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FINAL FEASIBILITY STUDY REPORT FOR SITE 86 OPERABLE UNIT 20 (OU 20) MCB CAMP LEJEUNE NC

10/1/2013

CH2M HILL

Final

Feasibility Study
Site 86, Operable Unit No. 20

Marine Corps Installations East – Marine Corps Base Camp Lejeune
North Carolina

Contract Task Order 081

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Acronyms and Abbreviations

°C	degree Celsius
µg/L	microgram per liter
ARAR	applicable or relevant and appropriate requirement
AS	air sparging
AST	aboveground storage tank
bgs	below ground surface
BTV	background threshold value
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action—Navy
COC	constituent of concern
CSM	conceptual site model
CVOC	chlorinated volatile organic compound
DCE	dichloroethene
DHC	*Dehalococcoides*
DO	dissolved oxygen
ERA	Ecological Risk Assessment
ERD	enhanced reductive dechlorination
ESRI	Expanded Supplemental Remedial Investigation
EVO	emulsified vegetable oil
Fe(II)	ferrous iron
FS	Feasibility Study
ft/day	foot per day
ft/ft	foot per foot
ft^3	cubic foot
gc/mL	gene count per milliliter
GFM	groundwater flow model
GHG	greenhouse gas
gpm	gallon per minute
GRA	general response action
HHRA	Human Health Risk Assessment
HI	hazard index
IR	Installation Restoration
ISCO	in situ chemical oxidation
LTM	long-term monitoring
LUC	land use control
MCAS	Marine Corps Air Station
MCIEAST-MCB CAMLEJ	Marine Corps Installations East-Marine Corps Base Camp Lejeune
MCL	maximum contaminant level
mg/L	milligram per liter
MMBTU	million British Thermal Unit
MNA	monitored natural attenuation

msl	mean sea level
mV	millivolt
N/A	not applicable; not analyzed
NA	natural attenuation
NAIP	natural attenuation indicator parameter
Navy	Department of the Navy
NCDENR	North Carolina Department of Environment and Natural Resources
NCGWQS	North Carolina Groundwater Quality Standards
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NCSWQS	North Carolina Surface Water Quality Standards
ND	not detected
NO_x	nitrogen oxide
O&M	operation and maintenance
ORP	oxidation-reduction potential
OU	operable unit
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PM_{10}	particulate matter less than 10 microns in diameter
PPE	personal protective equipment
PRAP	Proposed Remedial Action Plan
PRB	permeable reactive barrier
PSI	Preliminary Site Investigation
RAO	remedial action objective
RFI	Resource Conservation and Recovery Act Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
ROI	radius of influence
RSL	regional screening level
RTF	remediation timeframe
SA	Site Assessment
SLERA	Screening-level Ecological Risk Assessment
SO_x	sulfur oxide
SRPC	slow-release permanganate candle
STM	solute transport model
SU	Standard Unit
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TCE	trichloroethene
TCL	Target Compound List
TOC	total organic carbon
TOD	total oxidant demand
TPH	total petroleum hydrocarbons
TTZ	target treatment zone
USEPA	United States Environmental Protection Agency
UST	underground storage tank

VC	vinyl chloride
VFA	volatile fatty acid
VI	vapor intrusion
VIMS	vapor intrusion mitigation systems
VOC	volatile organic compound

SECTION 1

Introduction

This report presents the findings of a Feasibility Study (FS) for Operable Unit (OU) No. 20, Site 86 on Marine Corps Air Station (MCAS) New River, located aboard Marine Corps Installations East-Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ) in Onslow County, North Carolina. This FS was prepared under the Naval Facilities Engineering Command – Atlantic, Comprehensive Long-Term Environmental Action—Navy (CLEAN) Contract N62470-08-D-1000, Contract Task Order 081.

1.1 Report Purpose

The purpose of this FS is to evaluate potential remedial alternatives to address the contamination identified during the Expanded Supplemental Remedial Investigation (ESRI), contained in the *Expanded Supplemental Remedial Investigation, Site 86, Operable Unit No. 20, Marine Corps Base, Camp Lejeune, North Carolina* (CH2M HILL, 2011a), according to the following process:

- Identify the remedial action objectives (RAOs)
- Identify potential treatment, resource recovery, and containment technologies that would satisfy these objectives
- Screen the technologies based on their effectiveness, implementability, and cost
- Assemble the technologies into treatment alternatives
- Analyze the alternatives against evaluation criteria

1.2 Report Organization

This FS is organized as follows:

- Section 1 is the introduction.
- Section 2 contains site characterization information, including: site description and background, summaries of previous investigations, the nature and extent of contamination (including updated information collected in 2011 and 2012), a streamlined risk evaluation, and a natural attenuation (NA) evaluation.
- Section 3 identifies applicable or relevant and appropriate requirements (ARARs) and RAOs and contains an initial screening of potential technologies.
- Section 4 develops the identified technologies into potential alternatives and evaluates those alternatives based on effectiveness, implementability, and cost.
- Section 5 presents a detailed analysis of the alternatives.
- Section 6 presents reference information.

SECTION 2

Site Characterization

This section contains site characterization information, including a discussion of site description and background, geology and hydrogeology, summaries of previous investigations, nature and extent of contamination, a streamlined risk evaluation, a summary of the Pilot Studies, and an NA evaluation.

2.1 MCIEAST-MCB CAMLEJ Setting

MCIEAST-MCB CAMLEJ is located in Onslow County, North Carolina, covers approximately 236 square miles, and is bisected by the New River, a large estuary extending to the Atlantic Ocean. The southeastern border of the MCIEAST-MCB CAMLEJ is the Atlantic Ocean shoreline. The western and northeastern boundaries are United States Route 17 and State Route 24, respectively. State Highway 50, Haws Run Road, and an unnamed perimeter road border the base to the north and west of the Greater Sandy Run Training Area, which is located west of United States Route 17 in the southwestern portion of MCIEAST-MCB CAMLEJ. The City of Jacksonville, North Carolina borders MCIEAST-MCB CAMLEJ to the north (**Figure 2-1**).

2.2 Site Description

Site 86 is located aboard MCAS New River, adjacent to Camp Geiger in the northwest portion of MCIEAST-MCB CAMLEJ (**Figure 2-1**). MCAS New River has been in service since 1951 and provides support for aircraft and personnel. Site 86 is located on an active military flight line with multiple areas of limited or restricted access. Approximately half of Site 86 is developed with buildings, parking lots, landscaped areas, and the flight line (**Figure 2-2**).

The topographic relief within Site 86 ranges from 8 to 20 feet above mean sea level (msl), with a slight slope to the east toward the New River. Stormwater runoff from the western portion of the site flows east through storm drains that discharge to a drainage ditch. Stormwater from the northern portion of the site flows to a retention pond. Stormwater that has not infiltrated the ground surface eventually discharges to the New River. Since the northern and western portions of the site are generally paved or developed, it is anticipated that infiltration rates are low. However, higher rates of infiltration are expected in the northeast grass area.

2.2.1 Site Geology

Surficial deposits observed at Site 86 vary in thickness from 30 feet in the western portion of the site to 40 feet near the central portion of the site. These deposits consist of sand, silty sand, and sandy clay that, when saturated, compose the surficial aquifer.

Beneath the sand, silty sand, and sandy clay of the surficial aquifer lies the River Bend Formation, which consists of silty sand and weakly cemented sandy limestone. This formation is typically observed at approximately 30 feet to 40 feet below ground surface (bgs) and ranges in thickness from 15 feet in the western portion of the site to 45 feet in the northeast grass area. The fossilized shells observed in this limestone are an identifying characteristic of the River Bend Formation (Cardinell et al., 1993). The proportion of shell fragments is greatest at approximately 45 to 55 feet bgs.

Below the weakly cemented sandy limestone lies a greenish gray sand with some silty sand lenses and fossils**.** This greenish gray sand was not encountered in the southern portion of the site because no borings were advanced to the expected depth of the unit in this area. However, this unit was observed at approximately 60 feet bgs in the northern portion of the site. This unit was observed to the borehole termination depth of approximately 90 feet bgs.

The locations of cross section lines are shown on **Figure 2-3**, and cross sectional views of the site lithology are shown on **Figures 2-4** though **Figure 2-6**.

2.2.2 Site Hydrogeology

The current and previous investigations have been limited to the surficial and Castle Hayne aquifers, which occur in the undifferentiated formation and River Bend Formation, respectively. The surficial aquifer, which is under unconfined conditions (water table aquifer), occurs within the sediments of the undifferentiated formation.

Locally, the River Bend Formation consists of weakly to completely cemented, fossiliferous, sandy limestone, and has been designated at MCIEAST-MCB CAMLEJ as the upper Castle Hayne aquifer. The middle Castle Hayne aquifer underlies the carbonate-rich zone, and is characterized by unconsolidated gray to olive green silty sand with trace amounts of fossil fragments.

The Castle Hayne confining unit, typically represented within the lower portion of the Belgrade Formation, was not encountered at Site 86. The absence of a laterally continuous confining unit allows direct hydraulic communication between the surficial and Castle Hayne aquifers.

Generally, groundwater flow is to the east-northeast toward the New River within the surficial and Castle Hayne aquifers (**Figure 2-7** and **Figure 2-8**). The average horizontal hydraulic gradients are 0.003 foot per foot (ft/ft) in both the surficial and upper Castle Hayne aquifers, which indicates that the surficial and Castle Hayne aquifers are acting as one aquifer (CH2M HILL, 2011a).

Downward vertical hydraulic gradients from the surficial to the upper Castle Hayne ranged from 0.002 ft/ft to 0.112 ft/ft (CH2M HILL, 2011a). A slight downward gradient (0.003 ft/ft to 0.049 ft/ft) from the upper Castle Hayne to the middle Castle Hayne aquifer was also observed (CH2M HILL, 2011a).

2.2.3 Aquifer Testing

The hydraulic properties of the surficial and upper Castle Hayne aquifers were evaluated using slug test and pump test techniques during the 2012 Pilot Test (discussed in Section 2.3 and **Appendix A**). Slug tests were conducted on five surficial aquifer wells. The results indicated that horizontal hydraulic conductivity values range from approximately 0.97 to 10.61 feet per day (ft/day) with a geometric mean of 3.44 ft/day (**Appendix A**).

Analyses of aquifer testing data from slug tests conducted on 11 upper Castle Hayne wells and pump tests conducted on three upper Castle Hayne wells indicated that horizontal hydraulic conductivity values range from approximately 1.37 to 26.85 ft/day, with a geometric mean of 10.02 ft/day (**Appendix A**-Table 1-1). Pump test data were additionally evaluated to yield a specific storage of 6×10^{-4} $feet^{-1}$ for the upper Castle Hayne aquifer.

The range of conductivity values noted in both aquifers with respect to close spacing of wells indicates the spatial hydraulic conductivity variability is most likely associated with the heterogeneity of aquifer material that the wells are screened through.

2.2.4 Seepage Velocities

As previously discussed, average horizontal hydraulic gradients are 0.003 ft/ft for both the surficial and upper Castle Hayne aquifers. The effective porosity for both the surficial and upper Castle Hayne aquifers is assumed to be 0.25, which is a typical value for coastal plain sandy sediments (Wiedemeier, et al., 1996). Groundwater seepage velocities for each aquifer were calculated using a modification of the Darcy equation.

Where,

$$v_h = \frac{K_h}{n} i$$

and,

v_h = groundwater seepage velocity (ft/day)

K_h = horizontal hydraulic conductivity (ft/day)

n = effective porosity (dimensionless) = 0.25

i = horizontal hydraulic gradient = 0.003 ft/ft (surficial)
= horizontal hydraulic gradient = 0.003 ft/ft (upper Castle Hayne)

Based on the surficial aquifer hydraulic conductivity values noted in Section 2.2.3, seepage velocity values ranged from 0.012 ft/day to 0.13 ft/day with a geometric mean of 0.042 ft/day.

Based on the upper Castle Hayne aquifer hydraulic conductivity values noted in Section 2.2.3, seepage velocity values ranged from 0.016 ft/day to 0.32 ft/day with a geometric mean of 0.12 ft/day. Variations in the groundwater seepage velocities are predominantly dependent on spatial variations in hydraulic conductivity rather than the hydraulic gradient, which is relatively consistent across the site.

2.2.5 Summary of Previous Investigations

Soil and groundwater investigations were initially conducted from 1990 through 1992 under the MCIEAST-MCB CAMLEJ Underground Storage Tank (UST) Program. The investigations focused on the former aboveground storage tanks (ASTs) area, which encompassed the original site boundary (**Figure 2-2**). Based on the presence of chlorinated volatile organic compound (CVOC)-impacted soil and groundwater, the site was transferred to the Installation Restoration (IR) Program and designated as Site 86.

A chronological summary of previous investigations is presented in **Table 2-1**. Select tables and figures for the documents summarized in **Table 2-1** are provided in **Appendix B**.

TABLE 2-1
Summary of Previous Investigations and Removal Actions
Operable Unit 20 (Site 86), MCIEAST-MCB CAMLEJ, North Carolina

Investigation Phase	Date	Reference	Conclusions
Preliminary Site Investigation (PSI)	1991	Dewberry & Davis, 1990	In 1990, a PSI was conducted to evaluate the AST area. Soil samples were collected and analyzed for total petroleum hydrocarbons (TPH) and volatile organic compounds (VOCs). The analytical data indicated that TPH and VOCs were present in soil and were likely attributable to localized surface spills from ASTs (Appendix B-Dewberry & Davis-Table 9).
Site Assessment (SA)	1992	O'Brien & Gere, Inc., 1992	In 1992, an SA was completed to evaluate the nature and extent of subsurface contamination at the AST area. Soil and groundwater samples were collected and TPH and VOCs were detected (Appendix B-O'Brien and Gere, Inc.-Figure 3).

TABLE 2-1
Summary of Previous Investigations and Removal Actions
Operable Unit 20 (Site 86), MCIEAST-MCB CAMLEJ, North Carolina

Investigation Phase	Date	Reference	Conclusions
Remedial Investigation (RI)	1995-1996	Baker, 1996	In 1995, an RI was conducted to further characterize the nature and extent of contamination identified in the SA. Soil samples were collected and analyzed for VOCs, semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), TPH, and metals. Groundwater samples were collected and analyzed for VOCs and SVOCs, metals, total suspended solids, and total dissolved solids. A limited number of groundwater samples were also analyzed for pesticides, PCBs, and dissolved metals (Appendix B-Baker 1996 RI-Figures 3-1 and 3-2). Surface and subsurface soil samples contained concentrations of metals and SVOCs above human health risk-based levels. Groundwater samples contained concentrations of VOCs and metals above human health risk-based levels (Appendix B-Baker 1996 RI-Figures 4-1 through 4-6).
Post-RI Activities	1997-1998	Baker, 1998	In 1997, post-RI activities were conducted to refine the vertical and horizontal extent of VOCs in groundwater. The results indicated that the horizontal extent of VOCs in groundwater was not delineated (Baker Post RI Figure 1-2).
Amended RI	2001-2002	CH2M HILL/ Baker/CDM, 2003	In 2001 and 2002, Amended RI field investigation activities were conducted to further characterize the groundwater contamination and to re-evaluate impacts to human health and the environment identified in the RI. The Amended RI concluded that the extent of VOC contamination in the soil was limited, and that two groundwater plumes were identified in the vicinity of Site 86. The plume near Site 86 was adequately defined; however, an unrelated upgradient plume was not defined (Appendix B-CH2M HILL/Baker/CDM Amended RI-Table 4-8 and Figures 4-1 through 4-12).
Resource Conservation and Recovery Act Facilities Investigation (RFIs)	2005	CH2M HILL, 2006a	In 2005 and 2006, an RFI was conducted to evaluate Solid Waste Management Units (SWMUs) 303 and 318. Based on the results, surface and subsurface soil samples contained concentrations of VOCs, SVOCs, and metals above human health risk-based levels, and groundwater samples contained concentrations of VOCs, SVOCs, and metals exceeding applicable human health risk-based levels. The RFI recommended the removal of contaminated soil from beneath the wash pad near SWMUs 303 and 318 and further investigation of groundwater contamination to determine the source of the chlorinated solvents at the SWMUs (Appendix B-CH2M HILL RFI-Figures 2-1 through 2-2 and Figures 4-1 through 4-19).
Interim Measure-Removal Action	2005	Shaw, 2005	In 2005, Shaw removed approximately 1,200 tons of SVOC and metals impacted soil from SWMUs 303 and 318 under Interim Measure, as recommended by the RFI. Soil removal activities occurred in three phases during November and December 2005. Confirmatory soil samples indicated that all target contaminants were below the applicable USEPA Region 9 Industrial Preliminary Remediation Goals (PRGs) and NC Soil-to-Groundwater Maximum Soil Contaminant Concentrations (MSCCs) or RCRA Base background concentrations (the mean plus two standard deviations).

TABLE 2-1
Summary of Previous Investigations and Removal Actions
Operable Unit 20 (Site 86), MCIEAST-MCB CAMLEJ, North Carolina

Investigation Phase	Date	Reference	Conclusions
ESRI	2006-2010	CH2M HILL, 2011a	An ESRI was conducted in a phased approach from 2006 to 2010 to complete the horizontal and vertical delineation of CVOCs in surface soil, subsurface soil, sediment, surface water, and groundwater and to quantify the potential risks to the human and ecological receptors (Appendix B-CH2M HILL ESRI-Figure-3-2 through 3-5 and Tables 5-1 through 5-7). The ESRI concluded that the nature and extent of soil and groundwater contamination was defined. The Human Health Risk Assessment (HHRA) concluded that potential future contact with groundwater may result in risk or hazards above the United States Environmental Protection Agency's (USEPA's) acceptable risk range and hazard levels based on contact with surficial and Castle Hayne aquifer groundwater by hypothetical future residents and industrial workers. The Ecological Risk Assessment (ERA) concluded that the overall risk to ecological receptors was acceptable. An FS was recommended to identify RAOs and identify and evaluate remedial alternatives to address the CVOC groundwater contamination.
Basewide Vapor Intrusion (VI) Evaluation	2007-2011	CH2M HILL, AGVIQ, 2009; CH2M HILL, 2011b	Site 86 was included in the phased Basewide VI evaluation to determine if complete or significant exposure pathways exist for VI into buildings. Current subslab soil gas concentrations were within an estimated target risk range; therefore, it was concluded that VI is not a current significant pathway of concern for the site buildings evaluated at Site 86. If new buildings are planned for construction in the vicinity of the VOC groundwater plume, the potential for a VI pathway will be evaluated and mitigated if needed.
Expanded Soil Background Study Report	2011	CH2M HILL, 2011c	A total of 60 surface soil and 51 subsurface soil samples were collected from developed and undeveloped areas of MCIEAST-MCB CAMLEJ to provide background threshold values (BTVs) for use in site-specific environmental investigations and HHRAs and ERAs. Because USEPA no longer has a regional screening level (RSL) for total chromium and data were compared to the hexavalent chromium RSL to be conservative, surface and subsurface soil data were speciated for hexavalent and total chromium to evaluate the ratio of hexavalent chromium to trivalent chromium in background soils. The background data were not available at the time the ESRI was completed; therefore, the BTVs were used to re-evaluate a potentially unacceptable risk identified in the ESRI. This risk evaluation is discussed in Section 2.5 of this FS.
IR86-MW59DW Groundwater Re-Sampling	2012	Not Applicable (N/A)	As noted in the 2010 ESRI, concentrations of chromium and polycyclic aromatic hydrocarbons detected in one groundwater sample (IR86-MW59DW) collected from the middle Castle Hayne aquifer may result in a risk to human receptors. Because the risk was a result of a single groundwater analytical result, a second groundwater sample was collected from IR86-MW59DW in March 2012 and was analyzed for chromium, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. The data were used to evaluate the validity of the risk and are discussed further in Section 2.4 of this FS.

2.3 Nature and Extent of Contamination

A comprehensive evaluation of the nature and extent of contamination at Site 86 is presented in the ESRI (CH2M HILL, 2011a). A brief summary, including the conditions following the Pilot Study, is provided as follows.

2.3.1 Surface and Subsurface Soil

SVOCs, pesticides, and metals are present in surface soil at concentrations that exceed the applicable soil screening levels. The magnitude of the SVOC and pesticide exceedances is generally low, and their occurrence and distribution appear to be related to the industrial nature of the site. The metals appear to be widespread and at concentrations that are generally consistent with naturally occurring levels. Metals and pesticides were detected in the subsurface soil at concentrations that exceeded regulatory screening levels. Their occurrence and distribution appeared to be consistent with the surface soil. Additionally, pesticide impacts were limited to one subsurface soil sample location. Limited petroleum-related VOC impacts were present within the former UST tank basins at the UST-AS410N, UST-AS410S, and UST–AS510 sites.

2.3.2 Sediment and Surface Water

SVOCs, metals, and one pesticide were present in sediment samples collected from both the western stormwater retention pond and the drainage ditch at concentrations that exceed soil screening levels. The extent of impacted sediment is confined to the stormwater retention pond and ditch. Within the drainage ditch, sediment impacts extend to the furthest downgradient sample location (IR86-SD113). The magnitude of the SVOC and pesticide exceedances in the surface water and sediment is generally low and their occurrence and distribution appear to be related to the industrial nature of the site. The metals appear to be widespread and at concentrations that are generally consistent with naturally occurring levels.

No VOCs, SVOCs, pesticides, PCBs, or metals were detected above regulatory screening levels in surface water samples collected from the western stormwater retention pond. However, SVOCs, pesticides, and metals were detected above the applicable regulatory screening levels in the drainage ditch. The extent of surface water contamination is confined to the drainage ditch and does not appear to extend beyond sample location IR86-SW110, where SVOCs and metals were detected at the highest frequency at concentrations exceeding regulatory levels.

2.3.3 Groundwater

The surficial and upper Castle Hayne aquifers at Site 86 are primarily impacted by CVOCs (tetrachloroethene [PCE], trichloroethene [TCE], cis-1,2-dichloroethene [DCE], and vinyl chloride [VC]). Benzene has been detected in the surficial and upper Castle Hayne aquifers at relatively low concentrations compared to the North Carolina Groundwater Quality Standards (NCGWQS). Groundwater contamination occurs as large, diffuse, elongate plumes that encompass more than 40 acres of total area. **Figures 2-9 through 2-12** identify the areal extent of TCE- and VC-impacted groundwater in the surficial and Upper Castle Hayne aquifers, respectively. **Figures 2-13 and 2-14** depict vertical extents of the compounds. Only TCE and VC are depicted on the figures, as the remaining constituents of concern (COCs) are collocated or isolated. Additionally, TCE and VC are the only CVOCs that were detected at concentrations exceeding 100 times the NCGWQS, which, as detailed in Section 3, is the basis of the treatment scenario evaluated in this FS.

Figure 2-15 presents the conceptual site model (CSM), a three-dimensional graphic representation of the current site conditions, type and location of potential human health risks, potential source areas and receptors, generalized lithology, groundwater impacts, and typical site hydrogeologic conditions. As shown on the CSM, the westernmost plume appears to have originated near SWMUs 303 and 318 and is likely a result of surficial releases associated with the former aircraft maintenance operations. The central plume appears to have originated near Building AS510 and is likely the result of surficial releases associated with former aircraft maintenance activities. The easternmost plume appears to be associated with an open, unlined

drainage ditch that receives surface water runoff from the stormwater conveyance network within the eastern portion of the flight line.

2.3.4 Surficial Aquifer

Within the surficial aquifer, CVOCs appear as three large, diffuse plumes. The westernmost plume extends approximately 700 feet between monitoring wells IR86-MW40 and IR86-MW41 on the industrial and flight line portion of the site. The central plume extends approximately 630 feet between monitoring well IR86-MW-10IW and monitoring well IR86-MW47. The easternmost plume extends approximately 1,645 feet between monitoring wells IR86-MW58 and IR86-MW63. The horizontal extents of TCE and VC impacts in the surficial aquifer have been delineated to their respective NCGWQS (**Figures 2-9 and 2-11**). The vertical extent of impacts within the surficial aquifer ranges from approximately 5 to 25 feet bgs. Analytical results are provided in **Table 2-2**, and the primary COC analytical results are summarized in **Table 2-3**.

TABLE 2-3
Surficial Aquifer Groundwater Exceedance Summary
Operable Unit 20 (Site 86), MCIEAST-MCB CAMLEJ, North Carolina

VOCs	Detection Rate	Exceedance Rate	Maximum Concentration (µg/L)	Location of Maximum Concentration	NCGWQS (µg/L)
Benzene	12/20	7/20	11	IR86-MW52	1
TCE	19/26	13/26	170	IR86-MW61	3
cis-1,2-DCE	22/29	1/29	150 J	IR86-MW58	70
VC	3/26	3/26	68 J	IR86-MW58	0.03

J – concentration is estimated.
µg/L – micrograms per liter

2.3.5 Upper Castle Hayne Aquifer

Within the upper Castle Hayne aquifer, CVOCs appear as four large, diffuse plumes similar to those observed in the surficial aquifer, with slight differences in orientation and generally higher levels of CVOCs. The westernmost plume extends approximately 950 feet east from IR86-MW52IW over the industrial portion of the site. The northernmost plume, located near the original Site 86 RI boundaries, extends approximately 1,925 feet to the northeast toward monitoring well IR86-MW38IW. The easternmost plume, located near the drainage ditch toward the eastern portion of the flight line, extends approximately 1,470 feet east from IR86-MW22IW into the northeast grass area. The fourth plume, not present in the surficial aquifer, is located in the grassy area in the northeast portion of the site and centers on IR86-MW34IW. As shown on **Figures 2-10 and 2-12**, the horizontal extents of TCE and VC impacts in the upper Castle Hayne aquifer have been delineated to their respective NCGWQS. The vertical extent of impacts within the upper Castle Hayne aquifer ranges from 25 to approximately 60 feet bgs. Analytical results are provided in **Table 2-4**, and the primary COC analytical results are summarized in **Table 2-5.**

TABLE 2-5
Upper Castle Hayne Aquifer Groundwater Exceedance Summary
Operable Unit 20 (Site 86), MCIEAST-MCB CAMLEJ, North Carolina

VOCs	Detection Rate	Exceedance Rate	Maximum Concentration (µg/L)	Location of Maximum Concentration	NCGWQS (µg/L)
1,1-DCE	12/31	3/31	9.9	IR86-MW58IW	7
Benzene	11/21	5/21	4.0	IR86-MW15IW	1
TCE	15/31	13/31	330	IR86-MW42IW	3
cis-1,2-DCE	22/31	7/31	350 J	IR86-MW15IW	70
VC	14/31	14/31	76	IR86-MW58IW	0.03

2.3.6 Middle Castle Hayne Aquifer

A single detection of PCE that exceeded the NCGWQS was noted in the middle Castle Hayne aquifer; however, it appeared to be isolated and delineated. As discussed in Section 2.5, chromium, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected in groundwater collected from IR86-MW59DW. In March 2012, the monitoring well was sampled again to verify the detections. Based on the March 2012 data, there are no detectable concentrations of chromium, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, or indeno(1,2,3-cd)pyrene in the middle Castle Hayne aquifer (**Table 2-6**).

