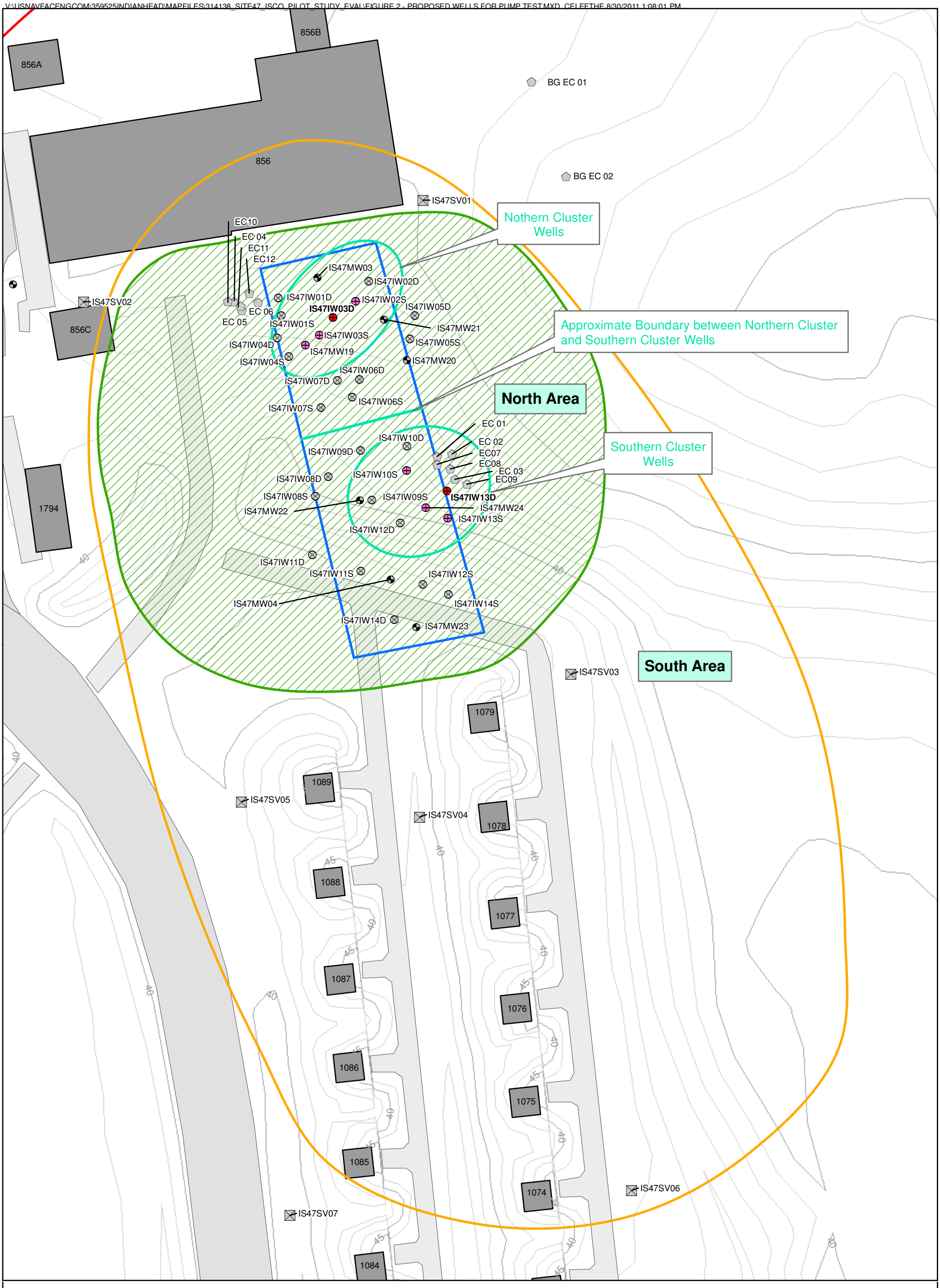
V:\USNAVFACENGCOM\359525INDIANHEAD\MAPFILES\314138_SITE47_ISCO_PILOT_STUDY_EVAL\FIGURE 2 - PROPOSED WELLS FOR PUMP TEST.MXD, CELFETHE 8/30/2011 1:08:01 PM



Legend

- Proposed Wells for Pump Test
- Datalogging Transducer
- Existing Monitoring Well Location
- Existing Permanent Injection Wells
- EC Profiling Location
- Passive Soil Gas Venting Locations
- Elevation Contour Line (1 ft Interval)
- Elevation Contour Line (5 ft Interval)
- Pilot Study Area
- Source Area (Carbon Terachloride >= 500 ppb)
- Inferred Residual DNAPL Area (North Area)
- Road
- Building

Notes:
1. North Area has CT concentrations exceeding 10,000 µg/L.
2. South Area has CT concentrations ranging from 500 µg/L to 10,000 µg/L.

N
W E
S

0 25 50
Feet

Figure 2
Proposed Injection Well Locations
Site 47 Aquifer Performance Test
NSF-IH, Indian Head, Maryland

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