2.4 Risk Assessments

2.4.1 Human Health Risk Assessment

In order to assess the potential human health risks associated with the presence of site-related contamination, an HHRA was conducted as part of the ESRI (CH2M HILL, 2011a), Basewide VI evaluation reports (CH2M HILL, 2011b), and the Technical Memorandum presented in **Appendix C**. The exposure scenarios evaluated included current and/or future receptors from exposure to soil in the industrial area and flight line, surface water and sediment in the pond and drainage ditch, and surficial, upper Castle Hayne and middle Castle Hayne aquifer groundwater. The potential for VI was also evaluated to assess buildings located within 100 feet of groundwater impacts exceeding site-specific VI screening levels. The CSM (**Figure 2-15**) depicts the potential risk identified at Site 86, including the exposure media, exposure routes, and potential human health receptors.

Health risks are based on a conservative estimate of the potential cancer risk or the potential to cause other health effects not related to cancer (non-cancer hazard, or hazard index [HI]). USEPA identifies an acceptable cancer risk range of 1 in 10,000 (10^{-4}) to 1 in 1,000,000 (10^{-6}) and an acceptable non-cancer hazard as a target-organ-specific HI that does not exceed 1. The estimates of risk were used to determine if any further actions were required to sufficiently protect human health. Based on the results of the HHRAs, it was concluded:

- There are no unacceptable risks to any of the potential current receptors from exposure to site media.
- While VOCs were detected in groundwater at concentrations above vapor intrusion groundwater screening levels (GWSLs) for an industrial building, current subslab soil gas concentrations result in estimated risk within the target risk range, therefore VI is not a significant pathway of concern based on current site use. However, the VI pathway would need to be re-evaluated if new construction were to take place or if future land uses changes.
- There are no unacceptable risks based on future contact with surface soil, surface water, or sediment.
- There was a potential risk identified from exposure to chromium in soil within the flight line area by hypothetical future residents. However, between the time that the HHRA was completed and this FS was completed, a new Base background soil evaluation was performed. As part of the evaluation, concentrations of both naturally occurring total chromium and naturally occurring hexavalent chromium were measured in background soil samples. Based on the chromium speciation data, a ratio of hexavalent chromium to total chromium of 1:5 was calculated. Once this ratio was applied to the total chromium data from Site 86, the maximum estimated concentrations of hexavalent chromium were within the acceptable cancer risk range (**Appendix C**).
- There are no unacceptable risks from exposure to surficial aquifer groundwater by construction workers.
- Future potable use of surficial aquifer and upper Castle Hayne aquifer groundwater by residents or industrial workers may result in unacceptable carcinogenic risks and/or non-carcinogenic hazards from exposure to PCE, TCE, VC, and benzene.

- Future potable use of middle Castle Hayne aquifer groundwater was also identified as a potential unacceptable risk from exposure to chloroform, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(ah,h)anthracene, indeno(1,2,3-cd)pyrene, and chromium. However, these COCs are associated with one groundwater sample collected. Based on the infrequency of detections, low concentrations, and laboratory qualifiers associated with the detections (estimated concentrations) the well was re-sampled in March 2012 for these analytes. The results indicated that detectable concentrations of these constituents were not present in the well. Therefore, groundwater from the middle Castle Hayne aquifer does not pose an unacceptable risk.

The results of the groundwater HHRA is summarized in **Table 2-7**.

2.4.2 Ecological Risk Assessment

A Screening-level Ecological Risk Assessment (SLERA) was conducted as part of the ESRI to assess the potential ecological risks associated with the presence of site-related soil, sediment, surface water, and groundwater contamination. Based on the results of the SLERA, risks to populations of ecological receptors exposed to soils, groundwater, surface water, and sediment at or near Site 86 were not considered significant.

2.5 Pilot Studies

To evaluate the efficacy of several remedial options, three pilot studies were conducted at Site 86. The first of which was conducted in 2004 through 2005 and included a horizontal air sparge well and ozone injection system. Then, in 2011/2012, two additional pilot studies were conducted involving enhanced reductive dechlorination (ERD) using a recirculation system and in situ chemical oxidation (ISCO) using slow release permanganate candles (SRPC). Locations of the pilot studies are shown on **Figure 2-16**, and a description of the pilot studies and results is presented in the following sections.

2.5.1 2004 Air Sparge/Ozone Injection Pilot Study

In 2004, a 950-foot-long, 65-foot-deep horizontal directionally drilled well was constructed in the upper Castle Hayne aquifer with a 350-foot section of screen to evaluate the effectiveness of a horizontal directionally drilled well for transferring TCE mass in the target area. Additionally, 12 monitoring wells were installed in the upper Castle Hayne aquifer. Groundwater monitoring was conducted throughout the Pilot Study (Appendix B-CH2M HILL Pilot Study-Figure 2-1).

The results indicated that TCE concentrations were reduced by 99 percent. The zone of influence created by sparging operations was observed to propagate 50 feet on either side of the well. Groundwater samples collected from 13 of the 16 monitoring wells within the treatment area contained target VOCs below the NCGWQS within 1 year of the start of system operation (Appendix B-CH2M HILL Pilot Study-Figure 3-2).

2.5.2 2011/2012 ERD and ISCO Pilot Studies

The 2011/2012 pilot studies were separated into two zones, consisting of an ERD injection and extraction recirculation system in the upper Castle Hayne aquifer (Zone 1) and ISCO using SRPCs in the surficial aquifer (Zone 2). The Zone 1 Pilot Study area encompassed a 0.3-acre area that included a drainage swale, portions of an asphalt parking lot, hangar support structures, security fencing, and a grassy area. The Zone 2 Pilot Study area encompassed a 0.15-acre area located in the northeast grassy area east of the flight line (Appendix A-Figures 2-4 and 1-4). A complete summary of the Pilot Study is presented in **Appendix A**.

Zone 1-ERD Injection and Extraction Recirculation

In 2011, a groundwater injection and extraction recirculation system was installed in the upper Castle Hayne aquifer consisting of six injection wells (IR86-IW01 through IR86-IW06), two extraction wells (IR86-EW01 and IR86-EW02), six monitoring wells (IR86-MW70IW through IR86-MW75IW), and ancillary pumps and piping in Zone 1.

The type of substrate used in the Pilot Study was a WilClear sodium lactate solution. The lactate solution was delivered in a 60 percent solution and diluted to 5.9 percent when dosed into the extracted groundwater in the recirculation system, which operated at a rate of 7.5 gallons per minute (gpm). Three separate injection events took place within the span of 4 months, delivering approximately 30,000 pounds of WilClear to the upper Castle Hayne aquifer.

Four groundwater monitoring events were performed during the Pilot Study and included a baseline, 1-month, 3-month, and 6-month event. During each monitoring event, groundwater was collected for VOCs, volatile fatty acids (VFAs), dechlorinating bacteria, and total organic carbon (TOC) analyses.

Dechlorinating bacteria populations, which were already present at the site, grew significantly throughout the Pilot Study, specifically *Dehalococcoides* (DHC), which grew by 5 orders of magnitude. Simultaneous decreasing trends of lactate concentration and increasing trends of its fermentation products in the treatment area indicated bacterial consumption of the injected substrate and the health of the bacterial consortium.

At the conclusion of the Pilot Study, analytical data indicated that overall concentrations of VOCs (TCE, cis-1,2-DCE, 1,1-DCE, and VC) had decreased by approximately 80 percent relative to baseline concentrations. Additionally, as concentrations of TCE decreased, concentrations of cis-1,2-DCE and VC appeared to initially increase and then began to follow a decreasing trend. In two monitoring wells (IR86-MW70IW and IR86-MW71IW), concentrations of VC were reduced to less than 1 µg/L within 6 months of treatment. This indicated that, along with the favorable microbial, TOC, and VFA data, complete degradation of TCE was occurring and could be expected to continue.

Zone 2-ISCO using SRPCs

In October 2011, 60 SRPCs were deployed in 30 borings in the surficial aquifer near monitoring well IR86-MW61 (Zone 2). SRPCs were installed along two 80-foot-long transects, each consisting of 15 SRPC borings at a 3-foot offset spacing to form an SRPC permeable reactive barrier (PRB) in the surficial aquifer. Each SRPC consisted of a 3-foot-long by 1.5-inch-diameter potassium permanganate and paraffin wax candle and contained approximately 3.44 pounds of potassium permanganate (2.55 pounds of permanganate) and 0.86 pound of paraffin wax. Periodic sampling of groundwater at SRPC-8 showed a logarithmic concentration of permanganate. Initial concentrations were approximately 9,000 milligrams per liter (mg/L). Concentrations fell to 1,000 mg/L after 1 month and decreased to 400 mg/L over the next 8 months. However, the effectiveness target was 200 mg/L.

Groundwater samples were collected from upgradient monitoring well IR86-MW61 and five downgradient monitoring wells, IR86-MW66 through IR86-MW69 and IR86-MW63, prior to and 1, 3, 6, and 9 months after SRPC deployment. The detected concentration of TCE in groundwater collected from IR86-MW66 (within the SRPC PRB) decreased from a background concentration of 62 µg/L to 13 µg/L during the first 3 months of the pilot test. The concentration of TCE detected in groundwater collected from IR86-MW66 rebounded to 83 µg/L after 9 months of treatment.

TCE concentrations in groundwater collected from downgradient wells IR86-MW67, IR86-MW68, and IR86-MW69 decreased after the first 3 months. However, the same trend toward baseline conditions observed in IR86-MW66 was observed after 9 months of treatment. Concentrations of cis-1,2-DCE in groundwater collected from IR86-MW66 through IR86-MW69 were reduced below the NCGWQS of 70 µg/L by the SRPCs. However, concentrations of cis-1,2-DCE exhibited the same slight increase after 9 months of treatment. The previously described rebound trend is likely related to formation oxidant demand and low seepage velocities in the surficial aquifer. The oxidant demand may have consumed the permanganate as it diffused off the candle. The low seepage velocity did not provide adequate transport; therefore, not enough permanganate was present to overcome these two factors.

2.6 Natural Attenuation Lines of Evidence

To evaluate monitored natural attenuation (MNA) as a remedial option at Site 86, several lines of evidence were considered. These lines of evidence are summarized below and detailed explanations are provided in the referenced sections, tables, and/or figures.

- Detection of parent VOC degradation compounds have been observed site wide (**Section 2.3**).
- Removal of mass from higher concentration areas through the implementation of two pilot studies.
  - 2006 Air sparging/ozone injection pilot study (summarized in **Section 2-5**) reduced concentrations of TCE by approximately 99 percent in the northeastern portion of the site (**Figure 2-16**).
  - 2011/2012 ERD recirculation pilot study (summarized in **Section 2.5**) reduced concentrations of VOCs by approximately 80 percent near eastern end of the industrial portion of Site 86 (**Figure 2-16**).
- Presence of adequate MNA scores (USEPA, 1998) for upper Castle Hayne plume wells (**Section 2.6.1.2**) has been observed (**Figure 2-16**).
- Presence of microbial populations observed in groundwater samples collected from upper Castle Hayne wells (**Table 2-9**).
- Indication that MNA will be protective of the New River based on predictive groundwater modeling (**Section 2.6.1.3**).
- Similarity between remedial timeframes (**Section 2.6.1.3**) for treatment and mass transfer alternatives to MNA (40 years vs. 53 years, respectively).

Based on the lines of evidence presented above, MNA appears to be a sustainable remedial alternative for Site 86. A detailed evaluation of the natural attenuation indicator parameters (NAIPs) present in the surficial and upper Castle Hayne aquifers, MNA scores, and groundwater modeling and remedial timeframes is provided in the following sections.

2.6.1 Natural Attenuation Evaluation

NAIPs provide qualitative evidence of favorable conditions and semi-quantitative evidence of biodegradation. Among these parameters used to assess favorable subsurface conditions are a loss of other electron acceptors (dissolved oxygen [DO], nitrate, and sulfate), the production of metabolic byproducts (nitrite, ferrous iron [Fe(II)], sulfide, and methane), an increase in alkalinity, sufficient organic carbon source(s), a neutral pH, and a reduced groundwater environment (USEPA, 1998). Also, a decrease in parent compound concentrations and/or mass, the detection of daughter products (DCE, VC, ethane, and ethene), and an increase in chloride would provide semi-quantitative evidence that reductive dechlorination is occurring.

Field measurements and groundwater samples were collected to evaluate the geochemical characteristics of the surficial and upper Castle Hayne aquifers. Field measurements collected during the purging of the wells included temperature, pH, DO, oxidation-reduction potential (ORP), Fe(II), nitrate, and nitrite. Additionally, groundwater samples were collected and submitted for laboratory analysis of geochemical parameters including alkalinity, chloride, sulfate, sulfide, TOC, total iron, methane, ethane, and ethane.

To assess NA properties at Site 86 and the suitability of MNA as a remedial option, and due to potential variations in geochemistry across the site, the monitoring wells at the site were divided into “plume area wells,” samples that contained VOC concentrations exceeding the NCGWQS, and “non-plume area wells,” consistent with *Performance Monitoring of MNA Remedies for VOCs in Ground Water* (USEPA, 2004). This way, the spatial distribution of NAIPs, with respect to degradation processes, could be evaluated. Summaries of NAIPs from each well sampled during the most recent (March 2010) groundwater monitoring event and total scores are presented in **Table 2-8** and **Table 2-9** and on **Figure 2-16**. A more-detailed discussion of the NA processes in each aquifer is provided as follows.

Surficial Aquifer

The geochemistry of groundwater upgradient of the plume, within the plume, and downgradient of the plume can provide evidence of favorable conditions for biodegradation. Therefore, NAIPs in the surficial aquifer were evaluated based on their location in reference to the contaminant plumes. IR86-MW09, IR86-MW10IW, IR86-MW27IW, IR86-MW40, IR86-MW41, IR86-MW47, IR86-MW58, IR86-MW61, and IR86-MW63 are located within the contaminant plumes (**Figure 2-16**). The remaining 16 surficial aquifer wells are sidegradient and/or downgradient. A summary of NAIPs measured in the surficial aquifer is provided in **Table 2-8**, as follows:

TABLE 2-8
Natural Attenuation Indicator Parameters Summary-Surficial Aquifer
Operable Unit 20 (Site 86), MCIEAST-MCB CAMLEJ, North Carolina

		Plume Area		Non-Plume Area	
Parameter	**Favorable Criteria for NA**	**Measured Range**	**Frequency Meeting Criteria**	**Measured Range**	**Frequency Meeting Criteria**
Temperature (°C)	>20	16.2 – 23.39	4/9	16.90 – 23.53	10/16
DO (mg/L)	<0.5	0.16 – 2.95	8/9	0.12 – 3.91	12/16
pH (SUs)	5 – 9	4.84 – 7.04	8/9	4.31 – 8.45	12/16
ORP (mV)	<50	(-150.2) – 50.0	8/9	(-204.2) – 186.8	14/16
Fe(II) (mg/L)	>1	1.2 – 3.4	8/9	1.1 – 5.8	12/15*
Sulfide (mg/L)	>1	0.64 J – 1.7	1/9	0.82 J – 18	4/16
Nitrite (mg/L)	presence	ND	0/9	ND	0/15*
Methane (mg/L)	>0.5	0.01 – 1.7	2/9	0.003 J -1	4/16
Chloride (mg/L)	>2X Background (7 mg/L)	6 B – 38 B	4/9	4.5 B – 23 B	5/16
Alkalinity (mg/L)	>2X Background (30 mg/L)	7.2 J – 520	5/9	6.0 J – 430	10/16
Sulfate (mg/L)	<20	11 B – 130 B	2/9	0.24 JB – 5,700	9/16
Nitrate (mg/L)	<1	ND	9/9	ND	15/15*
TOC (mg/L)	>20	1.8 – 7.5	0/9	0.74 J – 11	0/16
Ethene (mg/L)	>0.01	ND	0/9	0.0078 J	0/16
Ethane (mg/L)	>0.01	ND	0/9	0.0072 J	0/16
USEPA Scores	>14	8 – 19	3/9	5 – 21	4/16

Data Collected between December 2009 and January 2010

B – Value may be attributable to blank contamination

J – Analyte present, value may or may not be accurate or precise

* Fe(II), Nitrate, and Nitrite data not collected for well IR86-MW65

°C – degrees Celsius ND – Not Detected

mV – millivolts SU – standard unit

The NA evaluation was also conducted in accordance with the *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* (USEPA, 1998). The protocol uses a simplified scoring system that assigns a positive value to each NAIP result that is favorable or a negative value to unfavorable results. All points are added together to arrive at a total score. The scores for each well are averaged by plume location and aquifer to provide a general indication of evidence for biodegradation. A score of 0 to 5 indicates inadequate evidence for anaerobic degradation, a score of 6 to 14 indicates limited evidence for anaerobic degradation, a score of 15 to 20 indicates adequate evidence for anaerobic degradation, and a score greater than 20 indicates strong evidence for anaerobic degradation (USEPA, 1998). Because this scoring process is based on conditions favorable for reductive dechlorination, it does not incorporate the benefit of zones of more oxidizing conditions for DCE and VC degradation.

The average score within the plume area was 14 and the average score outside of the plume area was 13, indicating limited evidence for anaerobic degradation (**Figure 2-16**).

Indicator parameters suggest that conditions in the CVOC plume area of the surficial aquifer are limited to somewhat favorable for reductive dechlorination. The surficial aquifer is naturally more aerobic and oxidizing than the other aquifers at the site. However, within the plume area, groundwater is more reduced and DO is typically below 0.5 mg/L. The lack of nitrite and nitrate indicates that denitrification may not be a significant process in groundwater. On the contrary, the presence of Fe(II) provides evidence of iron reduction, particularly in plume area wells, which had the highest concentrations. Limited methanogenesis is also occurring based on the presence of trace concentrations of methane. Because there is very limited sulfide, no conclusion can be made in regards to sulfate reduction.

The strongest evidence of reductive dechlorination in the surficial aquifer is the presence of biodegradation daughter products (DCE and VC) and chloride. This suggests that some degree of biodegradation is occurring.

Upper Castle Hayne Aquifer

Similar to the surficial aquifer, NAIPs in the upper Castle Hayne aquifer were evaluated based on their location in reference to the contaminant plumes. IR86-MW16IW, IR86-MW22IW, IR86-MW19IW, IR86-MW30IW, IR86-MW31IW, IR86-MW34IW, IR86-MW38IWB, IR86-MW38IWBC, IR86-MW42IW, IR86-MW44IW, IR86-MW54IW, IR86-MW55IW, and IR86-MW58IW are located within the plumes, while the 10 remaining wells are sidegradient and/or downgradient of the plume (**Figure 2-16**). A summary of NAIPs measured in the upper Castle Hayne aquifer is provided in **Table 2-9,** as follows:

TABLE 2-9
Natural Attenuation Indicator Parameters Summary-Upper Castle Hayne Aquifer
Operable Unit 20 (Site 86), MCIEAST-MCB CAMLEJ, North Carolina

		Plume Area		Non-Plume Area	
Parameter	**Favorable Criteria for NA**	**Measured Range**	**Frequency Meeting Criteria**	**Measured Range**	**Frequency Meeting Criteria**
Temperature (°C)	>20	17.79 – 21.55	9/13	17.5 – 22.31	5/10
DO (mg/L)	<0.5	0.11 – 2.43	12/13	0.13 – 0.31	10/10
pH (SUs)	5 – 9	6.82 – 2.43	13/13	6.19 – 8.99	10/10
ORP (mV)	<50	(-152.6) – (-13.3)	13/13	(-356.1) – (-45)	10/10
Fe(II) (mg/L)	>1	1.4 – 4.0	13/13	0.5 – 3.4	8/10
Sulfide (mg/L)	>1	6.8	1/13	0.99 J	0/10
Nitrite (mg/L)	presence	ND	0/13	ND	0/10
Methane (mg/L)	>0.5	0.02 B – 1.2	3/13	0.01 JB – 0.79	1/10
Chloride (mg/L)	>2X Background (7 mg/L)	10 B – 32 B	7/13	7.0 B – 130 B	3/10
Alkalinity (mg/L)	>2X Background (30 mg/L)	210 – 400	13/13	200 – 430	10/10
Sulfate (mg/L)	<20	0.29 J – 1,400 B	7/13	0.13 JB – 39 B	8/10
Nitrate (mg/L)	<1	8.8	12/13	4.84	9/10
TOC (mg/L)	>20	0.7 J – 6.9	0/13	0.48 J – 2.8	0/10
Ethene (mg/L)	>0.01	0.01 J	0/13	ND	0/10
Ethane (mg/L)	>0.01	ND	0/13	ND	0/10
USEPA Scores	>14	14 – 23	11/13	10 – 21	3/10
DHC (gc/mL)	>1,000 gc/mL	1.8 – 78.9	0/6	N/A	N/A
Dehalobacter (gc/mL)	>1,000 gc/mL	196 – 13,700	4/6	N/A	N/A
Desulfuromonas (gc/mL)	>1,000 gc/mL	189 – 2,930	2/6	N/A	N/A

Data Collected between December 2009 and January 2010

B – Value may be attributable to blank contamination

J – Analyte present, value may or may not be accurate or precise

gc/mL – gene count per milliliter

N/A – not analyzed

The average score within the plume area was 18, indicating adequate evidence for anaerobic degradation. The average score outside of the plume area was 14, indicating limited evidence for anaerobic degradation (**Figure 2-16**).

Indicator parameters suggest that conditions in the CVOC plume area of the upper Castle Hayne aquifer are favorable for reductive dechlorination. This aquifer appears to be naturally under anaerobic and somewhat reduced conditions, with DO typically below 0.5 mg/L and ORP below -100 mV. DO and ORP levels within the plumes are comparable to those measured outside of the plume extents. Similar to the surficial aquifer, denitrification does not appear to be a significant process. Other geochemical data indicate that iron

reduction and methanogenesis are proceeding. Sulfate reduction is likely occurring but difficult to identify as sulfide is non-detect. CVOC daughter products were detected in all monitoring wells located within the plume. Specifically, analytical data for groundwater collected from IR86-MW55IW (**Figure 2-16**) indicate a decreasing trend in concentrations of VC from 210 µg/L in June 2008 to 64 µg/L in January 2012.

Groundwater samples collected from upper Castle Hayne monitoring wells were also analyzed for microbial populations to assess the presence of dehalogenating bacteria (DHC, Desulfuromonas sp., Dehalobacter sp., and Desulfitobacterium sp.). The analytical data indicate that populations of DHC, Desulfitobacterium, and Desulfuromonas are present at Site 86, as shown in **Table 2-9**. All three genera of microorganisms can carry reductive dechlorination of chloroethenes, although DHC is the only genus that can mediate complete reductive dechlorination to ethene. Although the populations of DHC are not in the optimal range for ERD, it is reasonable to assume that reductive dechlorination will occur, albeit more slowly than under enhanced conditions.

Additionally, as noted in **Table 2-1** and Section 2.6, two Pilot Studies have been conducted at the site. Each Pilot Study was effective in reducing the overall mass of CVOCs in the upper Castle Hayne aquifer at Site 86.

Groundwater Modeling and Remediation Timeframes

Numerical groundwater flow and solute transport models (STMs) have been developed for Site 86 using analytical and hydrogeologic data collected during the ESRI. The groundwater flow model (GFM) was originally developed using MODFLOW 2000 (Harbaugh et al., 2000) as a tool for hypothesis testing to gain insight into the physical groundwater flow system at Site 86. The STM was originally developed using Modular Three-Dimensional Multispecies Transport Model for Simulation (Zheng and Wang, 1999) to help forecast mobile-phase concentrations of selected VOCs that may eventually discharge from the aquifer to the New River. Recent efforts associated with the STM have focused on VC specifically, because VC is the most persistent, mobile, and toxic VOC in groundwater at Site 86 (**Appendix D**).

Because VC-impacted groundwater at concentrations greater than the NCGWQS occurs as diffuse plumes in two aquifers (Surficial and upper Castle Hayne) covering an area of nearly 40 acres, active treatment of VC to its respective NCGWQS across the entire site is not practical and would be cost-prohibitive. Thus, target treatment zones (TTZs) limited to concentrations >100 times the NCGWQS was selected to focus on the core each plume to maximize the potential for mass reduction. Additionally, the numerical GFM and STM were used to forecast the remediation timeframe (RTF) of VC that may result from implementation of three different scenarios, including the following:

- Scenario 1–No further treatment
- Scenario 2–Reduction in VC concentrations in TTZs that exceed 100 times the NCGWQS in the mobile porosity only.
- Scenario 3– Reduction in VC concentrations in TTZs that exceed 100 times the NCGWQS in the mobile and immobile porosity.

Scenario 1 served as a base-case scenario against which the potential benefit of implementing the two active treatment scenarios (Scenarios 2 and 3) could be compared. Scenarios 2 and 3 were conducted to allow for the evaluation of the comparative benefit of implementing two different levels of treatment effectiveness in the TTZs. Depictions of the TTZs are shown on **Figure 2-17** and a summary of their dimensions are provided in **Table 2-10**.

TABLE 2-10
Treatment Area Summary
Operable Unit 20 (Site 86), MCIEAST-MCB CAMLEJ, North Carolina

Area	**Treatment Depth (feet bgs)**	**Treatment Area (square feet)**	**Treatment Volume (ft^3)**
Surficial Aquifer			
Area 1	10 to 30	22,050	441,000
Area 2	10 to 30	88,200	1,764,000
Upper Castle Hayne Aquifer			
Area 1	35 to 55	105,000	2,100,000
Area 2	35 to 55	87,500	1,750,000

ft^3 – cubic feet

Modeling results for all three scenarios indicate the potential for VC to eventually discharge from the aquifer to the New River at concentrations greater than the NCGWQS (0.03 µg/L), but below the North Carolina Surface Water Quality Standards (NCSWQS) (2.4 µg/L). Because the forecast maximum VC concentrations that may eventually discharge to the New River are below the NCSWQS, it is believed that NA will be protective of the New River. The forecast RTF under no further treatment (Scenario 1) to effectively reduce mobile-phase VC concentrations to less than the NCGWQS is 53 years, whereas the forecast under the most effective treatment scenario (Scenario 3) is 40 years. Thus, implementing a highly effective active remedial treatment option in the TTZs could potentially reduce the RTF by 13 years. More details on the GFM and STM and the associated modeling results are provided in **Appendix D**.

TABLE 2-2

Surficial Aquifer Groundwater Analytical Data

Feasibility Study

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Station ID	**NCGWQS (January, 2010)*,1**	IR86-MW03	IR86-MW09	IR86-MW10IW	IR86-MW27IW	IR86-MW38IWA	IR86-MW39	IR86-MW40		IR86-MW41	IR86-MW47	IR86-MW48
Sample ID		IR86-GW03-09D	IR86-GW09-09D	IR86-GW10IW-09D	IR86-GW27IW-09D	IR86-GW38IWA-09D	IR86-GW39-10A	IR86-GW40-09D	IR86-GW40D-09D	IR86-GW41-09D	IR86-GW47-09D	IR86-GW48-09D
Sample Date		12/14/09	12/11/09	12/14/09	12/10/09	12/10/09	01/13/10	12/15/09	12/15/09	12/07/09	12/09/09	12/13/09
Chemical Name												
Volatile Organic Compounds (µg/L)												
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	200,000	1 U	1 U	620	1.5	1 U	1 U	1 U	1 U	28	1 U	1 U
1,1-Dichloroethane	6	1 U	1 U	3.4	0.19 J	1 U	1 U	0.3 J	0.35 J	0.52 J	0.36 J	0.67 J
1,1-Dichloroethene	7	1 U	1 U	1 U	0.6 J	1 U	1 U	1 U	1 U	0.63 J	1 U	1 U
2-Hexanone	280	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	**1.9**	0.75 J	0.22 J	0.11 J	1 U	1 U	0.34 J	**9.6**	0.86 J
Carbon disulfide	700	1 U	1 U	1 U	1 U	1 U	0.6 J	1 U	1 U	1 U	1 U	1 U
Chloroform	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	70	1 U	1 U	37	15	0.57 J	1 U	1.6	1.4	4.2	0.7 J	1.5
Cyclohexane	1,300	1 U	1 U	1.5	32	1 U	0.61 J	1 U	1 U	1 U	8	4.7
Dichlorodifluoromethane (Freon-12)	1,000	1 U	1 U	51	1.4	1 U	1 U	1 UJ	1 UJ	1.8	1 U	1 U
Ethylbenzene	600	1 U	1 U	0.92 J	1 U	1 U	0.83 J	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	70	1 U	1 U	1 U	1 U	1 U	0.12 J	1 U	1 U	1 U	1 U	1 U
Methyl-tert-butyl ether (MTBE)	20	1 U	1 U	1 U	1 U	1 U	**66**	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane	--	5 U	5 U	5 U	2.6 J	5 U	5 U	5 U	5 U	5 U	4.1 J	5 U
Tetrachloroethene	0.7	1 U	1 U	**190**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	600	1 U	1 U	2.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	100	1 U	1 U	1.1	0.22 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	3	0.5 U	0.5 U	**54**	**13**	1.3	0.5 U	**3.4**	**3.2**	**3.3**	**8**	0.56
Vinyl chloride	0.03	0.5 U	0.5 U	**19**	**1.1**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Xylene, total	500	0.5 U	0.5 U	6.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Notes:

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available.
Adjusted Tap Water RSLs are 10X the Tap Water RSL for non-carcinogen analytes

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
NCGWQS - North Carolina Groundwater Quality Standards
R - Unreliable result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

TABLE 2-2

Surficial Aquifer Groundwater Analytical Data

Feasibility Study

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Station ID	**NCGWQS (January, 2010)*,1**	IR86-MW52	IR86-MW53	IR86-MW56		IR86-MW58			IR86-MW59		IR86-MW60	IR86-MW61
Sample ID		IR86-GW52-09D	IR86-GW53-09D	IR86-GW56-09D	IR86-GW56-09D	IR86-GW58-09D	IR86-GW58-10A	IR86-GW58D-10A	IR86-GW59-09D	IR86-GW59D-09D	IR86-GW60-09D	IR86-GW61-12B
Sample Date		12/09/09	12/08/09	12/16/09	03/16/10	12/16/09	03/16/10	03/16/10	12/12/09	12/12/09	12/18/09	05/02/12
Chemical Name												
Volatile Organic Compounds (µg/L)												
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	200,000	1 U	1 U	1 U	NA	1 U	NA	NA	1 U	1 U	1 U	NA
1,1-Dichloroethane	6	1 U	0.2 J	1 U	NA	1 U	NA	NA	1 U	1 U	1 U	NA
1,1-Dichloroethene	7	1 U	1 U	2.3	NA	0.48 J	NA	NA	1 U	1 U	1 U	3.4
2-Hexanone	280	5 U	5 U	5 U	NA	5 U	NA	NA	5 U	5 U	5 U	NA
Benzene	1	**11**	1 U	**4.3**	NA	**1.2 J**	NA	NA	1 U	1 U	**2.2**	NA
Carbon disulfide	700	1 U	1 U	1 U	NA	1 UJ	NA	NA	1 UJ	1 UJ	1 U	NA
Chloroform	70	1 U	1 U	1 U	NA	2 J	NA	NA	1 U	1 U	1 U	NA
Chloromethane	3	0.3 J	1 U	1 U	NA	1 U	NA	NA	1 U	1 U	1 U	NA
cis-1,2-Dichloroethene	70	0.22 J	1 U	28	NA	**150 J**	NA	NA	1 U	1 U	9.9	64
Cyclohexane	1,300	1 U	1 U	1 U	NA	1 U	NA	NA	1 U	1 U	1 U	NA
Dichlorodifluoromethane (Freon-12)	1,000	1 U	1 U	1 U	NA	2.8 J	NA	NA	1 UJ	1 UJ	1 U	NA
Ethylbenzene	600	4.6	1 U	1 U	NA	1 U	NA	NA	1 U	1 U	1 U	NA
Isopropylbenzene	70	0.46 J	1 U	1 U	NA	1 U	NA	NA	1 U	1 U	1 U	NA
Methyl-tert-butyl ether (MTBE)	20	1 U	1 U	1 U	NA	1 U	NA	NA	1 U	1 U	1 U	NA
Methylcyclohexane	--	5 U	5 U	5 U	NA	5 U	NA	NA	5 U	5 U	5 U	NA
Tetrachloroethene	0.7	1 U	1 U	1 U	NA	1 U	NA	NA	1 U	1 U	1 U	1 U
Toluene	600	5.1	1 U	1 U	NA	0.48 J	NA	NA	1 U	1 U	0.2 J	NA
trans-1,2-Dichloroethene	100	1 U	1 U	1.6	NA	3.7 J	NA	NA	1 U	1 U	0.54 J	NA
Trichloroethene	3	0.5 U	0.5 U	2.4	NA	**52 J**	NA	NA	0.5 U	0.5 U	1.8	**170**
Vinyl chloride	0.03	0.5 U	0.5 U	0.5 U	NA	**68 J**	NA	NA	0.5 U	0.5 U	0.5 U	1 U
Xylene, total	500	6.8	0.5 U	0.5 U	NA	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA

Notes:

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available.
Adjusted Tap Water RSLs are 10X the Tap Water RSL for non-carcinogen analytes

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
NCGWQS - North Carolina Groundwater Quality Standards
R - Unreliable result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

TABLE 2-2

Surficial Aquifer Groundwater Analytical Data

Feasibility Study

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Station ID	**NCGWQS (January, 2010)*,1**	IR86-MW62		IR86-MW63	IR86-MW64	IR86-MW65	IR86-MW66	IR86-MW67	IR86-MW68	IR86-MW69	USTAS410S-MW02
Sample ID		IR86-GW62-09D	IR86-GW62D-09D	IR86-GW63-12B	IR86-GW64-09D	IR86-GW65-10A	IR86-GW66-12B	IR86-GW67-12B	IR86-GW68-12B	IR86-GW69-12B	USTAS410S-GW02-09D
Sample Date		12/14/09	12/14/09	05/02/12	12/16/09	03/24/10	05/02/12	05/02/12	04/30/12	04/30/12	12/09/09
Chemical Name											
Volatile Organic Compounds (µg/L)											
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	200,000	1 U	1 U	NA	1 U	1 U	NA	NA	NA	NA	1 U
1,1-Dichloroethane	6	1 U	1 U	NA	1 U	1 U	NA	NA	NA	NA	1 U
1,1-Dichloroethene	7	1 U	1 U	1 U	1 U	1 U	1.1 J	0.94 J	1.1	1.9 J	1 U
2-Hexanone	280	5 U	5 U	NA	5 U	5 U	NA	NA	NA	NA	5 U
Benzene	1	1 U	1 U	NA	1 U	1 U	NA	NA	NA	NA	1 U
Carbon disulfide	700	1 U	1 U	NA	1 U	1 U	NA	NA	NA	NA	1 U
Chloroform	70	0.44 J	0.42 J	NA	1 U	0.5 J	NA	NA	NA	NA	1 U
Chloromethane	3	1 U	1 U	NA	1 U	2 U	NA	NA	NA	NA	1 U
cis-1,2-Dichloroethene	70	1 U	1 U	6	1 U	1 U	21	19	22	38	1 U
Cyclohexane	1,300	1 UJ	1 UJ	NA	1 U	1 U	NA	NA	NA	NA	1 U
Dichlorodifluoromethane (Freon-12)	1,000	1 U	1 U	NA	1 UJ	2 U	NA	NA	NA	NA	1 U
Ethylbenzene	600	1 U	1 U	NA	1 U	1 U	NA	NA	NA	NA	0.38 J
Isopropylbenzene	70	1 U	1 U	NA	1 U	1 U	NA	NA	NA	NA	1 U
Methyl-tert-butyl ether (MTBE)	20	1 U	1 U	NA	1 U	2 U	NA	NA	NA	NA	1 U
Methylcyclohexane	--	5 U	5 U	NA	5 U	1 U	NA	NA	NA	NA	5 U
Tetrachloroethene	0.7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	600	1 U	1 U	NA	1 U	1 U	NA	NA	NA	NA	0.19 J
trans-1,2-Dichloroethene	100	1 U	1 U	NA	1 U	1 U	NA	NA	NA	NA	1 U
Trichloroethene	3	0.5 U	0.5 U	**6.1**	0.5 U	1 U	**44**	**34**	**39**	**46**	0.5 U
Vinyl chloride	0.03	0.5 U	0.5 U	1 U	0.5 U	2 U	1 U	1 U	1 U	1 U	0.5 U
Xylene, total	500	0.5 U	0.5 U	NA	0.5 U	3 U	NA	NA	NA	NA	0.5 U

Notes:

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available.
Adjusted Tap Water RSLs are 10X the Tap Water RSL for non-carcinogen analytes

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
NCGWQS - North Carolina Groundwater Quality Standards
R - Unreliable result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

TABLE 2-2

Surficial Aquifer Groundwater Analytical Data

Feasibility Study

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Station ID	**NCGWQS (January, 2010)*,1**	SWMU318-MW01		SWMU318-MW05	SWMU318-MW08
Sample ID		SWMU318-GW01-09D	SWMU318-GW01D-09D	SWMU318-GW05-09D	SWMU318-GW08-09D
Sample Date		12/10/09	12/10/09	12/15/09	12/08/09
Chemical Name					
Volatile Organic Compounds (µg/L)					
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	200,000	1 U	1 U	1 U	1 U
1,1-Dichloroethane	6	0.4 J	0.37 J	1 U	0.42 J
1,1-Dichloroethene	7	1 U	1 U	1 U	0.27 J
2-Hexanone	280	5 UJ	5 UJ	5 U	5 U
Benzene	1	1 U	1 U	1 U	1.9
Carbon disulfide	700	1 U	1 U	1 U	1 U
Chloroform	70	1 U	1 U	1 U	1 U
Chloromethane	3	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	70	0.24 J	0.21 J	0.83 J	1.5
Cyclohexane	1,300	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon-12)	1,000	1 U	1 U	1 U	1 U
Ethylbenzene	600	1 U	1 U	1 U	1 U
Isopropylbenzene	70	1 U	1 U	1 U	1 U
Methyl-tert-butyl ether (MTBE)	20	1 U	1 U	1 U	1 U
Methylcyclohexane	--	5 U	5 U	5 U	5 U
Tetrachloroethene	0.7	1 U	1 U	1 U	1 U
Toluene	600	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	100	1 U	1 U	1 U	1 U
Trichloroethene	3	0.5 U	0.5 U	0.53	0.79
Vinyl chloride	0.03	0.5 U	0.5 U	0.5 U	0.5 U
Xylene, total	500	0.5 U	0.5 U	0.5 U	0.5 U

Notes:

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available.
Adjusted Tap Water RSLs are 10X the Tap Water RSL for non-carcinogen analytes

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
NCGWQS - North Carolina Groundwater Quality Standards
R - Unreliable result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

TABLE 2-4

Upper Castle Hayne Aquifer Groundwater Analytical Data

Feasibility Study

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Station ID	**CLEAN NCGWQS (January, 2010)*[1,2]**	IR86-MW15IW	IR86-MW16IW	IR86-MW17IW	IR86-MW22IW	IR86-MW29IW	IR86-MW30IW	IR86-MW31IW	IR86-MW34IW	IR86-MW38IWB	IR86-MW38IWC
Sample ID		IR86-GW15IW-09D	IR86-GW16IW-09D	IR86-GW17IW-09D	IR86-GW22IW-09D	IR86-GW29IW-09D	IR86-GW30IW-09D	IR86-GW31IW-09D	IR86-GW34IW-09D	IR86-GW38IWB-09D	IR86-GW38IWC-09D
Sample Date		12/14/09	12/15/09	12/11/09	12/13/09	12/15/09	12/11/09	12/16/09	12/17/09	12/10/09	12/10/09
Chemical Name											
Volatile Organic Compounds (µg/L)											
1,1-Dichloroethane	6	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1.5	1.5
1,1-Dichloroethene	7	1 U	1 U	1 U	1 U	1 U	0.85 J	1 UJ	0.58 J	0.66 J	0.45 J
2-Butanone	4,000	10 R	10 R	10 UJ	10 R	10 R	10 UJ	10 R	10 R	10 UJ	10 UJ
Acetone	6,000	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ	10 UJ
Benzene	1	**4**	0.25 J	1 U	0.32 J	0.45 J	**1.1**	1 UJ	1 U	1 U	1 U
Carbon disulfide	700	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Chloroform	70	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Chloromethane	3	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	0.35 J	1 U	1 U
cis-1,2-Dichloroethene	70	**350 J**	3.3	1 U	4	41	**150**	4.2 J	4.2	66	64
Ethylbenzene	600	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Tetrachloroethene	0.7	1 U	1 U	1 U	1 U	1 U	1 U	0.28 J	1 U	1 U	1 U
Toluene	600	0.31 J	0.17 J	0.23 J	1 U	0.19 J	1 U	0.19 J	0.26 J	1 U	0.24 J
trans-1,2-Dichloroethene	100	10	1 U	1 U	1 U	1 U	4.2	0.14 J	1 U	0.75 J	10
Trichloroethene	3	0.5 U	**3.8**	0.5 U	0.5 U	**140**	**1.1**	**7.7 J**	**3.5**	**2.7**	**3.1**
Vinyl chloride	0.03	0.5 U	0.5 U	0.5 U	**22**	0.5 U	**1.6**	0.5 UJ	**0.6**	**0.52**	**0.4 J**

Notes:

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available

2 - Project Action Limits reported where no NCGWQS, MCL, or Adjusted Tap Water RSL was available

µg/L - Micrograms per liter

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

NA - Not analyzed

NCGWQS - North Carolina Groundwater Quality Standards

R - Unreliable result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

TABLE 2-4

Upper Castle Hayne Aquifer Groundwater Analytical Data

Feasibility Study

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Station ID	**CLEAN NCGWQS (January, 2010)*[1,2]**	IR86-MW42IW	IR86-MW43IW	IR86-MW44IW	IR86-MW46IW	IR86-MW47IW	IR86-MW48IW	IR86-MW52IW		IR86-MW53IW	IR86-MW54IW
Sample ID		IR86-GW42IW-09D	IR86-GW43IW-09D	IR86-GW44IW-09D	IR86-GW46IW-09D	IR86-GW47IW-09D	IR86-GW48IW-09D	IR86-GW52IW-10A	IR86-GW52IWD-10A	IR86-GW53IW-10A	IR86-GW54IW-09D
Sample Date		12/12/09	12/13/09	12/12/09	12/07/09	12/09/09	12/16/09	03/17/10	03/17/10	03/16/10	12/14/09
Chemical Name											
Volatile Organic Compounds (µg/L)											
1,1-Dichloroethane	6	1 U	1 U	1 U	1 U	1 U	0.25 J	1 U	1 U	1 U	1 U
1,1-Dichloroethene	7	1.1	1 U	2.7 J	1 U	1 U	3.7	1 U	1 U	1 U	7.6
2-Butanone	4,000	10 U	10 R	10 U	10 U	10 UJ	10 R	4 J	4 J	5 U	10 R
Acetone	6,000	10 U	10 U	10 U	10 U	10 UJ	10 U	47 J	42	5 U	10 U
Benzene	1	0.7 J	1 U	1.6 J	1 U	1 U	2.4	1 U	1 U	1 U	2.4
Carbon disulfide	700	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	3	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	2 U	1 U
cis-1,2-Dichloroethene	70	63	1 U	210 J	1 U	1 U	110	1 U	1 U	1 U	270
Ethylbenzene	600	1 U	1 U	1 U	1 U	1 U	1 U	0.3 J	0.3 J	1 U	1 U
Tetrachloroethene	0.7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	600	1.1	0.22 J	0.72 J	0.41 J	1 U	1 U	0.4 J	0.4 J	1 U	0.34 J
trans-1,2-Dichloroethene	100	0.46 J	1 U	1.5 J	1 U	1 U	6.4	1 U	1 U	1 U	1.4
Trichloroethene	3	330	0.5 U	110 J	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	260
Vinyl chloride	0.03	3.5	0.5 U	24 J	0.5 U	0.5 U	0.5 U	2 U	2 U	2 U	1.8

Notes:

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available

2 - Project Action Limits reported where no NCGWQS, MCL, or Adjusted Tap Water RSL was available

µg/L - Micrograms per liter

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

NA - Not analyzed

NCGWQS - North Carolina Groundwater Quality Standards

R - Unreliable result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

TABLE 2-4

Upper Castle Hayne Aquifer Groundwater Analytical Data

Feasibility Study

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Station ID	**CLEAN NCGWQS (January, 2010)*,[1,2]**	IR86-MW55IW	IR86-MW58IW	IR86-MW58IW	IR86-MW58IW	IR86-MW59IW	IR86-MW60IW	IR86-MW61IW	IR86-MW63IW	IR86-MW70IW	IR86-MW71IW
Sample ID		IR86-GW55IW-12A	IR86-GW58IW-09D	IR86-GW58IW-11C	IR86-GW58IW-12B	IR86-GW59IW-12B	IR86-GW60IW-09D	IR86-GW61IW-12B	IR86-GW63IW-09D	IR86-GW70IW-12B	IR86-GW71IW-12B
Sample Date		01/23/12	12/16/09	10/18/11	05/01/12	05/02/12	12/17/09	05/02/12	12/17/09	05/01/12	05/01/12
Chemical Name											
Volatile Organic Compounds (µg/L)											
1,1-Dichloroethane	6	NA	1 U	NA	NA	NA	1 U	NA	1 U	NA	NA
1,1-Dichloroethene	7	**8.3**	6.6 J	**62**	**9.9**	1 U	1 U	2.3	1 U	1 U	1 U
2-Butanone	4,000	NA	10 U	NA	NA	NA	10 R	NA	10 R	NA	NA
Acetone	6,000	NA	10 U	NA	NA	NA	10 U	NA	10 U	NA	NA
Benzene	1	NA	**1.4 J**	NA	NA	NA	0.12 J	NA	0.2 J	NA	NA
Carbon disulfide	700	NA	1 UJ	NA	NA	NA	1 U	NA	1 U	NA	NA
Chloroform	70	NA	1 U	NA	NA	NA	1 U	NA	1 U	NA	NA
Chloromethane	3	NA	1 U	NA	NA	NA	1 U	NA	1 U	NA	NA
cis-1,2-Dichloroethene	70	**290**	**100 J**	**120**	**100**	1 U	0.51 J	45	1.7	1 U	13
Ethylbenzene	600	NA	1 U	NA	NA	NA	1 U	NA	1 U	NA	NA
Tetrachloroethene	0.7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	600	NA	0.26 J	NA	NA	NA	0.22 J	NA	1 U	NA	NA
trans-1,2-Dichloroethene	100	NA	6.2 J	NA	NA	NA	1 U	NA	1 U	NA	NA
Trichloroethene	3	1 U	**710**	**170**	**32**	1 U	0.5 U	**51**	0.5 U	1 U	1 U
Vinyl chloride	0.03	**64**	**9.1 J**	**19**	**76**	1 U	0.5 U	1 U	0.5 U	1 U	**51**

Notes:

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available

2 - Project Action Limits reported where no NCGWQS, MCL, or Adjusted Tap Water RSL was available

µg/L - Micrograms per liter

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

NA - Not analyzed

NCGWQS - North Carolina Groundwater Quality Standards

R - Unreliable result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

TABLE 2-4

Upper Castle Hayne Aquifer Groundwater Analytical Data

Feasibility Study

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Station ID	**CLEAN NCGWQS (January, 2010)*,1,2**	IR86-MW72IW	IR86-MW73IW	IR86-MW74IW	IR86-MW75IW
Sample ID		IR86-GW72IW-12B	IR86-GW73IW-12B	IR86-GW74IW-12B	IR86-GW75IW-12B
Sample Date		05/01/12	05/02/12	05/01/12	05/01/12
Chemical Name					
Volatile Organic Compounds (µg/L)					
1,1-Dichloroethane	6	NA	NA	NA	NA
1,1-Dichloroethene	7	1 U	1.4 J	1 U	1 U
2-Butanone	4,000	NA	NA	NA	NA
Acetone	6,000	NA	NA	NA	NA
Benzene	1	NA	NA	NA	NA
Carbon disulfide	700	NA	NA	NA	NA
Chloroform	70	NA	NA	NA	NA
Chloromethane	3	NA	NA	NA	NA
cis-1,2-Dichloroethene	70	1 U	40	16	20
Ethylbenzene	600	NA	NA	NA	NA
Tetrachloroethene	0.7	1 U	1 U	1 U	1 U
Toluene	600	NA	NA	NA	NA
trans-1,2-Dichloroethene	100	NA	NA	NA	NA
Trichloroethene	3	1 U	5.4	5.5	6.1
Vinyl chloride	0.03	1.2 J	15	9.2	12

Notes:

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available

2 - Project Action Limits reported where no NCGWQS, MCL, or Adjusted Tap Water RSL was available

µg/L - Micrograms per liter

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

NA - Not analyzed

NCGWQS - North Carolina Groundwater Quality Standards

R - Unreliable result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

TABLE 2-6

Middle Castle Hayne Aquifer Groundwater Analytical Data

Feasibility Study

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Station ID	**CLEAN NCGWQS (January, 2010)*[1,2]**	IR86-MW15DW	IR86-MW16DW	IR86-MW17DW	IR86-MW18DW		IR86-MW19DW	IR86-MW31DW	IR86-MW42DW	IR86-MW44DW
Sample ID		IR86-GW15DW-10A	IR86-GW16DW-09D	IR86-GW17DW-09D	IR86-GW18DW-09D	IR86-GW18DWD-09D	IR86-GW19DW-09D	IR86-GW31DW-09D	IR86-GW42DW-09D	IR86-GW44DW-09D
Sample Date		01/14/10	12/15/09	12/11/09	12/15/09	12/15/09	12/14/09	12/18/09	12/13/09	12/13/09
Chemical Name										
Volatile Organic Compounds (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	200,000	1 U	1 U	1 U	1 U	1 U	0.52 J	1 U	1 U	1 U
Carbon disulfide	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	0.7	1 U	1 U	1 U	1 U	1 U	2.4	1 U	1 U	1 U
Toluene	600	1 U	0.37 J	0.28 J	0.21 J	0.31 J	1	1 U	0.25 J	0.44 J
Trichloroethene	3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Xylene, total	500	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Semivolatile Organic Compounds (µg/L)										
Benzo(a)pyrene	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	200	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	3	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	700	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* - The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available

2 - Project Action Limits reported where no NCGWQS, MCL, or Adjusted Tap Water RSL was available

µg/L - Micrograms per liter

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

NA - Not analyzed

NCGWQS- North Carolina Groundwater Quality Standards

R - Unreliable result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

TABLE 2-6

Middle Castle Hayne Aquifer Groundwater Analytical Data

Feasibility Study

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Station ID	**CLEAN NCGWQS (January, 2010)*[1,2]**	IR86-MW45DW	IR86-MW49DW	IR86-MW51DW		IR86-MW56DW	IR86-MW58DW	IR86-MW59DW	IR86-MW61DW
Sample ID		IR86-GW45DW-10A	IR86-GW49DW-09D	IR86-GW51DW-10A	IR86-GW51DWD-10A	IR86-GW56DW-10A	IR86-GW58DW-10A	IR86-GW59DW-09D	IR86-GW61DW-09D
Sample Date		01/15/10	12/17/09	01/15/10	01/15/10	01/14/10	01/13/10	12/18/09	12/18/09
Chemical Name									
Volatile Organic Compounds (µg/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	200,000	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	700	1 UJ	1 U	1 U	1 U	1 U	3.4	1 U	1 U
Chloroform	70	1 UJ	1 U	1 U	1 U	0.19 J	1 U	0.38 J	1 U
Chloromethane	3	1 UJ	1 U	1 U	1 U	1 U	0.18 J	1 U	0.18 J
cis-1,2-Dichloroethene	70	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	0.13 J
Tetrachloroethene	0.7	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	600	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	3	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.29 J
Xylene, total	500	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.28 J	0.5 U
Semivolatile Organic Compounds (µg/L)									
Benzo(a)pyrene	0.005	NA	NA	NA	NA	0.2 U	0.22 U	0.2 J	0.22 U
Benzo(b)fluoranthene	0.05	NA	NA	NA	NA	0.2 U	0.22 U	0.38 J	0.22 U
Benzo(g,h,i)perylene	200	NA	NA	NA	NA	0.2 U	0.22 U	0.46 J	0.22 U
Benzo(k)fluoranthene	0.5	NA	NA	NA	NA	0.2 U	0.22 U	0.31 J	0.22 U
bis(2-Ethylhexyl)phthalate	3	NA	NA	NA	NA	0.2 U	5.6 U	5.3 U	0.33 J
Dibenz(a,h)anthracene	0.005	NA	NA	NA	NA	0.2 U	0.22 U	0.55 J	0.22 U
Di-n-butylphthalate	700	NA	NA	NA	NA	0.2 U	5.6 U	5.3 U	0.2 J
Indeno(1,2,3-cd)pyrene	0.05	NA	NA	NA	NA	0.2 U	0.22 U	0.45 J	0.22 U

Notes:

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* - The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available

2 - Project Action Limits reported where no NCGWQS, MCL, or Adjusted Tap Water RSL was available

µg/L - Micrograms per liter

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

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UJ - Analyte not detected, quantitation limit may be inaccurate

TABLE 2-7

Human Health Risk Assessment Summary

Feasibility Study

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Receptor	Media	Pathway	COC	Exposure Point Concentration (µg/L)[a]	Reasonable Maximum Exposure (RME) Non- Cancer Hazard Index (HI)	Central Tendency Exposure (CTE) Non-Cancer Hazard (HI)	RME Cancer Risk	CTE Cancer Risk	Non-Cancer Toxicity Factor - Reference Dose[b] (Ingestion/Dermal/Inhalation) (ingestion and dermal mg/kg-day, inhalation mg/m^3)	Cancer Toxicity Factor – Cancer Slope Factor[b] (Ingestion/Dermal/Inhalation) (ingestion and dermal (mg/kg-day)$^{-1}$, inhalation (µg/m^3)$^{-1}$)
Future Resident Child	Groundwater - Surficial Aquifer	ingestion/dermal contact/inhalation	Tetrachloroethene	190	2	0.16	--	--	$1.0 \times 10^{-02}/1.0 \times 10^{-02}/2.7 \times 10^{-01}$	--
		ingestion/dermal contact/inhalation	Vinyl chloride	10	0.2	0.03	--	--	$3.0 \times 10^{-03}/3.0 \times 10^{-03}/1.0 \times 10^{-01}$	--
	Groundwater - MCH Aquifer	ingestion/dermal contact	Chromium	76	2	0.22	--	--	$3.0 \times 10^{-03}/7.5 \times 10^{-05}$/NA	--
Future Resident Child/Adult	Groundwater - Surficial Aquifer	ingestion/dermal contact/inhalation	Benzene	2.3	--	--	2.8×10^{-06}	1.4×10^{-07}	--	$5.5 \times 10^{-02}/5.5 \times 10^{-02}/7.8 \times 10^{-06}$
		ingestion/dermal contact/inhalation	Tetrachloroethene	190	--	--	2.4×10^{-03}	1.1×10^{-04}	--	$5.4 \times 10^{-01}/5.4 \times 10^{-01}/5.9 \times 10^{-06}$
		ingestion/dermal contact/inhalation	Trichloroethene	45	--	--	7.0×10^{-06}	2.9×10^{-07}	--	$5.9 \times 10^{-03}/5.9 \times 10^{-03}/2.0 \times 10^{-06}$
		ingestion/dermal contact/inhalation	Vinyl chloride	10	--	--	1.1×10^{-04}	7.9×10^{-06}	--	$7.2 \times 10^{-01}/7.2 \times 10^{-01}/4.4 \times 10^{-06}$
	Groundwater - MCH Aquifer	ingestion/dermal contact/inhalation	Chloroform	0.38	--	--	1.0×10^{-05}	1.3×10^{-08}	--	$3.1 \times 10^{-02}/3.1 \times 10^{-02}/2.3 \times 10^{-05}$
		ingestion/dermal contact	Benzo(a)pyrene	0.2	--	--	1.5×10^{-03}	1.6×10^{-06}	--	$7.3 \times 10^{-00}/7.3 \times 10^{-00}$/NA
		ingestion/dermal contact	Benzo(b)fluoranthene	0.38	--	--	2.9×10^{-04}	3.0×10^{-07}	--	$7.3 \times 10^{-01}/7.3 \times 10^{-01}$/NA
		ingestion/dermal contact	Benzo(k)fluoranthene	0.31	--	--	2.2×10^{-05}	2.4×10^{-08}	--	$7.3 \times 10^{-02}/7.3 \times 10^{-02}$/NA
		ingestion/dermal contact	Dibenz(a,h)anthracene	0.55	--	--	2.5×10^{-04}	4.4×10^{-06}	--	$7.3 \times 10^{-00}/7.3 \times 10^{-00}$/NA
		ingestion/dermal contact	Indeno(1,2,3-cd)pyrene	0.45	--	--	1.6×10^{-05}	3.6×10^{-07}	--	$7.3 \times 10^{-01}/7.3 \times 10^{-01}$/NA
		ingestion/dermal contact	Chromium	76	--	--	1.7×10^{-03}	4.2×10^{-05}	--	$5.0 \times 10^{-01}/1.3 \times 10^{-02}$/NA
	Groundwater - UCH Aquifer	ingestion/dermal contact/inhalation	Benzene	1.8	--	--	2.3×10^{-05}	1.1×10^{-07}	--	$5.5 \times 10^{-02}/5.5 \times 10^{-02}/7.8 \times 10^{-06}$
		ingestion/dermal contact/inhalation	Trichloroethene	157	--	--	3.8×10^{-04}	1.0×10^{-06}	--	$5.9 \times 10^{-03}/5.9 \times 10^{-03}/2.0 \times 10^{-06}$
		ingestion/dermal contact/inhalation	Vinyl chloride	23	--	--	4.6×10^{-04}	1.8×10^{-05}	--	$7.2 \times 10^{-01}/7.2 \times 10^{-01}/4.4 \times 10^{-06}$
Future Industrial Worker	Groundwater - Surficial Aquifer[c]	ingestion	Tetrachloroethene	190	--	--	3.6×10^{-04}	1.1×10^{-04}	--	5.4×10^{-01}/NA/NA
		ingestion	Vinyl chloride	10	--	--	2.5×10^{-05}	7.9×10^{-06}	--	7.2×10^{-01}/NA/NA
		ingestion	Benzo(a)pyrene	0.2	--	--	5.1×10^{-06}	NA	--	7.3×10^{-00}/NA/NA
		ingestion	Dibenz(a,h)anthracene	0.55	--	--	1.4×10^{-05}	NA	--	7.3×10^{-00}/NA/NA
		ingestion	Chromium	76	--	--	1.3×10^{-03}	NA	--	5.0×10^{-01}/NA/NA

a Exposure Point Concentration = 95% upper confidence level (UCL).

b Sources: Integrated Risk Information System, Health Effects Assessment Summary Tables, Agency for Toxic Substances and Disease Registry Toxicity Profiles, California EPA, and National Center for Environmental Assessment, current at time HHRA conducted

c Although cumulative HI exceeds 1, no target organ HIs exceed 1, so no unacceptable non-carcinogenic hazard.

d Although HHRA indicated unacceptable risk, risk determined acceptable based on Tech Memo (Appendix C)

ug/L - micrograms per liter

mg/m^3- milligrams per cubit meters

mg/m^3- micrograms per cubit meters

COC – chemical of concern

HI - hazard index

NA - not applicable or not available

RME- reasonable maximum exposure

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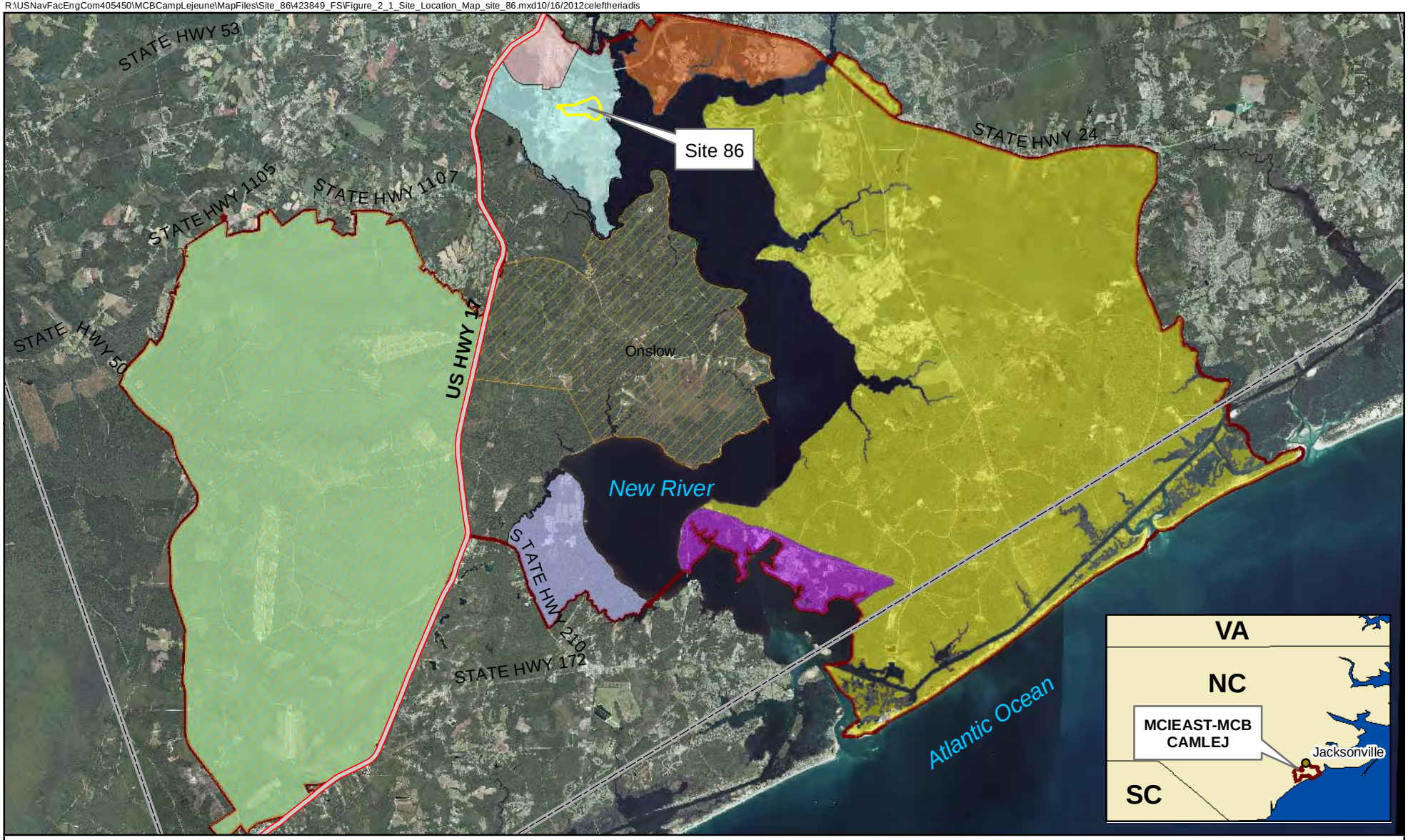


Legend

- Highways
- Onslow County
- Site 86
- Greater Sandy Run Training Area
- Installation Boundary
- Camp Geiger
- Greater Sandy Run
- Marine Corps Air Station New River
- Stone Bay
- Montford Point/Tarawa Terrace
- Courthouse Bay
- Main Side

N

0 7,500 15,000 30,000 Feet

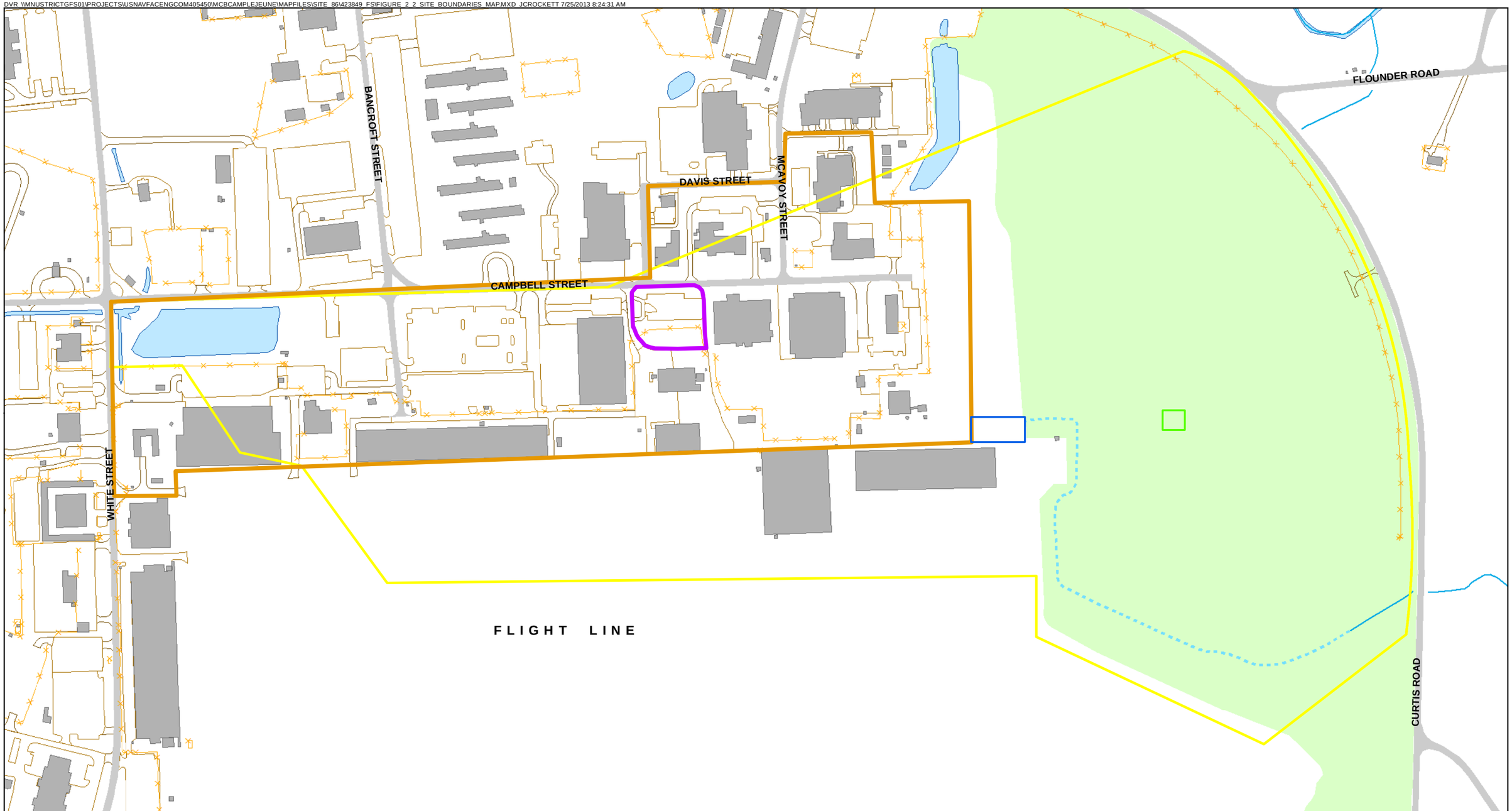
1 inch = 15,000 feet

Figure 2-1
Site Location Map
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

CH2MHILL

Generated By: K. Howell/CLT Checked by: T. Grim/CLT

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\MCBCAMPLEJEUNE\MAPFILES\SITE_86\423849_FS\FIGURE_2_2_SITE_BOUNDARIES_MAP.MXD JCROCKETT 7/25/2013 8:24:31 AM



Legend

- Fence Line
- Drainage Ditch
- Surface Water Centerline
- Surface Water Body Area
- Buildings
- Road
- Vehicle Driveway Area
- Vehicle Parking Area
- Original Site 86 Boundary
- August 2006 Site 86 Boundary
- Northeast Grass Area
- Zone 1 Pilot Study Area
- Zone 2 Pilot Study Area
- Current Site 86 Boundary

N

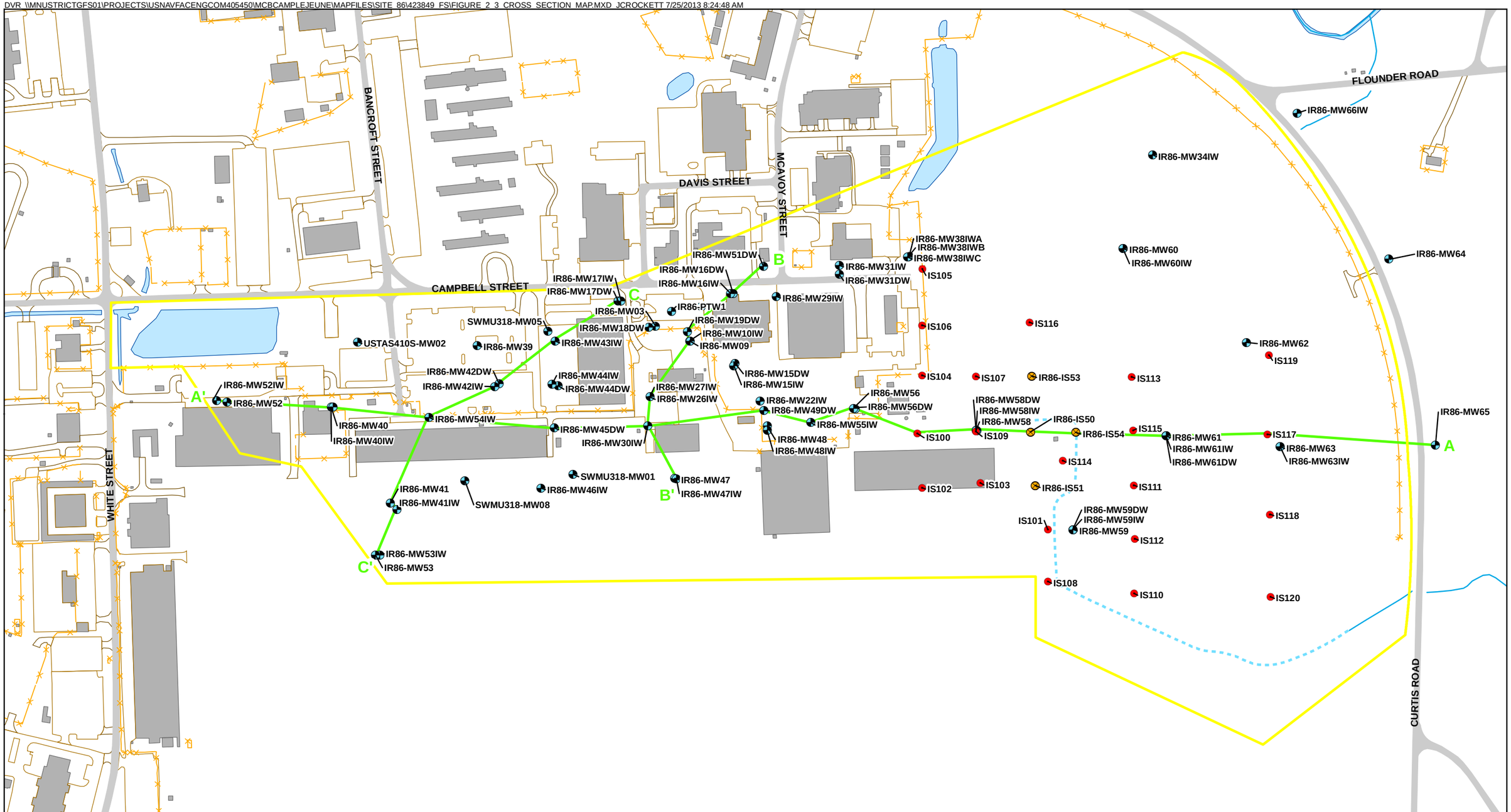
0 175 350 700 Feet

1 inch = 350 feet

Figure 2-2
Site Boundaries Map
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\MCBCAMPLEJEUNE\MAPFILES\SITE_86\423849_FS\FIGURE_2_3_CROSS_SECTION_MAP.MXD JCROCKETT 7/25/2013 8:24:48 AM



Legend

- Direct Push Sampling Locations (2008)
- Direct Push Sampling Locations (2009)
- Monitoring Well Locations
- Cross Section Location
- Fence Line
- Drainage Ditch
- Surface Water Centerline
- Surface Water Course Area
- Buildings
- Road
- Vehicle Parking Area
- Vehicle Driveway Area
- Current Site 86 Boundary

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 2-3
Geologic Cross Section Location Map
Feasibiltiy Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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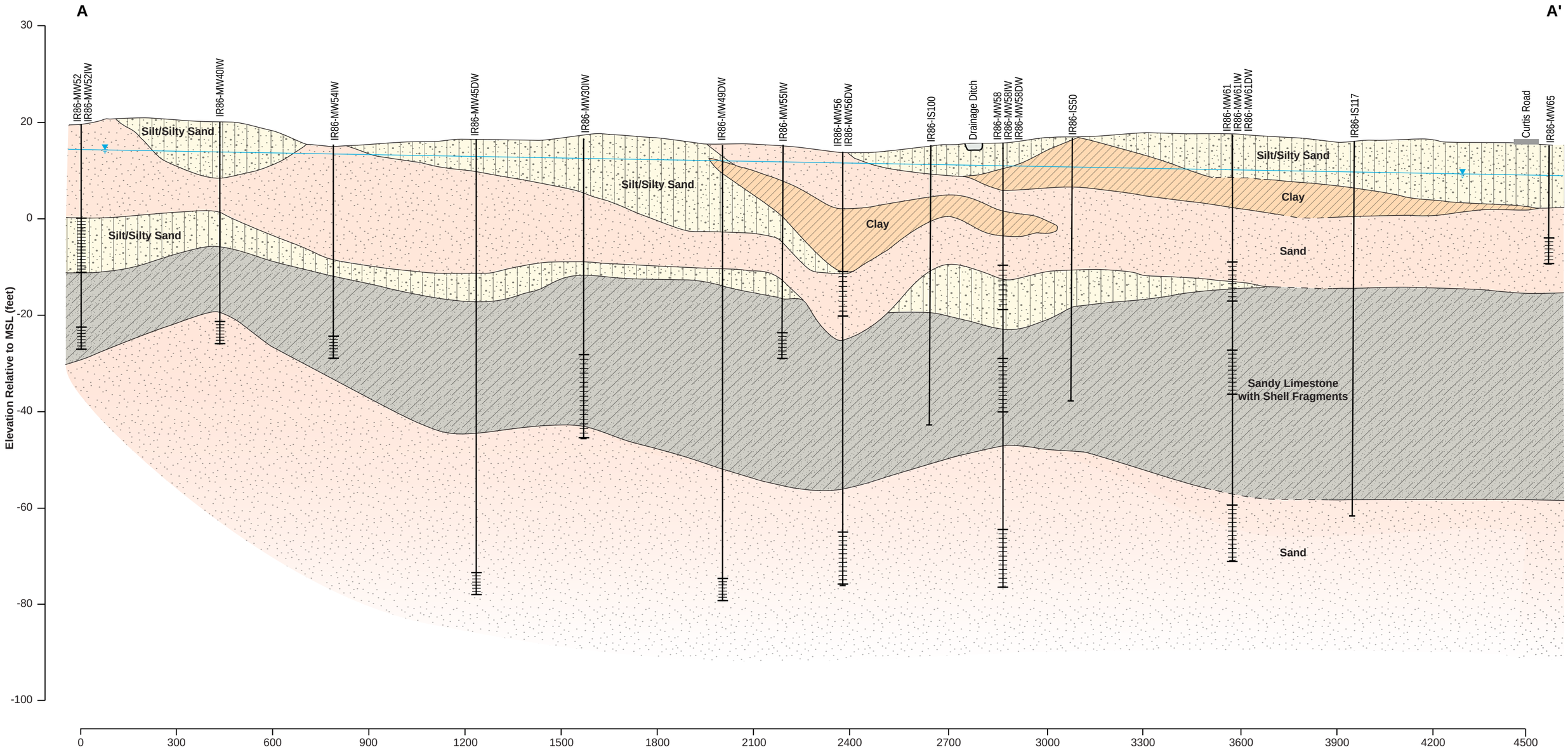
ES051410163354MKE



LEGEND

- Silt/Silty Sand
- Clay
- Sand
- Partially to completely cemented sandy limestone with shell fragments
- Screened interval
- Soil boring
- Water table

Horizontal : 1" = 300'
Vertical: 1" = 20'
V.E. = 15x

Notes

1) The depth and thickness of the subsurface strata indicated on this section (profile) were generalized from and interpolated between test locations. Subsurface conditions occurring at the other locations may differ from conditions occurring at indicated locations.

Figure 2-4
Geologic Cross Section A-A'
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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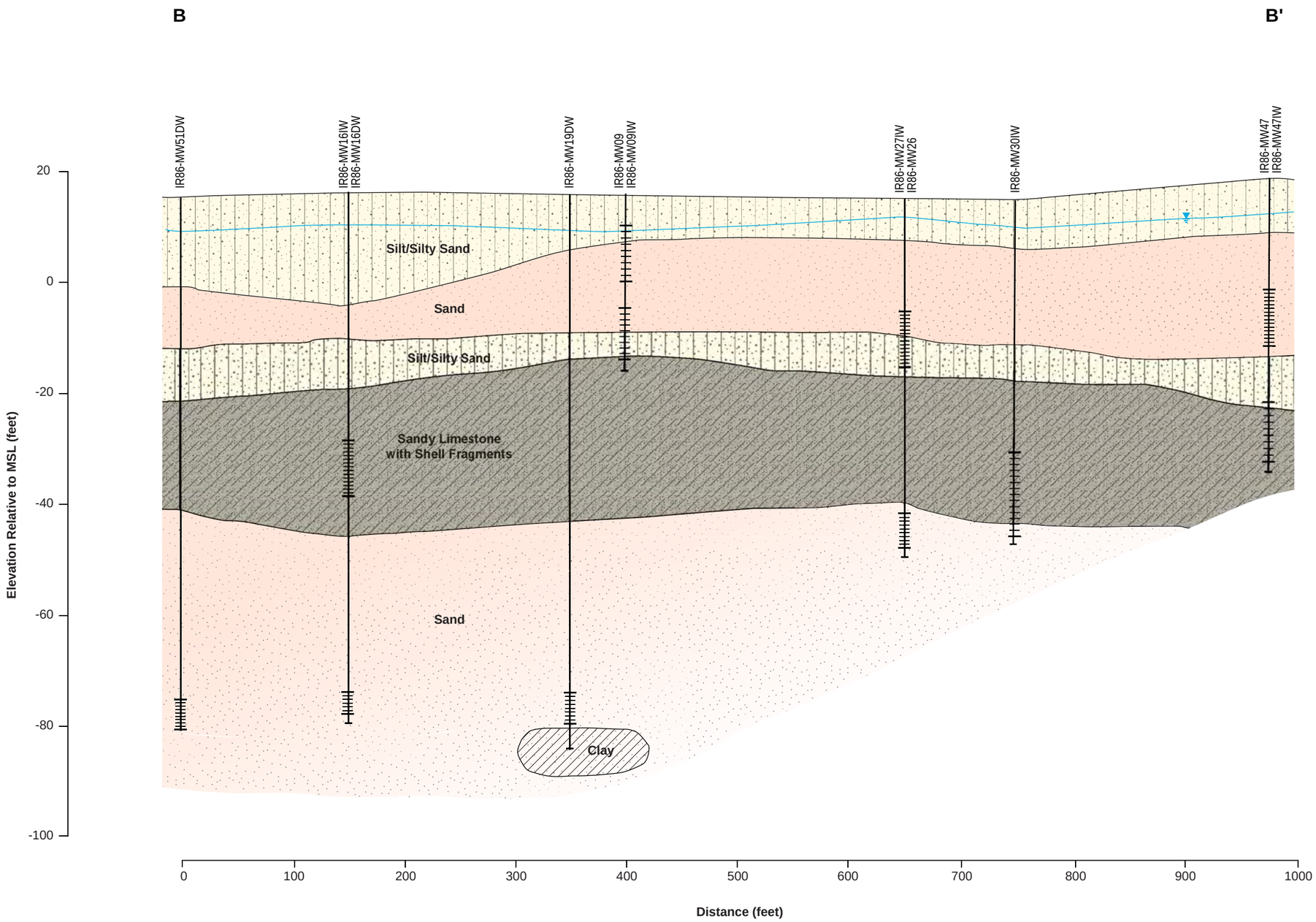

LEGEND

- Silty/Sandy Clay
- Clay
- Sand
- Partially to completely cemented sandy limestone with shell fragments
- Silty Sand
- Screened Interval
- Soil Boring
- Water Table

Horizontal : 1" = 100'
Vertical: 1" = 20'
V.E. = 15x

Note

The depth and thickness of the subsurface strata indicated on this section (profile) were generalized from and interpolated between test locations. Subsurface conditions occurring at the other locations may differ from conditions occurring at indicated locations.

Figure 2-5
Geologic Cross Section B-B'
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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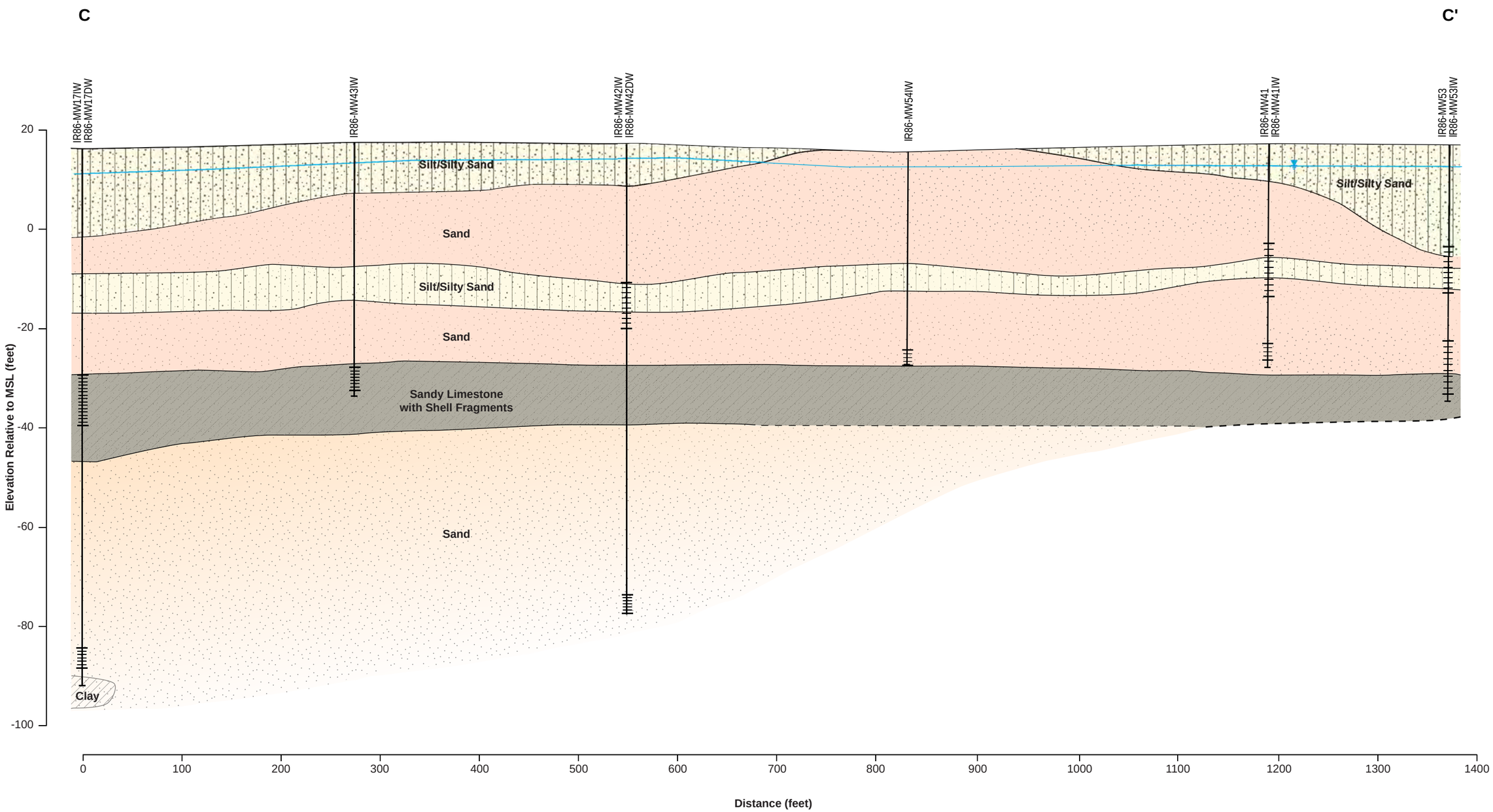

LEGEND

- Silt/Silty Sand
- Clay
- Sand
- Partially to completely cemented sandy limestone with shell fragments
- Screened Interval
- Soil Boring
- Water Table

Horizontal : 1" = 100'
Vertical: 1" = 20'
V.E. = 15x

Note

The depth and thickness of the subsurface strata indicated on this section (profile) were generalized from and interpolated between test locations. Subsurface conditions occurring at the other locations may differ from conditions occurring at indicated locations.

Figure 2-6
Geologic Cross Section C-C'
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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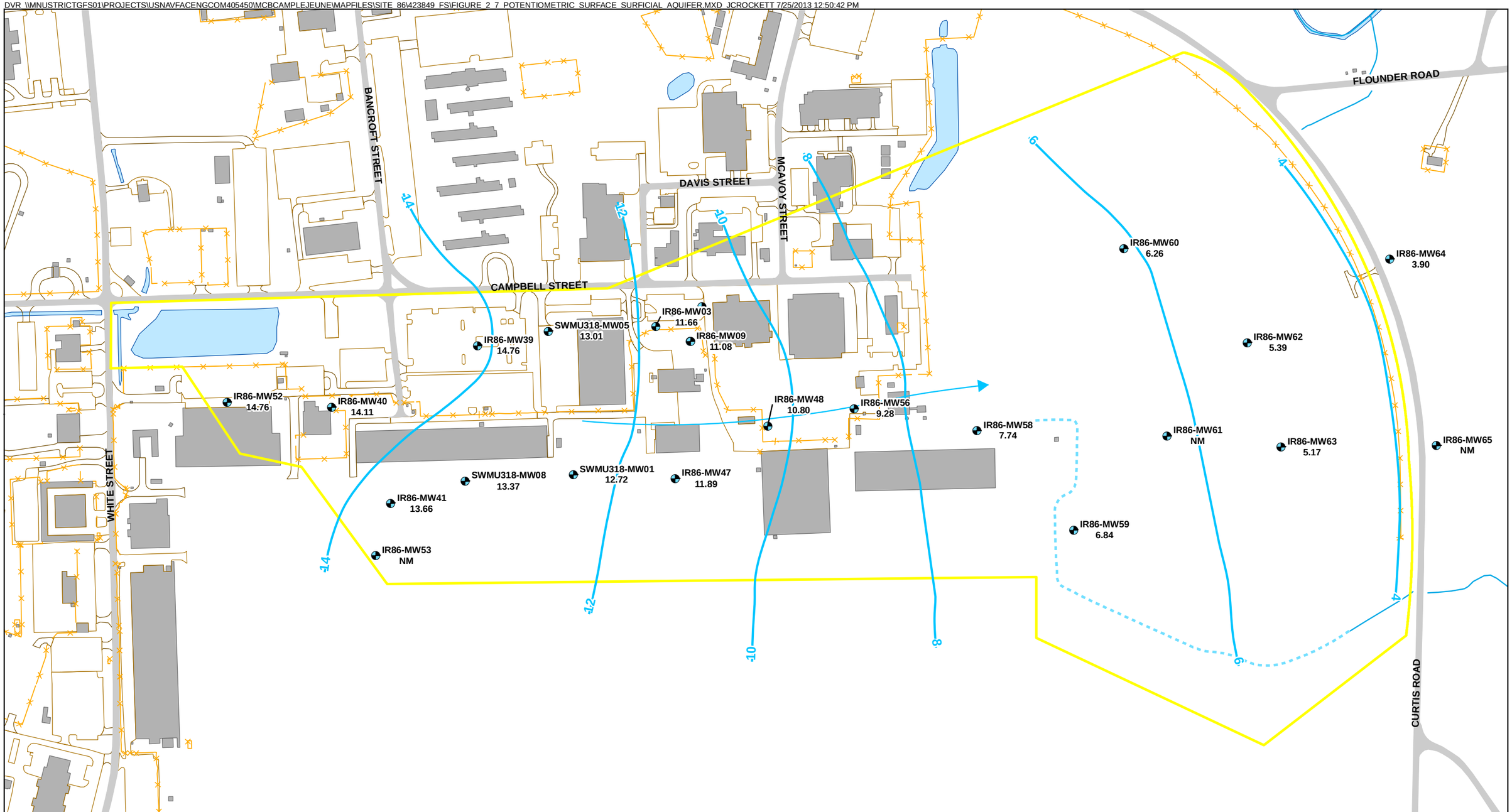
DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\MCBCAMPLEJEUNE\MAPFILES\SITE_86\423849_FS\FIGURE_2_7_POTENTIOMETRIC_SURFACE_SURFICIAL_AQUIFER.MXD JCROCKETT 7/25/2013 12:50:42 PM



Legend

- Monitoring Well
- Potentiometric Contours
- Groundwater Flow Direction
- Drainage Ditch
- Fence Line
- Surface Water Centerline
- Surface Water Body Area
- Road
- Buildings
- Vehicle Parking Area
- Vehicle Driveway Area
- Current Site 86 Boundary

Notes:
- Water level elevations are reported in feet above mean sea level
- Water levels were measured on March 13/14, 2010
- NM - Not Measured
6.84 - Water Level Elevations

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 2-7
Potentiometric Surface - Surficial Aquifer
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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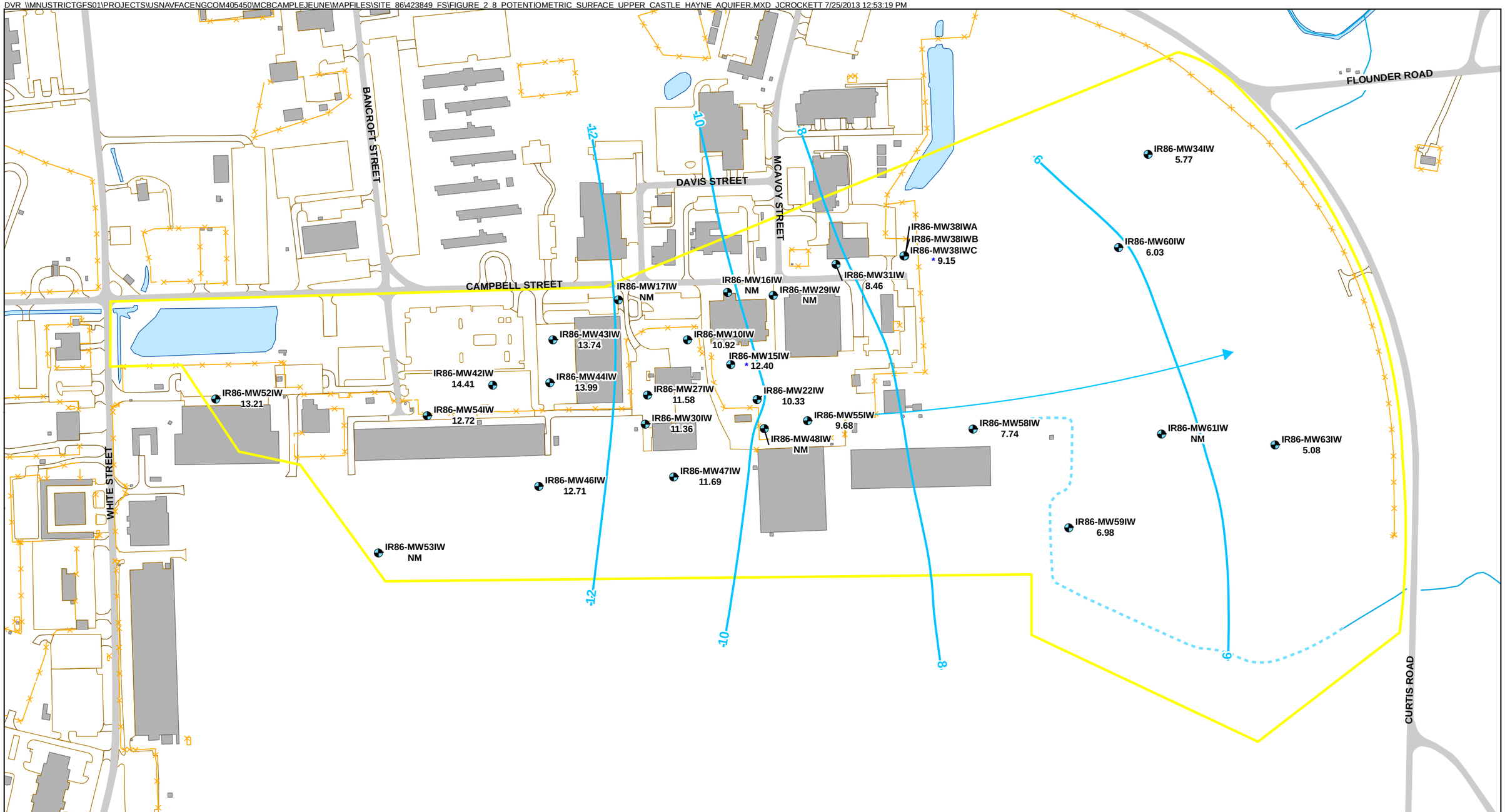
DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\MCBCAMPLEJEUNE\MAPFILES\SITE_86\423849_FS\FIGURE_2_8_POTENTIOMETRIC_SURFACE_UPPER_CASTLE_HAYNE_AQUIFER.MXD JCROCKETT 7/25/2013 12:53:19 PM



Legend

- Monitoring Well
- Potentiometric Contours
- Groundwater Flow Direction
- Drainage Ditch
- Fence Line
- Surface Water Centerline
- Surface Water Body Area
- Road
- Buildings
- Vehicle Parking Area
- Vehicle Driveway Area
- Current Site 86 Boundary

Notes:
- Water level elevations are reported in feet above mean sea level
- Water levels were measured on March 13/14, 2010
- NM - Not Measured
6.98 - Water Level Elevations
* - Not used to develop potentiometric contorus

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 2-8
Potentiometric Surface - Upper Castle Hayne Aquifer
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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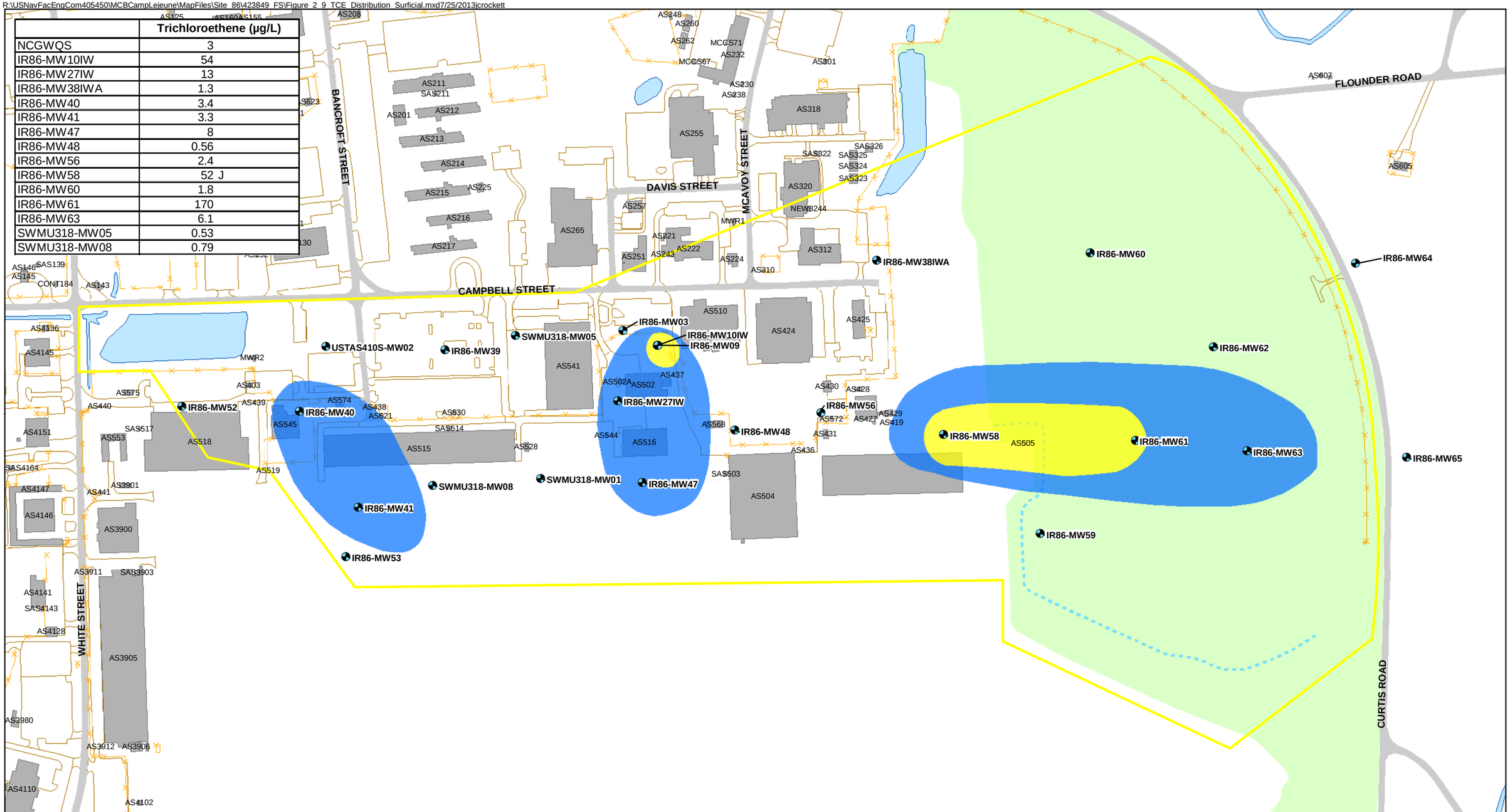
R:\USNavFacEngCom405450\MCBCampLejeune\MapFiles\Site_86\423849_FS\Figure_2_9_TCE_Distribution_Surficial.mxd7/25/2013jcrockett

	Trichloroethene (µg/L)
NCGWQS	3
IR86-MW10IW	54
IR86-MW27IW	13
IR86-MW38IWA	1.3
IR86-MW40	3.4
IR86-MW41	3.3
IR86-MW47	8
IR86-MW48	0.56
IR86-MW56	2.4
IR86-MW58	52 J
IR86-MW60	1.8
IR86-MW61	170
IR86-MW63	6.1
SWMU318-MW05	0.53
SWMU318-MW08	0.79



Legend

- Surficial Aquifer Monitoring Well

TCE Concentrations

- > 30 µg/L
- > 3.0 µg/L
- Fence Line
- Drainage Ditch
- Surface Water Course Area
- Road
- Buildings
- Vehicle Parking Area
- Northeast Grass Area
- Current Site 86 Boundary

Notes:
- All concentrations are reported in µg/L.
- Contours have been interpolated between monitoring well locations. Actual conditions may differ from those shown.
- Samples collected in December 2009, January 2010, March 2010, and May 2012.
- NCGWQS for TCE = 3.0 µg/L.
- Only detected concentrations of TCE shown in table.
- **Bold** indicates value above NCGWQS.

J- Analyte present, value may or may not be accurate or precise.

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 2-9
TCE Distribution in the Surficial Aquifer
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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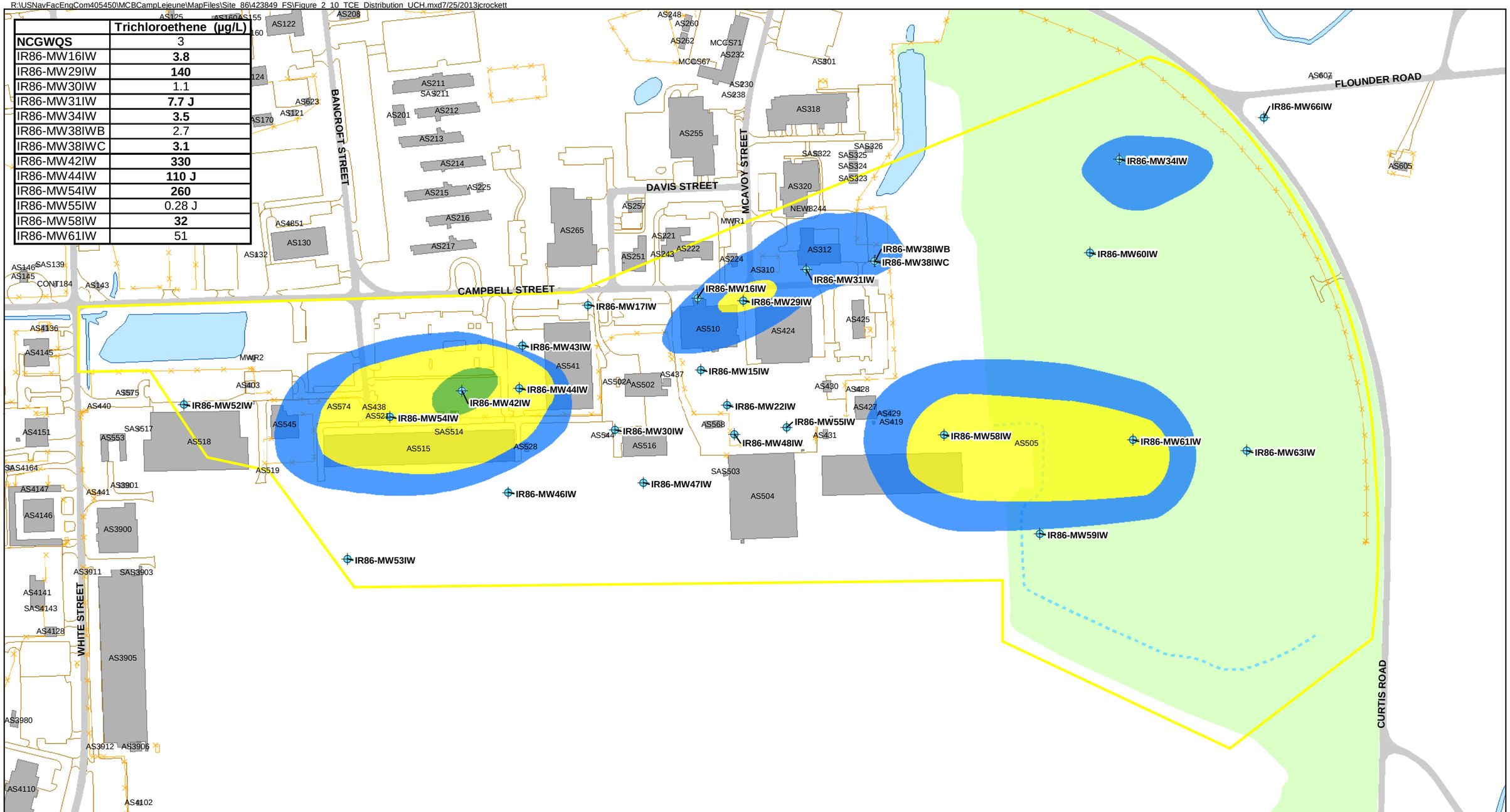
	Trichloroethene (µg/L)
NCGWQS	3
IR86-MW16IW	**3.8**
IR86-MW29IW	**140**
IR86-MW30IW	1.1
IR86-MW31IW	**7.7 J**
IR86-MW34IW	**3.5**
IR86-MW38IWB	2.7
IR86-MW38IWC	**3.1**
IR86-MW42IW	**330**
IR86-MW44IW	**110 J**
IR86-MW54IW	**260**
IR86-MW55IW	0.28 J
IR86-MW58IW	**32**
IR86-MW61IW	51



Legend

- Upper Castle Hayne Aquifer Monitoring Well

TCE Concentrations

- > 300 µg/L
- > 30 µg/L
- > 3.0 µg/L
- Fence Line
- Drainage Ditch
- Surface Water Course Area
- Road
- Buildings
- Vehicle Parking Area
- Northeast Grass Area
- Current Site 86 Boundary

Notes:
- All concentrations are reported in µg/L.
- Contours have been interpolated between monitoring well locations. Actual conditions may differ from those shown.
- Samples collected in December 2009, March 2010, June 2010, and May 2012.
- NCGWQS for TCE = 3.0 µg/L.
- Only detected concentrations of TCE shown in table.
- **Bold** indicates value above NCGWQS.
- J- Analyte present, value may or may not be accurate or precise.

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 2-10
TCE Distribution in the Upper Castle Hayne Aquifer
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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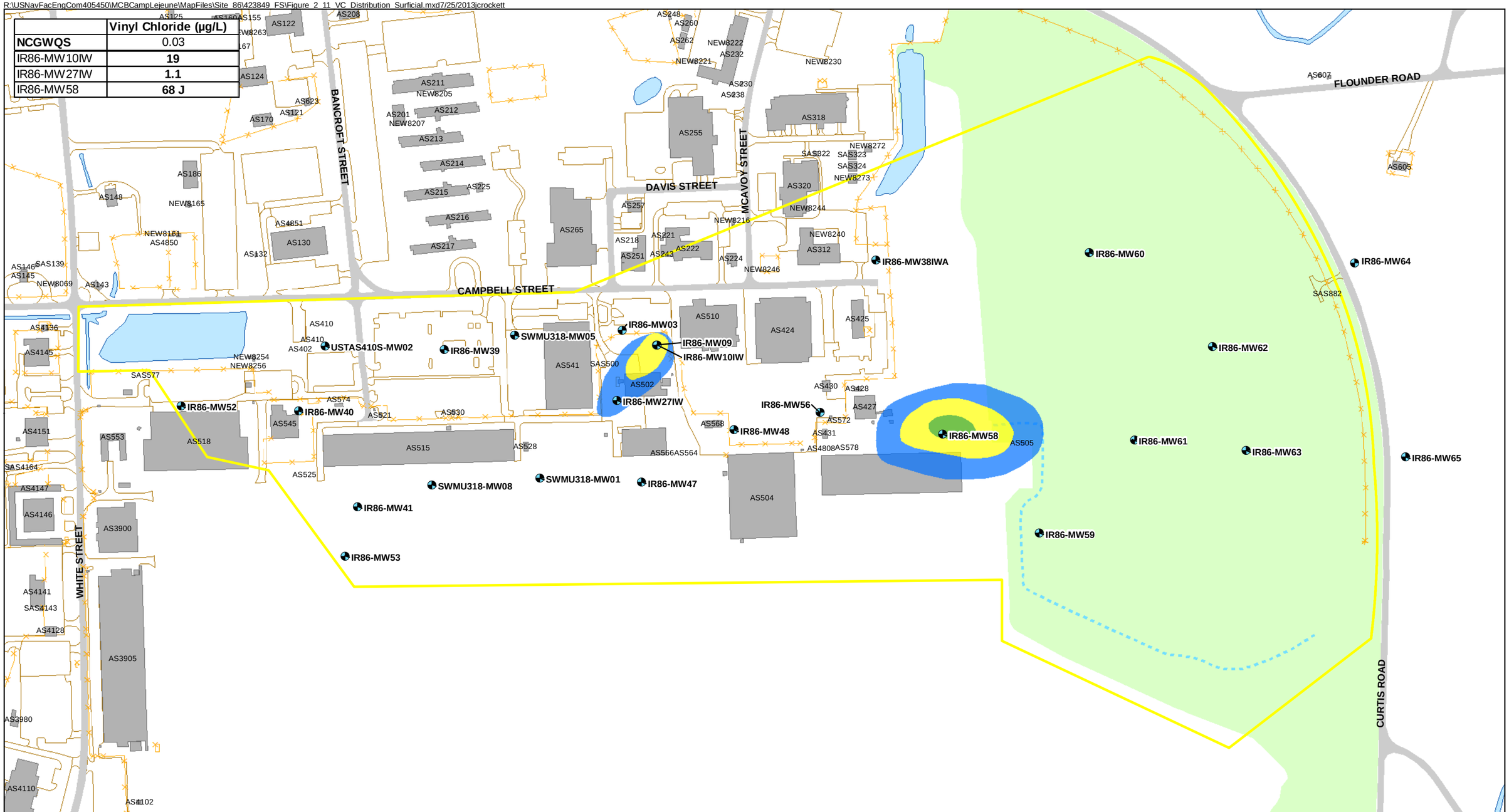

	Vinyl Chloride (µg/L)
NCGWQS	0.03
IR86-MW10IW	**19**
IR86-MW27IW	**1.1**
IR86-MW58	**68 J**

Legend

- Surficial Aquifer Monitoring Well

VC Concentrations

- > 50 µg/L
- > 5.0 µg/L
- > 0.5 µg/L
- Fence Line
- Drainage Ditch
- Surface Water Course Area
- Road
- Buildings
- Vehicle Parking Area
- Northeast Grass Area
- Current Site 86 Boundary

Notes:
- All concentrations are reported in µg/L.
- Contours have been interpolated between monitoring well locations. Actual conditions may differ from those shown.
- Samples collected in December 2009, January 2010, and March 2010.
- NCGWQS for VC = 0.03 µg/L.
- Only detected concentrations of VC shown in table.
- **Bold** indicates value above NCGWQS.
- J- Analyte present, value may or may not be accurate or precise.

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 2-11
VC Distribution in the Surficial Aquifer
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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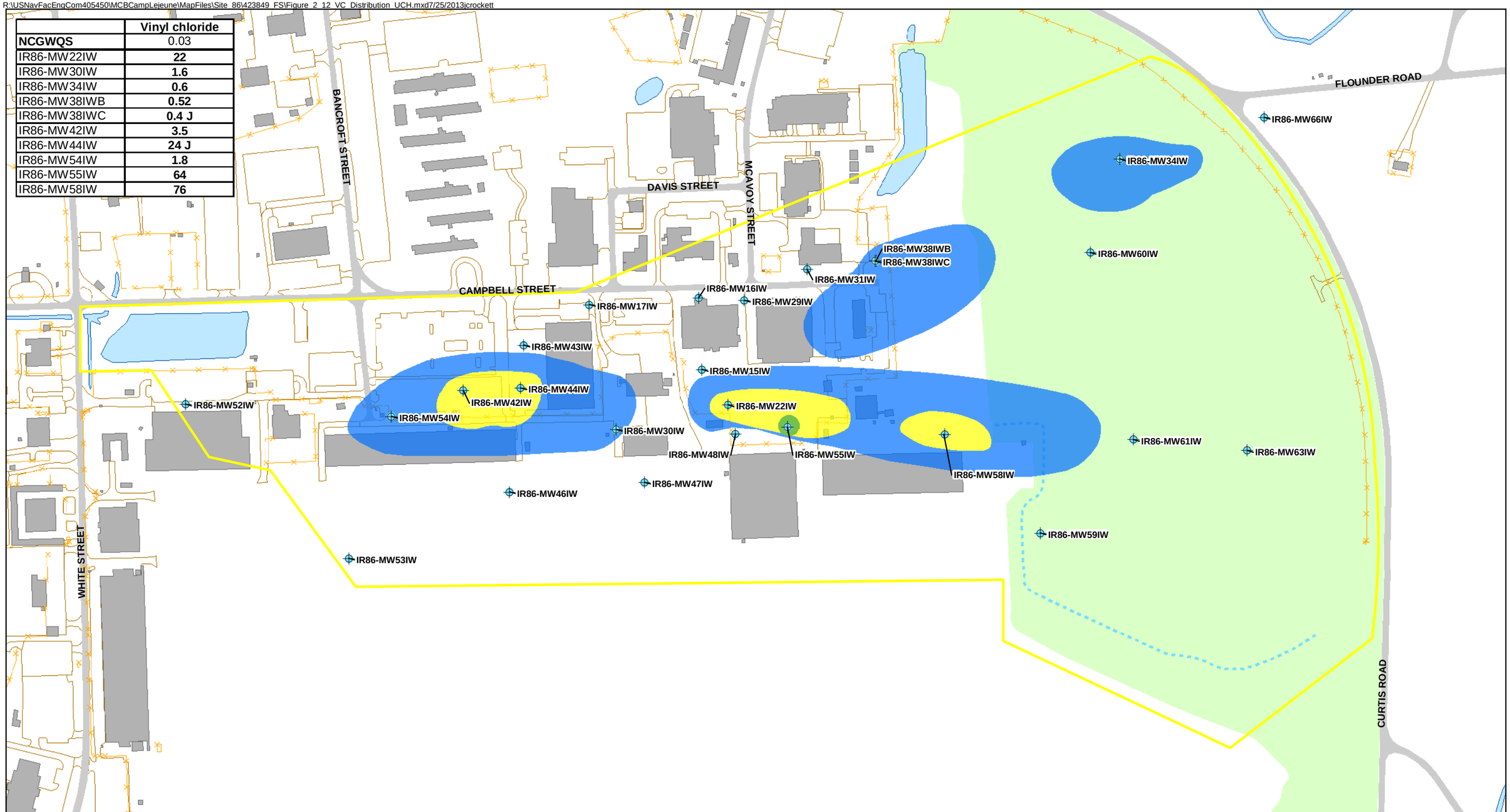
	Vinyl chloride
NCGWQS	0.03
IR86-MW22IW	**22**
IR86-MW30IW	**1.6**
IR86-MW34IW	**0.6**
IR86-MW38IWB	**0.52**
IR86-MW38IWC	**0.4 J**
IR86-MW42IW	**3.5**
IR86-MW44IW	**24 J**
IR86-MW54IW	**1.8**
IR86-MW55IW	**64**
IR86-MW58IW	**76**



Legend

- Upper Castle Hayne Aquifer Monitoring Well

VC Concentrations

- > 50 µg/L
- > 5.0 µg/L
- > 0.5 µg/L
- Fence Line
- Drainage Ditch
- Surface Water Course Area
- Road
- Buildings
- Vehicle Parking Area
- Northeast Grass Area
- Current Site 86 Boundary

Notes:
- All concentrations are reported in µg/L.
- Contours have been interpolated between monitoring well locations. Actual conditions may differ from those shown.
- Samples collected in December 2009, January 2010, March 2010, January 2012, and May 2012.
- NCGWQS for VC = 0.03 µg/L.
- Only detected concentrations of VC shown in table.
- **Bold** indicates value above NCGWQS.
- J- Analyte present, value may or may not be accurate or precise.

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 2-12
VC Distribution in the Upper Castle Hayne Aquifer
Feasibility Study
Operable Unit 20 (Site 86)
NCIEAST-MCB CAMLEJ
North Carolina

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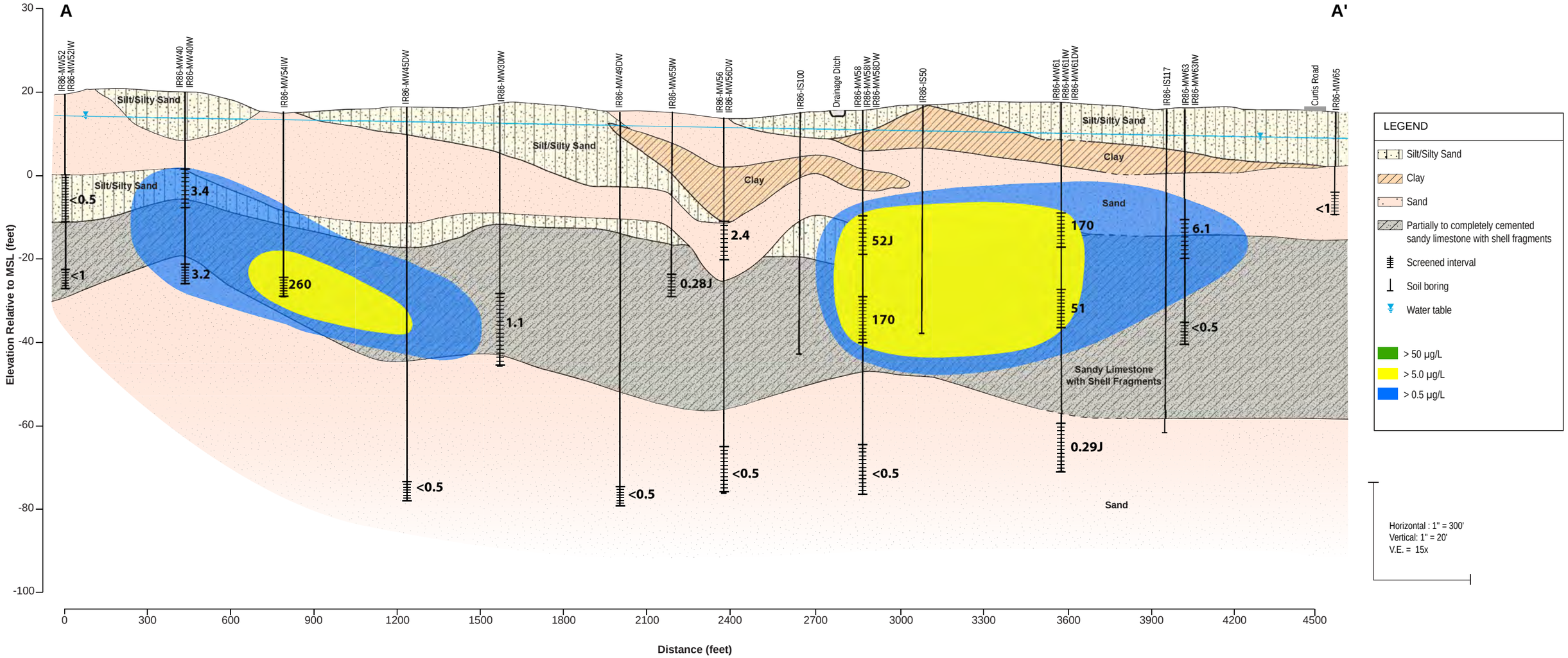


Notes

1) The depth and thickness of the subsurface strata indicated on this section (profile) were generalized from and interpolated between test locations. Subsurface conditions occurring at the other locations may differ from conditions occurring at indicated locations.

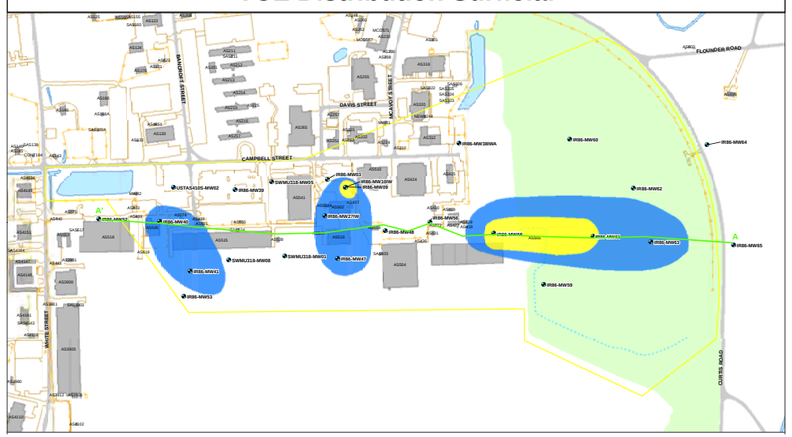
2) Analytical results from December 2009 and January 2010 through May 2012.

3) All values in µg/L

4) J - Reported value is estimated

5) TCE - Trichloroethene

TCE Distribution Surficial



TCE Distribution Upper Castle Hayne

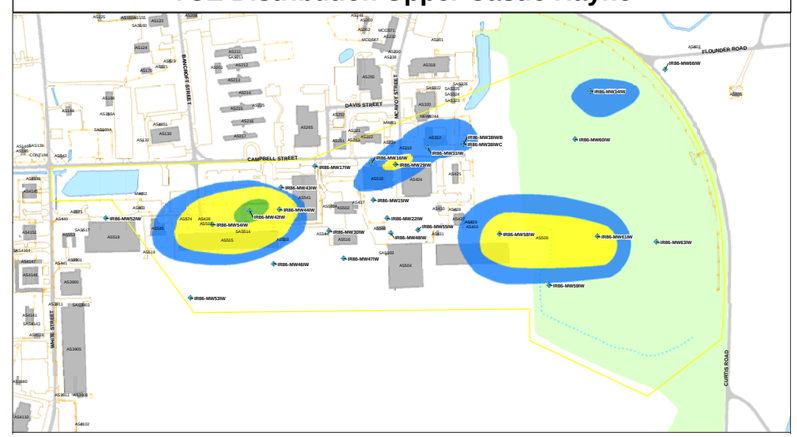


Figure 2-13
Geologic Cross Section A-A'
Trichloroethene Concentrations
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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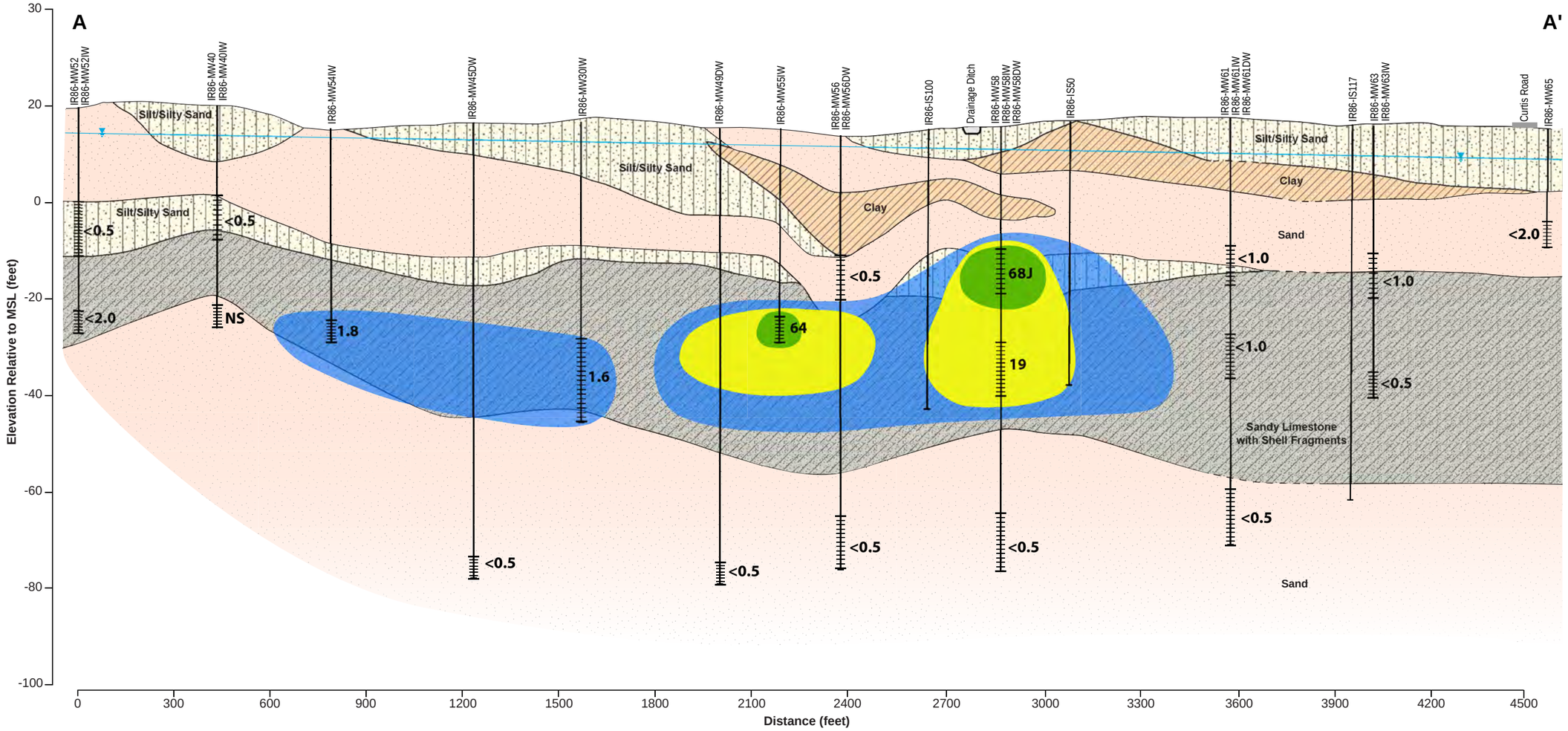
ES051410163354MKE_Figure_2-13_CamLej_Site86_A-A_TCE_alt3.ai_ez_10.19.12



Notes

1) The depth and thickness of the subsurface strata indicated on this section (profile) were generalized from and interpolated between test locations. Subsurface conditions occurring at the other locations may differ from conditions occurring at indicated locations.

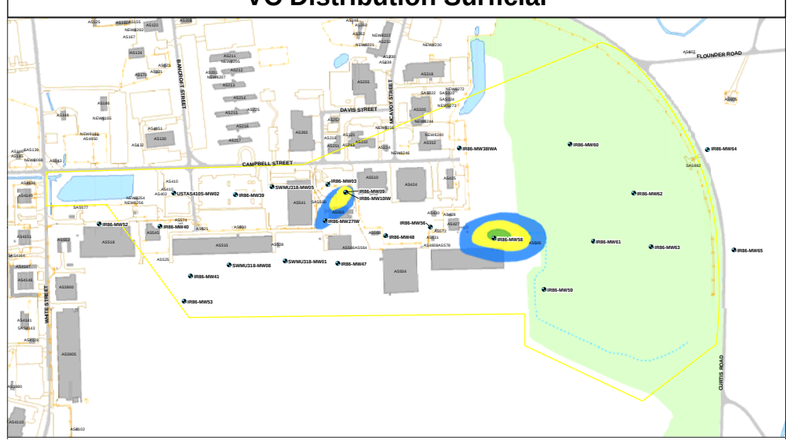
2) Analytical results from December 2009 and January 2010 through May 2012.

3) All values in µg/L

4) J - Reported value is estimated

5) NS = Not sampled

VC Distribution Surficial



VC Distribution Upper Castle Hayne

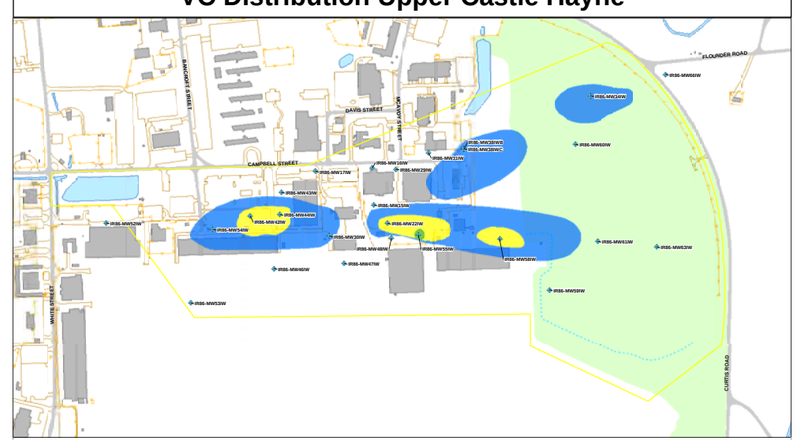


Figure 2-14
Geologic Cross Section A-A'
Vinyl Chloride Concentrations
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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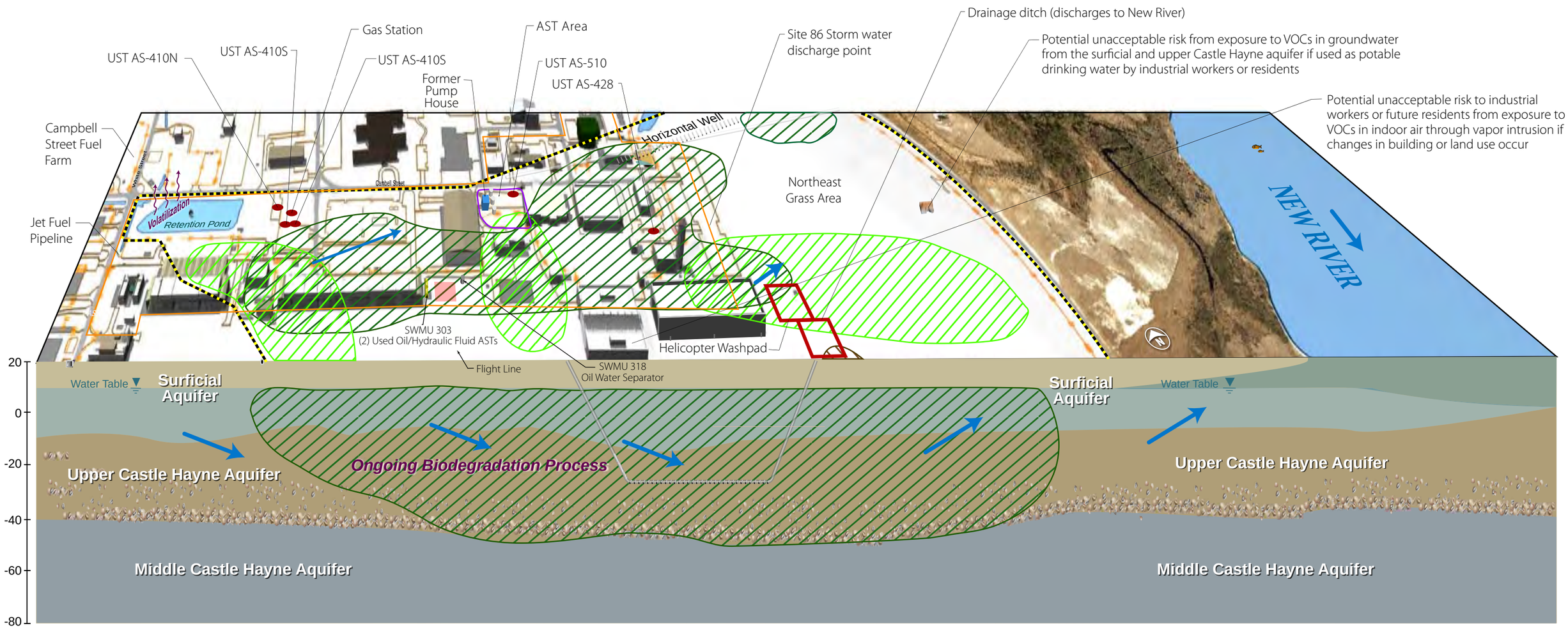

Legend

- Groundwater Flow Direction
- Horizontal Well
- Drainage Area
- Underground Storage Tank
- Expanded Site 86 Boundary
- Fence Line
- Drainage Ditch
- Surface Water Centerline

Utilities

- Stormwater Drain
- Water Line
- Wastewater Line
- Industrial Waste Collection and Treatment Facilities
- Historic Wastewater (replaced in 1998)

- Vehicle Driveway Area
- Extent of VOC Impacted Surficial Groundwater
- Extent of VOC Impacted Upper Castle Hayne Groundwater
- Surface Water Course Area
- Buildings
- Vehicle Parking Area

Note: Not to scale.

FIGURE 2-15
Conceptual Site Model
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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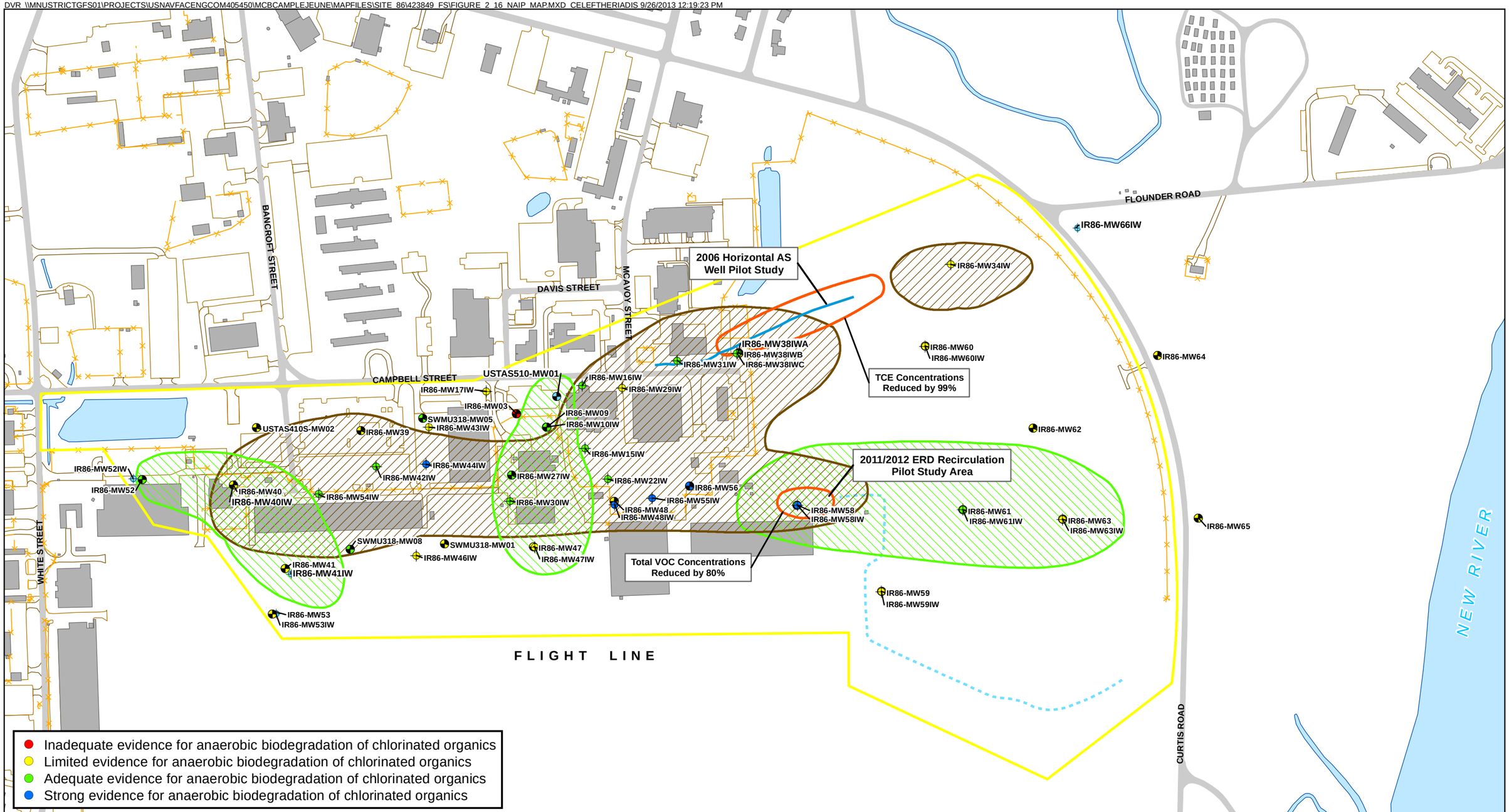

Legend

- Upper Castle Hayne Aquifer Monitoring Well
- Surficial Aquifer Monitoring Well
- Horizontal AS Well Pilot Study
- Fence Line
- Drainage Ditch
- Pilot Studies
- Surface Water Course Area
- Road
- Buildings
- Vehicle Parking Area
- Vehicle Driveway Area
- Extent of COC Impacted Surficial Groundwater
- Extent of COC Impacted Upper Castle Hayne Groundwater
- Current Site 86 Boundary

COC Plume:
PCE > 0.7 µg/L
TCE > 3 µg/L
cis-1,2 DCE > 70 µg/L
VC > 0.03 µg/L
Benzene > 1 µg/L

N

0 200 400 800 Feet

1 inch = 400 feet

Figure 2-16
Natural Attenuation Indicator Parameter Conditions
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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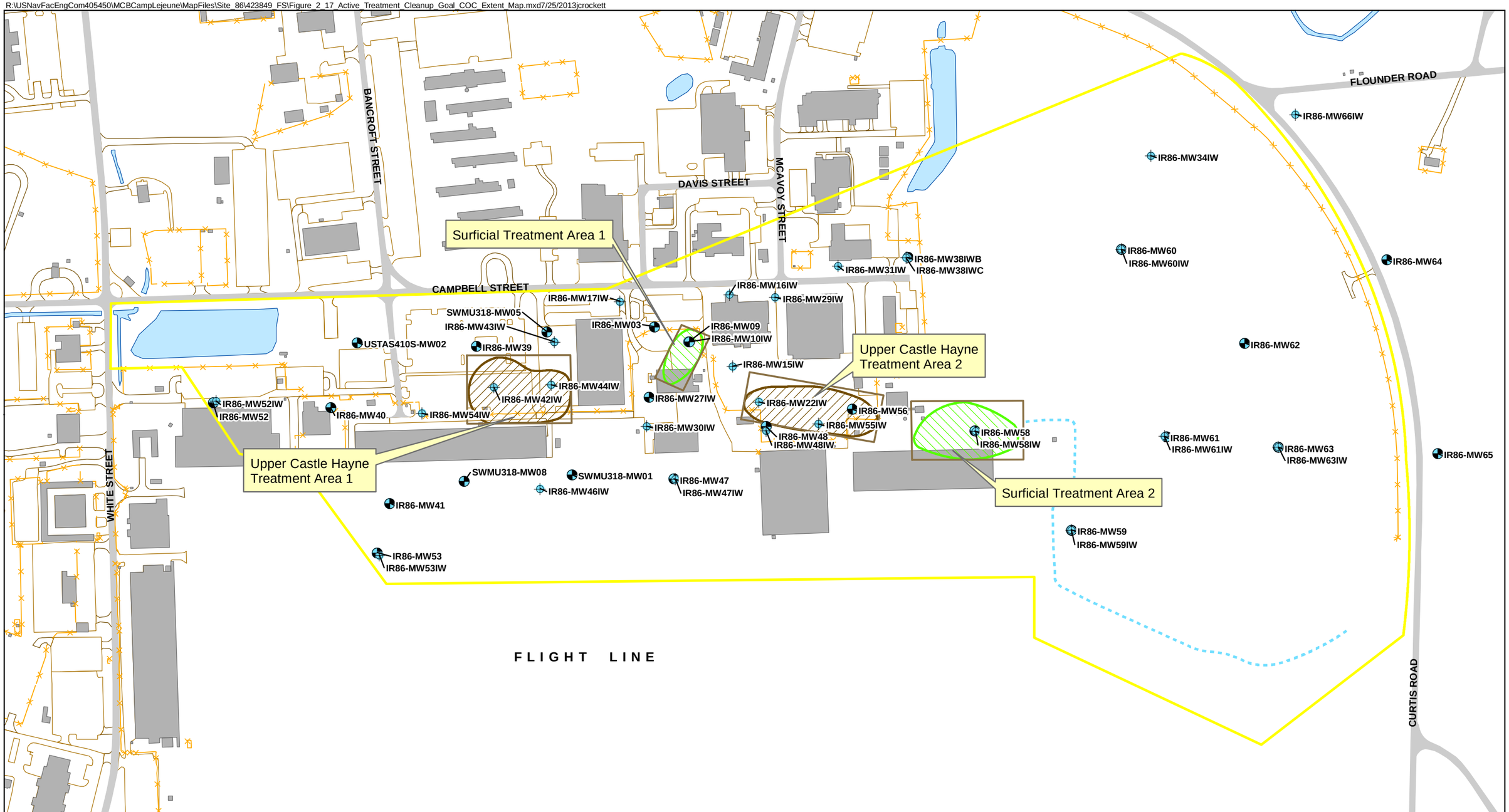

Legend

- Upper Castle Hayne Aquifer Monitoring Well
- Surficial Aquifer Monitoring Well
- Drainage Ditch
- Fence Line
- Surface Water Course Area
- Buildings
- Road
- Vehicle Parking Area
- Vehicle Driveway Area
- Treatment Areas
- Extent of Treatment Goals Surficial Groundwater
- Extent of Treatment Goals Impacted Upper Castle Hayne Groundwater
- Current Site 86 Boundary

Treatment Goals:
PCE > 70 µg/L
TCE > 300 µg/L
cis-1,2 DCE > 70000 µg/L
VC > 3 µg/L
Benzene > 1000 µg/L

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 2-17
Active Treatment Cleanup Goal COC Extent Map
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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SECTION 3

Identification and Screening of Technologies

This section describes the initial steps to develop alternatives for the remediation of soil and groundwater at Site 86, including the presentation of ARARs, the development of RAOs, the identification of the remediation target areas, the identification of general response actions (GRAs), and the initial identification and screening of potential technologies.

3.1 Applicable or Relevant and Appropriate Requirements

Certain regulatory requirements and standards are referred to as ARARs. There are three types of ARARs: chemical-specific, action-specific, and location-specific. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(d) specifies, in part, that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are applicable or relevant and appropriate (thus, ARARs) to the hazardous substances or particular circumstances at a site or a waiver must be obtained; see also 40 Code of Federal Regulations (CFR) 300.430(f)(1)(ii)(B). ARARs include only federal and state environmental or facility siting laws and regulations and do not include occupational safety or worker protection requirements. In addition, in accordance with 40 CFR 300.405(g)(3), other advisories, criteria, or guidance may be considered in determining remedies (commonly referred to as the To-Be-Considered guidance category). Under CERCLA 121(e)(1), permits are not required for response actions conducted entirely onsite. In addition, response actions must comply with the ”substantive,“ as opposed to ”administrative,” requirements of any of the identified ARARs.

3.1.1 Chemical-specific ARARs

Chemical-specific ARARs provide health- or risk-based concentration limits or discharge limitations in various environmental media (such as surface water, groundwater, soil, and air) for specific hazardous substances, pollutants, or contaminants, and are listed in **Table 3-1**. Remediation levels for most of the COCs in groundwater are based upon relevant and appropriate drinking water standards, including NCGWQS or federal maximum contaminant levels (MCLs).

3.1.2 Action-specific ARARs

Action-specific ARARs are usually technology- or activity-based requirements that define acceptable treatment and disposal procedures for hazardous substances. The action-specific ARARs for the groundwater at Site 86 are summarized in **Table 3-2**.

3.1.3 Location-specific ARARs

Location-specific ARARs restrict remedial activities and media concentrations based on characteristics of surrounding environments. Location-specific ARARs may include restrictions on remedial actions within wetlands or floodplains, near locations of archeological and natural resources, near historic landmarks, near locations of known endangered species, or on protected waterways. An evaluation of location-specific ARARs for Site 86 is presented in **Table 3-3**.

3.2 Remedial Action Objectives

RAOs consist of medium-specific goals for protecting human health and the environment. The RAOs for the remediation of groundwater are based on the potential for future potable groundwater use. Groundwater is the only medium for which RAOs were established, because there were no potentially unacceptable risks identified for soil, surface water, or sediment.

The RAOs are the following:

1. Restore groundwater quality to meet North Carolina Department of Environment and Natural Resources (NCDENR) and federal primary drinking water standards based on the classification of the aquifer as a potential source of drinking water (Class GA or Class GSA) under 15A North Carolina Administrative Code 02L.0201.
2. Prevent exposure to COCs in groundwater and VI from COCs in groundwater until such time as groundwater concentrations or VI mitigation measures allow for unlimited use and unrestricted exposure.

3.3 COCs, Remediation Target Areas, and Cleanup Levels

Based on the HHRA, benzene, PCE, TCE, cis-1,2-DCE, and VC have been retained as site COCs and their respective cleanup levels are listed in **Table 3-4.** Remediation target areas are based on the extent of COCs exceeding 100 times their respective cleanup levels and are shown on **Figure 3-1**.

TABLE 3-4
Cleanup Levels for Groundwater
Operable Unit 20 (Site 86), MCIEAST-MCB CAMLEJ, North Carolina

COCs	**Cleanup Level (µg/L)[a]**	**Maximum Detection (µg/L)**	**Location of Maximum Detection**
Benzene	1	11	IR86-MW52
PCE	0.7	190	IR86-MW10IW
TCE	3	330	IR86-MW42IW
cis-1,2-DCE	70	350J	IR86-MW15IW
VC	0.03	140	IR86-MW55IW

[a] - Cleanup Level is the more conservative value (either NCGWQS or MCL)

3.4 Identification and Screening of Technology Types and Process Options

GRAs describe general remedial activities that may satisfy RAOs, either independently or in combination. GRAs to be considered for satisfying RAOs for the remediation are no action, land use controls (LUCs), monitoring, containment, removal, treatment, and disposal. **Table 3-5** identifies potentially applicable technologies and process options for addressing the impacted groundwater. Certain technologies and/or process options are not appropriate because of economics, impracticality, site conditions, or COC characteristics and were excluded from further consideration.

TABLE 3-1

Chemical-Specific ARARs

Operable Unit 20 (Site 86)

Feasibility Study

MCIEAST-MCB CAMLEJ, North Carolina

Federal and North Carolina Chemical-Specific ARARs

Media	Requirement	Prerequisite	Citation
Classification of contaminated groundwater	Groundwaters in the state naturally containing 250 mg/L or less of chloride are *classified as GA (Existing or potential source of drinking water supply for humans)* under 15A NCAC 02L .0201(1)	Groundwaters located within the boundaries or under the extraterritorial jurisdiction of the State of North Carolina **- Applicable to groundwater alternatives 1, 2, 3, 4, and 5**	15A NCAC 02L .0302(1)
	Groundwaters in the state naturally containing greater than 250 mg/L of chloride are *classified as GSA* under 15A NCAC 02L .0201(2)		15A NCAC 02L .0302(2)
Restoration of contaminated groundwater	Shall not exceed the groundwater quality standards[1] for contaminants specified in Paragraphs (g) or (h) for the site related contaminants of concern. - Benzene (1 µg/L), 1,1-DCE (6 µg/L), PCE (0.7 µg/L), TCE (3 µg/L), cis-1,2-DCE (70 µg/L), VC (0.03 µg/L)	Class GA or GSA groundwaters with contaminant(s) concentrations exceeding standards listed in 15A NCAC 02L .0202 **- Applicable to groundwater alternatives 1, 2, 3, 4, and 5**	15A NCAC 02L .0202(a) and (b)
	Shall not exceed the Safe Drinking Water Act National Revised Primary Drinking Water Regulations: maximum contaminant levels (MCLs) for organic contaminants specified in 40 CFR 141.61(a).	Groundwaters classified as GA or GSA which are an existing or potential source of drinking water **- Relevant and Appropriate to groundwater alternatives 1, 2, 3, 4, and 5**	40 CFR 141.61(a) 15A NCAC 18C .1517
Protection of adjacent surface water body	Toxic substances: shall not exceed the numerical quality standards (maximum permissible levels) to protect human health from carcinogens through consumption of fish (and shellfish) -Benzene (51 µg/L), PCE (3.3 µg/L), TCE (30 µg/L), VC (2.4 µg/L)	Tidal Salt Waters classified as Class SC with chemical concentrations exceeding 15A NCAC 02B Standards **- Relevant and Appropriate to groundwater alternatives 1, 2, 3, 4, and 5**	15A NCAC 02B .0208(a)(2)(b)

Notes:

[1] Groundwater quality standards established on the basis of a National secondary drinking water standards are not utilized as remediation goals since these are based on taste, odor and other considerations unrelated to human health.

TABLE 3-2
Action-Specific ARARs
Operable Unit 20 (Site 86)
Feasibility Study
MCIEAST-MCB CAMLEJ, North Carolina

Federal and North Carolina Action-Specific ARARs

Action	Requirement	Prerequisite	Citation
General Construction Standards — All Land-disturbing Activities (i.e., excavation, clearing, grading, etc.)			
Managing storm water run off from land disturbing activities	Shall take all reasonable measures to protect all public and private property from damage caused by such activities.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-53) of more than 1 acre of land **- Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 4B.0105
	(1) Identify areas subject to severe erosion, and off-site areas especially vulnerable to damage from erosion and sedimentation.		15A NCAC 4B.0106
	(2) Limit the size of the area exposed at any one time.		
	(3) Limit exposure to the shortest feasible time.		
	(4) Control surface water run-off originating upgrade of exposed areas.		
	(5) Plan and conduct land-disturbing activity so as to prevent off-site sedimentation damage.		
	(6) Include measures to control velocity of storm water runoff to the point of discharge.		
	Erosion and sedimentation control measures, structures, and devices shall be planned, designed, and constructed to provide protection from the run-off of 10 year storm.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-53) of more than 1 acre of land **- Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 4B.0108
	Shall conduct activity so that the post-construction velocity of the ten year storm run-off in the receiving watercourse to the discharge point does not exceed the parameters provided in this Rule.		15A NCAC 4B.0109
	Shall install and maintain all temporary and permanent erosion and sedimentation control measures.		15A NCAC 4B.0113
	Erosion and sedimentation control measures, structures, and devices with High Quality Water (HQW) zones shall be planned, designed and constructed to provide protection from the runoff of the 25 year storm.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-52) of more than 1 acre of land in High Quality Water (HQW) zones **— Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 4B.0124(b)
	Provisions for ground cover sufficient to restrain erosion must be provided for any portion of the land-disturbing activity with 15 working days or 60 calendar days following completion of the construction or development, which period is shorter.		15A NCAC 4B.0124(e)
	Implement good construction management techniques, best management practices for sediment and erosion controls, and storm water management measures in accordance with 15A NCAC 02H .1008 to ensure storm water discharges are in compliance.	Development activity (otherwise requiring a stormwater permit) within one mile of and draining to waters classified as High Quality Waters (HQW) **— Relevant and Appropriate to groundwater alternatives 3, 4, and 5**	15A NCAC 02H .1006, NC General Permit CNCG 0100000
Manage fugitive dust emissions	Shall not cause or allow fugitive dust emissions to cause or contribute to substantive complaints, or visible emissions in excess of that allowed under paragraph (e) of this Rule.	Activities within facility boundary that will generate fugitive dust emissions - **Relevant and Applicable**	15A NCAC 02D .054D(c)
	Implement methods (e.g. wetting dry soils) to control dust emissions that could travel beyond the facility boundary.		15A NCAC 02D .054D(g)

TABLE 3-2
Action-Specific ARARs
Operable Unit 20 (Site 86)
Feasibility Study
MCIEAST-MCB CAMLEJ, North Carolina

Federal and North Carolina Action-Specific ARARs

Action	Requirement	Prerequisite	Citation
Monitoring Well Installation, Operation, and Abandonment			
Implementation of groundwater monitoring system	Shall be constructed in a manner that will not result in contamination of adjacent groundwater of a higher quality.	Installation of monitoring system to evaluate effects of any actions taken to restore groundwater quality, as well as the efficacy of treatment - **Applicable**	15A NCAC 02L .0110 (b)
Construction of groundwater monitoring well(s)	No well shall be located, constructed, operated, or repaired in any manner that may adversely impact the quality of groundwater.	Installation of wells (including temporary, monitoring wells) other than for water supply **- Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 02C .0108(a)
	Shall be located, designed, constructed, operated and abandoned with materials and by methods which are compatible with the chemical and physical properties of the contaminants involved, specific site conditions, and specific subsurface conditions.		15A NCAC 02C .0108(c)
	Monitoring well and recovery well boreholes shall not penetrate to a depth greater than the depth to be monitored or the depth from which contaminants are to be recovered. Any portion of the borehole that extends to a depth greater than the depth to be monitored or the depth from which contaminants are to be recovered shall be grouted completely to prevent vertical migration of contaminants.		15A NCAC 02C .108(d)
	Shall be constructed in such a manner as to preclude the vertical migration of contaminants with and along borehole channel.	Installation of wells (including temporary wells, monitoring wells) other than for water supply - Applicable	15A NCAC 02C .108(f)
	The well shall be constructed in such a manner that water or contaminants from the land surface cannot migrate along the borehole annulus into any packing material or well screen area.		15A NCAC 02C .108(g)
	Packing material placed around the screen shall extend at least one foot above the top of the screen. Unless the depth of the screen necessitates a thinner seal, a one foot thick seal, comprised of chip or pellet bentonite or other material approved by the Department as equivalent, shall be emplaced directly above and in contact with the packing material.		15A NCAC 02C .0108(h)
	Grout shall be placed in the annular space between the outermost casing and the borehole wall from the land surface to the top of the bentonite seal above any well screen or to the bottom of the casing for open hole wells. The grout shall comply with Paragraph (e) of Rule .0107 of this section except that the upper three feet of grout shall be concrete or cement grout.		15A NCAC 02C .0108(i)
	All wells shall be grouted within seven days after the casing is set. If the well penetrates any water-bearing zone that contains contaminated or saline water, the well shall be grouted within one day after the casing is set.		15A NCAC 02C .0108(j)
	Shall be secured with a locking well cap to ensure against unauthorized access and use.		15A NCAC 02C .0108(k) and 15A NCAC 02C .0108(l)
	Shall be equipped with a steel outer well casing or flush mount cover, set in concrete, and other measures sufficient to protect the well from damage by normal site activities.		
	The well casing shall be terminated no less than 12 inches above land surface unless all of the following conditions are met: (1) site specific conditions directly related to business activities, such as vehicle traffic, would endanger the physical integrity of the well; and (2) the well head is completed in such a manner so as to preclude surficial contaminants from entering the well.		15A NCAC 02C .108(n)

TABLE 3-2
Action-Specific ARARs
Operable Unit 20 (Site 86)
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Federal and North Carolina Action-Specific ARARs

Action	Requirement	Prerequisite	Citation
Monitoring Well Installation, Operation, and Abandonment cont.			
Construction of groundwater monitoring well(s)	Shall have permanently affixed an identification plate. The identification plate shall be constructed of a durable, waterproof, rustproof material or other material approved by the Department as equivalent and shall contain the following information: (1) well contractor name and certification number; (2) date well completed; (3) total depth of well; (4) a warning that the well is not for water supply and that the groundwater may contain hazardous materials; (5) depth(s) to the top(s) and bottom(s) of the screen(s); and (6) the well identification number or name assigned by the well owner		15A NCAC 02C .108(o)
	Shall be developed such that the level of turbidity or settleable solids does not preclude accurate chemical analyses of any fluid samples collected or adversely affect the operation of any pumps or pumping equipment.		15A NCAC 02C .108(p)
Maintenance of groundwater monitoring well(s)	Every well shall be maintained by the owner in a condition whereby it will conserve and protect groundwater resources, and whereby it will not be a source or channel of contamination or pollution tot eh water supply or any aquifer	Installation of wells (including temporary wells) other than for water supply- **Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 02C .0112(a)
	Broken, punctured, or otherwise defective or unserviceable casing, screens, fixtures, seals, or any part of the well head shall be repaired or replaced, or the well shall be abandoned pursuant to 15A NCAC 02C .0113		15A NCAC 02C .0112(d)
	All materials used in the maintenance, replacement, or repair of any well shall meet the requirements for new installation.		15A NCAC 02C .0112(c)
	No well shall be repaired or altered such that the outer casing is completed less than 12 inches above land surface. Any grout excavated or removed as a result of the well repair shall be replaced in accordance with Rule .107(f) of this Section.		15A NCAC 02C .0112(f)
Abandonment of groundwater monitoring and remediation well(s)	Shall be abandoned by filling the entire well up to land surface with grout, dry clay, or material excavated during drilling of the well and then compacted in place	Permanent abandonment of wells (including temporary wells, monitoring wells, and test borings other than for water supply *less than 20 feet in depth* and which do not penetrate the water table - **Applicable**	15A NCAC 02C .0113(d)(1)
	Shall be abandoned by completely filling with a bentonite or cement-type grout	Permanent abandonment of wells (including temporary wells, monitoring wells, and test borings other than for water supply *greater than 20 feet in depth* and which do penetrate the water table - **Applicable**	15A NCAC 02C .0113(d)(2)
	All wells shall be permanently abandoned in which the casing has not been installed or from which the casing has been removed, prior to removing drilling equipment from the site.	Permanent abandonment of wells (including temporary well) other than for water supply - **Applicable**	15A NCAC 02C .0113(f)

TABLE 3-2
Action-Specific ARARs
Operable Unit 20 (Site 86)
Feasibility Study
MCIEAST-MCB CAMLEJ, North Carolina

Federal and North Carolina Action-Specific ARARs

Action	Requirement	Prerequisite	Citation
Underground Injection Well Installation, Operation, and Abandonment			
Construction of injection well(s) for *in-situ* treatment of groundwater	Construction, use or operation may be allowed provided the injected material does not contain any waste or any substance of a composition and concentration such that, if it were discharged to the land or waters of the state, would create a threat to human health or would otherwise render those waters unsuitable for their intended usage.	Installation of Class 5 underground injection well (Type I – In-situ Groundwater Remediation Well and Type P - Air Injection Well) **- Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 02C .0209(e)(3)
	Shall provide information on the injection well, procedure, and material otherwise required for obtaining a permit in the Remedial Design or Remedial Action Work Plan.		15A NCAC 02C .0211(d)(3)
Location of injection well(s) for *in-situ* treatment of groundwater	Shall not be located in an area generally subject to flooding. Areas which are generally subject to flooding include those with concave slope, alluvial or colluvial soils, gullies, depressions, and drainage ways.	Installation of Class 5 underground injection well (Type I – In-situ Groundwater Remediation Well and Type P - Air Injection Well) **- Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 02C .0213(a)(1)
	Shall not be located at a point where the injectant would degrade the existing quality of the groundwater in the water-bearing unit into which the injectant is being released.	Installation of Class 5 underground injection well (Type I – In-situ Groundwater Remediation Well) where the concentration of any component of the injectant *exceeds* the groundwater quality standards specified in 15A NCAC 2L .0202 **- Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 02C .0213(a)(2)(A)(i)
	Shall not be located at a point where the injectant would result in a contravention of any of the aforementioned groundwater quality standards in the water-bearing unit into which the injectant is being released.	Installation of Class 5 underground injection well (Type I – In-situ Groundwater Remediation Well) where the concentration of any component of the injectant *is less than* the groundwater quality standards specified in 15A NCAC 2L .0202 **- Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 02C .0213(a)(2)(B)
Construction of injection well(s) for *in-situ* treatment of groundwater	Shall follow the procedures, methods, specified materials, and requirements specified in the subparagraphs (A) through (G) of this Rule for Drilling, Casing, Screens and Testing.	Installation of Class 5 underground injection well (Type I – In-situ Groundwater Remediation Well and Type P - Air Injection Well) **- Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 02C .0213(c)(1) through (4)
	Shall follow the procedures, methods, specified materials, and requirements specified in the paragraphs (1) through (8) of this Rule for Grouting and Sand-and-Gravel Packing.		15A NCAC 02C .0213(d)
Operating an injection well(s) for *in-situ* treatment of groundwater	Pressure at the well head shall be limited to a maximum which will ensure the pressure in the injection zone does not initiate new fractures or propagate existing fractures in the injection zone, initiate fractures in the confining zone, or cause the migration of injected or formation fluids outside the injection zone or area.		15A NCAC 02C .0213(e)
Abandonment of injection well(s) for *in-situ* treatment of groundwater	Shall be abandoned in accordance with the requirements of subparagraphs (1) and (2) of 15A NCAC 02C .0214(a).	Installation of Class 5 underground injection well (Type I – In-situ Groundwater Remediation Well *or* Type P Air Injection Well), including exploratory or test wells **- Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 02C .0214(a)

TABLE 3-2
Action-Specific ARARs
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MCIEAST-MCB CAMLEJ, North Carolina

Federal and North Carolina Action-Specific ARARs

Action	Requirement	Prerequisite	Citation
Control of Diffuse VOC Emissions from Groundwater Treatment			
Emissions of VOCs from groundwater treatment (e.g., sparging system)	Shall not emit any of the toxic air pollutants listed in the table of the Rule in such quantities that may cause or contribute beyond the premises (adjacent property boundary) to any significant ambient air concentration that may adversely affect human health.	Emissions of toxic air pollutants (e.g., VOCs) from facility into the ambient air**- Applicable to groundwater alternatives 3, 4 and 5**	15A NCAC 02D .1104
	Shall install and operate reasonable available control technology to limit emissions of VOCs.	Air emissions of VOCs from facilities where there is no other applicable emissions control rule**- Relevant and Appropriate to groundwater alternatives 3, 4 and 5**	15A NCAC 02D .0951(c)
	One of the applicable test methods in Appendix M in 40 CFR part 51 or Appendix A in 40 CFR Part 60 shall be used to determine compliance with VOC emission standards.	VOC emission source not covered by 15A NCAC 02D.2613(b) through (e)**- Relevant and Appropriate to groundwater alternatives 3, 4 and 5**	15A NCAC 02D .2613(g)
	Control emissions by meeting limitations and work practice standards reflecting application of the maximum achievable control technology.	Air emissions of organic Hazardous Air Pollutants (e.g.,VOCs) from site remediation**- Relevant and Appropriate to groundwater alternatives 3, 4 and 5**	40 CFR 63 Subpart G, NESHAPS for Site Remediation
	Periodic inspection of equipment and monitoring are required for the life of the remediation.		

TABLE 3-2
Action-Specific ARARs
Operable Unit 20 (Site 86)
Feasibility Study
MCIEAST-MCB CAMLEJ, North Carolina

Federal and North Carolina Action-Specific ARARs

Action	Requirement	Prerequisite	Citation
Waste Characterization and Storage — Primary Wastes (i.e., well soil cuttings and purge water) and secondary Wastes (e.g., PPE and used equipment)			
Characterization of solid waste (e.g., well soil cuttings)	Must determine if solid waste is hazardous waste or if waste is excluded under 40 CFR 261.4(b); and	Generation of solid waste as defined in 40 CFR 261.2 and which is not excluded under 40 CFR 261.4(a) **- Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 13A .0107 only as it incorporates 40 CFR 262.11(a)
	Must determine if waste is listed under 40 CFR Part 261; or		15A NCAC 13A .0107 only as it incorporates 40 CFR 262.11(b)
	Must characterize waste by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used.		15A NCAC 13A .0107 only as it incorporates 40 CFR 262.11(c)
Storage of solid waste	All solid waste shall be stored in such a manner as to prevent the creation of a nuisance, insanitary conditions, or a potential public health hazard.	Generation of solid waste which is determined *not* to be hazardous - **Relevant and Applicable**	15A NCAC 13B .0104(f)
	Containers for the storage of solid waste shall be maintained in such a manner as to prevent the creation of a nuisance or insanitary conditions. Containers broken or that otherwise fail to meet this Rule shall be replaced with acceptable containers		15A NCAC 13B .0104(e)
Disposal of solid waste	Shall ensure that waste is disposed of at a site or facility which is permitted to receive the waste.	Generation of solid waste intended for off-site disposal – **Relevant and Appropriate to groundwater alternatives 3, 4, and 5**	15A NCAC 13B .0106(b)
Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMTA and DOT HMR at 49 CFR 171-180	Any person who, under contract with a department or agency of the federal government, transports "in commerce", or causes to be transported or shipped, a hazardous material -**Applicable**	49 CFR 171.1(c)
Transportation of samples	Are not subject to any requirements of 40 CFR parts 261 through 268 or 270 when: (1) the sample is being transported to a laboratory for the purpose of testing; (2) the sample is being transported back to the sample collector after testing; or (3) the sample is being stored by sample collector before transport to a lab for testing.	Sample of solid waste or a sample of water, soil for purpose of conducting testing to determine its characteristics or composition - **Applicable**	15A NCAC 13A .0106 only as it incorporates 40 CFR 261.4(d)(1)(i)-(iii)
	In order to qualify for the exception in paragraphs (d)(1) (i) and (ii), a sample collector shipping the samples to a laboratory must: (1) comply with U.S. DOT, U.S. Postal Service, or any other applicable shipping requirements; (2) assure that the information provided in (1) thru (5) of this section accompanies the sample; and (3) package the sample so that it does not leak, spill, or vaporize from its packaging		15A NCAC 13A .0106 only as it incorporates 40 CFR 261.4(d)(2)(i)(A) and (B)
Characterization of hazardous waste	Must obtain a detailed chemical and physical analysis on a representative sample of the waste(s), which at a minimum contains all the information that must be known to treat, store, or dispose of the waste in accordance with pertinent sections of 40 CFR 264 and 268.	Generation of RCRA-hazardous waste for storage, treatment or disposal**- Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 13B .0106(b)
	Must determine the underlying hazardous constituents [as defined in 40 CFR 268.2(i)] in the waste.	Generation of RCRA characteristic hazardous waste (and is not D001 non-wastewaters treated by CMBST, RORGS, or POLYM of Section 268.42 Table 1) for storage, treatment or disposal**- Applicable to groundwater alternatives 3, 4, and 5**	40 CFR 268.9(a)
	Must determine if the waste is restricted from land disposal under 40 CFR 268*et seq.* by testing in accordance with prescribed methods or use of generator knowledge of waste.		40 CFR 268.7(a)(1)
	Must determine each EPA Hazardous Waste Number (Waste Code) to determine the applicable treatment standards under 40 CFR 268.40 *et. seq* .		40 CFR 268.9(a)

TABLE 3-2
Action-Specific ARARs
Operable Unit 20 (Site 86)
Feasibility Study
MCIEAST-MCB CAMLEJ, North Carolina

Federal and North Carolina Action-Specific ARARs

Action	Requirement	Prerequisite	Citation
Waste Characterization and Storage — Primary Wastes (i.e., excavated contaminated soils) cont.			
Temporary storage of hazardous waste in containers	A generator may accumulate hazardous waste at the facility provided that: - waste is placed in containers that comply with 40 CFR 265.171-173; and	Accumulation of RCRA hazardous waste on site as defined in 40 CFR 260.10- **Applicable to soil alternatives 3 and 4 and groundwater alternatives 2, 3, 4, and 5**	40 CFR 262.34(a) 40 CFR 262.34(a)(1)(i)
	- the date upon which accumulation begins is clearly marked and visible for inspection on each container		40 CFR 262.34(a)(2)
	- container is marked with the words "hazardous waste"; or - container may be marked with other words that identify the contents.	Accumulation of 55 gal. or less of RCRA hazardous waste at or near any point of generation - **Applicable to soil alternatives 3 and 4 and groundwater alternatives 2, 3, 4, and 5**	40 CFR 264.34(a)(3) 40 CFR 262.34(c)(1)
	Area must have a containment system designed and operated in accordance with 40 CFR 264.175(b) Area must be sloped or otherwise designed and operated to drain liquid resulting from precipitation, or Containers must be elevated or otherwise protected from contact with accumulated liquid.	Storage of RCRA hazardous waste in containers with *free liquids* - **Applicable to groundwater alternatives 2, 3, 4, and 5** Storage of RCRA-hazardous waste in containers that do not contain free liquids (other than F020, F021, F022, F023,F026 and F027) – **Applicable to soil alternative 4 and groundwater alternatives 2, 3, 4, and 5**	40 CFR 264.175(a) 15A NCAC 13A .0109 40 CFR 264.175(c)(1) and (2) 15A NCAC 13A .0109
Closure of RCRA container storage unit	At closure, all hazardous waste and hazardous waste residues must be removed from the containment system. Remaining containers, liners, bases, and soils containing or contaminated with hazardous waste and hazardous waste residues must be decontaminated or removed. [Comment: At closure, as throughout the operating period, unless the owner or operator can demonstrate in accordance with40 CFR 261.3(d) of this chapter that the solid waste removed from the containment system is not a hazardous waste, the owner or operator becomes a generator of hazardous waste and must manage it in accordance with all applicable requirements of parts 262 through 266 of this chapter].	Storage of RCRA hazardous waste in containers in a unit with a containment system –**Applicable to soil alternative 4 and groundwater alternatives 2, 3, 4, and 5**	40 CFR 264.178 15A NCAC 13A .0109
Temporary on-site storage of remediation waste in staging pile (e.g., excavated soils)	Must be located within the contiguous property under the control of the owner/operator where the wastes are to be managed in the staging pile originated. For purposes of this section, storage includes mixing, sizing, blending or other similar physical operations so long as intended to prepare the wastes for subsequent management or treatment.	Accumulation of solid *non-flowing hazardous remediation waste* (or remediation waste otherwise subject to land disposal restrictions) as defined in 40 CFR 260.10 - **Applicable to soil alternative 4**	40 CFR 264.554(a)(1)
Performance criteria for staging pile	Staging pile must: - facilitate a reliable, effective and protective remedy; - must be designed to prevent or minimize releases of hazardous wastes and constituents into the environment, and minimize or adequately control cross-media transfer as necessary to protect human health and the environment (e.g. use of liners, covers, run-off/run-on controls).	Storage of remediation waste in a staging pile– **Applicable to soil alternative 4**	40 CFR 264.554(d)(1)(i) and (ii) 15A NCAC 13A .0109
Operation of a staging pile	Must not operate for more than 2 years, except when an operating term extension under 40 CFR 264.554(i) is granted. *Note* : Must measure the 2-year limit (or other operating term specified) from first time remediation waste placed in staging pile	Storage of remediation waste in a staging pile– **Applicable to soil alternative 4**	40 CFR 264.554(d)(1)(iii) 15A NCAC 13A .0109
	Must not use staging pile longer than the length of time designated by EPA in appropriate decision document.		40 CFR 264.554(h) 15A NCAC 13A .0109

TABLE 3-2
Action-Specific ARARs
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Federal and North Carolina Action-Specific ARARs

Action	Requirement	Prerequisite	Citation
Waste Characterization and Storage — Primary Wastes cont.			
Disposal of solid waste	Shall ensure that waste is disposed of at a site or facility which is permitted to receive the waste.	Generation of solid waste intended for off-site disposal – **Relevant and Appropriate to groundwater alternatives 3, 4, and 5**	15A NCAC 13B .0106(b)
Disposal of RCRA hazardous waste in a land-based unit	May be land disposed if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA waste - **Applicable to groundwater alternatives 3, 4, and 5**	40 CFR 268.40(a) 15A NCAC 13A .0112
	All underlying hazardous constituents [as defined in 40 CFR 268.2(i)] must meet the Universal Treatment Standards (UTS), found in 40 CFR 268.48 Table UTS prior to land disposal	Land disposal of restricted RCRA characteristic wastes (D001-D043) that are not managed in a wastewater treatment system that is regulated under the CWA, that is CWA equivalent, or that is injected into a Class I nonhazardous injection well – **Applicable to groundwater alternatives 3, 4, and 5**	40 CFR 268.40(e) 15A NCAC 13A .0112
	To determine whether a hazardous waste identified in this section exceeds the applicable treatment standards of 40 CFR 268.40, the initial generator must test a sample of the waste extract or the entire waste, depending on whether the treatment standards are expressed as concentration in the waste extract or waste, or the generator may use knowledge of the waste. If the waste contains constituents (including UHCs in the characteristic wastes) in excess of the applicable UTS levels in 40 CFR 268.48, the waste is prohibited from land disposal, and all requirements of part 268 are applicable, except as otherwise specified.	Land disposal of RCRA toxicity characteristic wastes (D004-D011) that are newly identified (i.e., wastes, soil, or debris identified by the TCLP but not the Extraction Procedure) – **Applicable to groundwater alternatives 3, 4, and 5**	40 CFR 268.34(f) 15A NCAC 13A .0112
Disposal of RCRA-hazardous waste in a land-based unit	Must be treated according to the alternative treatment standards of 40 CFR 268.49(c) or according to the UTSs specified in 40 CFR 268.48 applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal	Land disposal, as defined in 40 CFR 268.2, of restricted hazardous soils –**Applicable to groundwater alternatives 3, 4, and 5**	40 CFR 268.49(b) 15A NCAC 13A .0112
Institutional Controls for Contamination Left in Place			
Notice of Contaminated Site	Prepare and certify by professional land surveyor a survey plat which identifies contaminated areas which shall be entitled "NOTICE OF CONTAMINATED SITE".	Contaminated site subject to current or future use restrictions included in a remedial action plan as provided in G.S. 143B-279.9(a) **- To-Be-Considered for groundwater alternatives 2, 3, 4, and 5**	NCGS 143B-279.10(a)
	Notice shall include a legal description of the site that would be sufficient as a description in an instrument of conveyance and meet the requirements of NCGS 47-30 for maps and plans.		
	The Survey plat shall identify: - the location and dimensions of any disposal areas and areas of potential environmental concern with respect to permanently surveyed benchmarks; - the type location, and quantity of contamination known to exist on the site; and - any use restriction on the current or future use of the site.		NCGS 143B-279.10(a)(1)-(3)
	The deed or other instrument of transfer shall contain in the description section, in no smaller type than used in the body of the deed instrument, a statement that the property is a contaminated site and reference by book and page to the recordation of the Notice.	Contaminated site subject to current or future use restrictions included in a remedial action plan as provided in G.S. 143B-279.9(a) - To-Be-Considered for groundwater alternatives 2, 3, 4, and 5	NCGS 143B-279.10(e)

TABLE 3-3

Location-Specific ARARs

Operable Unit 20 (Site 86)

Feasibility Study

MCIEAST-MCB CAMLEJ, North Carolina

Federal and North Carolina Location-Specific ARARs

Location	Requirement	Prerequisite	Citation
Presence of wetlands	Concentrations or combination of substances, which are toxic or harmful to human, animal, or plant life may not be present in amounts, which individually or cumulatively, can cause adverse impacts on existing wetland uses. Standards provided in 15A NCAC 02B.0231(b)(1), (2), (3), (5), and (6) shall be used to ensure the maintenance or enhancement of the existing uses of wetlands identified in 15A NCAC 02B.0231(a)	Activities within, wetlands as defined by G.S. 143-212(6) – **Applicable to groundwater alternatives 3, 4, and 5**	15A NCAC 02B.0231(b)(4)
	Requires Federal agencies to evaluate action to minimize the destruction, loss or degradation of wetlands and to preserve and enhance beneficial values of wetlands.	Actions that involve potential impacts to or take place within wetlands - **To Be Considered for groundwater alternatives 3, 4, and 5**	Executive Order 11990 - *Protection of Wetlands* Section 1.(a)
Location econmpassing aquatic ecosystem as defined in 40 CFR 230.(c)	No discharge of dredged or fill material into an aquatic ecosystem is permitted if there is a practicable alternative that would have less adverse impact.	Action that involves the discharge of dredged or fill material into waters of the United States including jurisdictional wetlands - **Relevant and Appropriate for groundwater alternatives 3, 4, and 5**	40 CFR 230.10(a)
	No discharge of dredged of fill material shall be permitted unless appropriate and practicable steps in accordance with 40 CFR 230.70 *et seq.* have been taken that will minimize potential adverse impacts of the discharge on the aquatic ecosystem.		40 CFR 30.10(d)
	Must comply with the substantive requirements of the NWP 38 General Conditions, as appropriate, any regional or case-specific conditions recommended by the Corps District Engineer, after consultation. *Note* : Despite that consultation may be considered an administrative requirement, it should be performed to ensure activities are in compliance with substantive provisions of the permit.	On-site CERCLA action conducted by Federal agency that involves the discharge of dredged or fill material into water s of the United States including jurisdicitonal wetlands - **Relevant and Appropriate for groundwater alternatives 3, 4, and 5**	Nation Wide Permit (38) Cleanup of Hazardous and Toxic Waste 33 CFR 323.3(b)
Presence of floodplain designated as such on a map	Shall consider alternatives to avoid, to the extent possible, adverse effects on and incompatible development in the floodplain.	Federal actions that involve potential impacts on, or take place within, floodplains—**To Be Considered for groundwater alternatives 3, 4, and 5**	Executive Order 11988 – *Floodplain Management* Section 2(a)(2)
Coastal zone or area that will affect the coastal zone	Federal activities must be consistent with, to the area that will affect maximum extent practicable, State coastal zone management programs. Federal agencies must supply the State with a consistency determination.	Wetland, flood plain, estuary, beach, dune, barrier island, coral reef, and fish and wildlife and their habitat, within the coastal zone **— Applicable to groundwater alternatives 3, 4, and 5**	15 CFR 930.33(a)(1), (a)(2), (b); .35(a), (b); .36(a)

TABLE 3-5

Initial Screening of Remedial Technologies and Process Options

Operable Unit 20 (Site 86)

Feasibility Study

MCIEAST-MCB CAMLEJ, North Carolina

General Response Actions	Remedial Technology Types	Process Options	Descriptions	Comments	Retain for Further Evaluation
No Action	None	None	No further actions to address contaminated groundwater.	Baseline for CERCLA process.	Yes
Institutional Controls	Access and Use Restrictions	Land Use Controls	Land Use Controls issued for property within potentially contaminated areas to restrict property use and well installation.	Prevents human exposure. Will be a component of any remedial alternative.	Yes
		Fences	Security fences installed around potentially contaminated areas to limit access.	Site 86 is located in an industrial area containing aircraft hangars, office buildings, and flight line. Fencing off these areas is not implementable.	No
	Alternative Drinking Water Source	Cisterns or Tanks	Drinking water is dispensed to users from a central point.	Not applicable, no drinking water wells affected	No
		Bottled Water	Drinking water is obtained from a commercial vendor.	Not applicable, no drinking water wells affected	No
		Deeper or Upgradient Wells	Wells are installed deep or upgradient if these areas are isolated from contamination.	Not applicable, no drinking water wells affected	No
		Relocation of Intake	Intake is relocated to an uncontaminated area.	Not applicable, no drinking water intake affected	No
		Municipal Water Supply	Additional water sources are established.	Not applicable, no drinking water supply affected	No
Monitoring	Monitoring	Monitoring	Long-term monitoring is implemented to record site conditions, contamination and groundwater levels.	Potential approach for use with natural attenuation. Will be a component of any active groundwater remedial alternative.	Yes

TABLE 3-5

Initial Screening of Remedial Technologies and Process Options

Operable Unit 20 (Site 86)

Feasibility Study

MCIEAST-MCB CAMLEJ, North Carolina

General Response Actions	Remedial Technology Types	Process Options	Descriptions	Comments	Retain for Further Evaluation
Containment	Vertical Barriers	Soil-Bentonite Slurry Wall	Trench downgradient of contaminated area excavated and filled with a bentonite slurry. Trench backfilled with a soil-bentonite mix.	May contain but not treat groundwater plume. Technically impracticable to install wall deep and wide enough to contain groundwater plume.	No
		Cement-Bentonite Slurry Wall	Trench downgradient of contaminated area. Excavation filled with a cement bentonite slurry. Cement sets and forms the wall.	May contain but not treat groundwater plume. Technically impracticable to install wall deep and wide enough to contain groundwater plume.	No
		Permeable Reactive Barrier (PRB)	Trench downgradient of contaminated area filled with permeable materials, such as zero valent iron (ZVI) or mulch/compost with a sand/gravel "binder" material. Groundwater is treated as it moves through the barrier by natural gradient.	May treat migrating groundwater in the surficial aquifer contaminated with chlorinated solvents. Services available to install wall deep and wide enough to treat plume.	Yes
		Grout Curtains	Grout is pressure-injected along contamination boundaries in a regular overlapping pattern of drilled holes.	May contain but not treat groundwater plume. Technically impracticable to install wall deep and wide enough to contain groundwater plume.	No
		Sheet Piling/"Funnel and Gate"	Steel sheet piling driven at downgradient periphery of the plume, with "gate" containing groundwater purge wells or permeable barrier.	Technically impracticable to install sheet pile to necessary depth to contain groundwater plume.	No
	Horizontal Barriers	Block Displacement	Controlled injection of slurry in notched injection holes produces a horizontal barrier beneath contamination. Experimental process option.	Vertical migration of groundwater contamination into deeper aquifers not likely.	No
		Grout Injection	Grout pressure injected at depth through closely spaced drilled holes.	Vertical migration of groundwater contamination into deeper aquifers not likely.	No
Removal	Removal or Extraction	Pump/Treat (vertical wells or horizontal wells)	Conventional groundwater extraction involves pumping in vertical wells. Other extraction devices include vacuum enhanced recovery, jet-pumping systems, etc. Extracted groundwater may be discharged to a sanitary sewer, or treated as required and then discharged, or treated and re-injected.	Ineffective for treatment of dissolved plumes within lower permeability materials. Requires operation of long term groundwater pump and treatment system and is not cost effective.	No
		Vacuum Enhanced Recovery	Application of strong vacuum to recovery wells can be used to enhance the capture zone and yield of groundwater recovery wells.	Considered prohibitively expensive. Effectiveness limited by vertical air "short circuiting".	No
		Horizontal Wells	Directionally drilled horizontal wells to increase groundwater capture.	Higher cost to install, but can be installed beneath above grade structures and directly into plume area. Geologic conditions and plume orientation are conducive to using horizontal well extraction, but health and safety issues related to potential chemical agent.	No
		One-pass Trenching	Groundwater collection technique to increase production rate from low permeability areas.	Not effective for groundwater extraction/removal.	No
		Drains	Underground gravel-filled trenches generally equipped with tile or perforated pipe are installed to collect contaminated groundwater and leachate.	Cost prohibitive due to the depth of the treatment area.	No

TABLE 3-5

Initial Screening of Remedial Technologies and Process Options

Operable Unit 20 (Site 86)

Feasibility Study

MCIEAST-MCB CAMLEJ, North Carolina

General Response Actions	Remedial Technology Types	Process Options	Descriptions	Comments	Retain for Further Evaluation
Treatment	Enhanced Aerobic Bioremediation	Aerobic Cometabolic Bioremediation	Injection of substrate containing inducers and electron acceptors (oxygen) to enhance aerobic biodegradation. Inducers serve as carbon sources that activate aerobic enzyme systems known to degrade chlorinated VOCs (fortuitous cometabolism).	Aerobic conditions, not present in the plume area, are most effective for VC degradation via direct metabolism, cometabolic degradation and possibly direct oxidation.	No
		Anaerobic Bioremediation with Bioaugmentation (Enhanced Bioremediation)	Subsurface delivery of electron donors within the target zone to stimulate anaerobic biodegradation of chlorinated compounds by reductive dechlorination.	Applicable for cis-1,2,DCE and VC groundwater treatment. Microbial analyses of groundwater samples collected from Site 86 indicate bioaugmentation may be required to mediate reductive dechlorination.	Yes
		In-Situ Chemical Oxidation/Reduction	Injection of oxidizing agents (Fenton's reagent, permanganate, persulfate, ozone) or reducing agents (zero-valent iron) to promote abiotic in-situ oxidation/reduction of chlorinated organic compounds.	Applicable for VOCs, ISCO is an efficient and fast acting treatment. Additional health and safety risks associated with application of an oxidant to the buried waste may create a reactive environment due to historical events.	Yes
		Phytoremediation	Use of plants and their associated rhizospheric microorganisms to remove, degrade, or contain chemical contaminants in groundwater.	Depth to water is too deep for phytoremediation to be effective.	No
	In-situ Physical, Chemical Treatment	Pneumatic and Hydraulic Fracturing	Creation of apertures in the soil to enhance bulk permeability, using pressurized gas or liquid slurry.	Localized hydraulic fracturing using a geoprobe and high pressure pumps can produce erratic results.	No
		Air Sparging	Air is injected into saturated matrices to remove contaminants through volatilization and/or bioremediation.	Air sparging is used to promote volatilization of target VOCs is potentially feasible. Effectiveness decreases in low permeability or heterogeneous materials because of low air channel density and/or "bypassing" of dense soils (Belgrade Formation present at the site). Additional health and safety risks are associated with disturbance of buried waste material, where addition of oxygen to the subsurface may create a reactive environment or potential increase in leakage of waste materials. Further there is risk of dispersing contaminated particles, including chemical agent, into the atmosphere.	Yes
		Electrical Resistive Heating	Involves installation of electrodes in hexagonal or three point arrays and application of high voltage electrical power to cause boiling of volatile compounds in groundwater. Volatilized compounds are removed by SVE, treated, and discharged under permit.	Cost prohibitive and technically challenging due to depth and extent of contamination. SVE difficult due to shallow depth to groundwater. Heating of buried drums present additional health and safety risks and well as a potential increase in leakage of contained waste materials.	No

TABLE 3-5

Initial Screening of Remedial Technologies and Process Options

Operable Unit 20 (Site 86)

Feasibility Study

MCIEAST-MCB CAMLEJ, North Carolina

General Response Actions	Remedial Technology Types	Process Options	Descriptions	Comments	Retain for Further Evaluation
Treatment (cont.)	In-situ Physical, Chemical Treatment (cont.)	Surfactant, Cosolvent Flushing "SEAR"	Delivery of a solution that enhances contaminant transport and recovery through low permeability, heterogeneous soils. Surfactants may also be used as a "stand alone" technology to remove target VOCs by physical displacement, solubilization, desorption, with subsequent recovery of both the solution and target contaminants. However, surfactant flooding within low permeability, heterogeneous soils is unproven.	Generally not recommended for application in low permeability, heterogeneous soils, where dense materials are bypassed by the injected solution.	No
		Hot Water or Steam Flushing, Stripping	Steam is forced into an aquifer through injection wells to vaporize volatile and semivolatile contaminants. Vaporized components rise to the unsaturated zone, where they are removed by vacuum extraction and treated.	Cost prohibitive due to depth and extent of contamination. SVE difficult due to shallow depth to groundwater. Heating of buried drums present additional health and safety risks and well as a potential increase in leakage of waste materials.	No
		Chemical Reduction	Reducing agents (zero-valent iron) are used to destroy organic contaminants in an ex-situ reactor.	Not technically practicable or cost effective. Requires pump and treat for groundwater capture and recovery. Pump and treat is not effective in heterogeneous, low permeability materials.	No
		Chemical Oxidation	Oxidizing agents (sodium persulfate, potassium permanganate) are used to destroy organic contaminants in an ex-situ reactor.	Not technically practicable or cost effective. Requires pump and treat for groundwater capture and recovery. Pump and treat is not effective in heterogeneous, low permeability materials.	No
	Ex-situ Physical, Chemical Treatment	Air Stripping	Volatile organics are partitioned from groundwater by increasing the surface area of the contaminated water exposed to air. Aeration methods include packed towers, diffused aeration, tray aeration, and spray aeration. Emissions from the air stripping system need to be monitored and may need to be treated to conform with federal (Clean Air Act) and local air emission monitoring requirements.	Requires pump and treat for groundwater capture and recovery. Pump and treat is not effective in heterogeneous, low permeability materials.	No
		Filtration	Solid particles are isolated by running a fluid stream through a porous medium. The driving force is either gravity or a pressure differential across the filtration medium.	Not applicable for site contaminants.	No
		Ion Exchange	Ions from the aqueous phase are removed by exchange with innocuous ions on the exchange medium.	Not applicable for site contaminants.	No
		Liquid-Phase Carbon Adsorption	Groundwater is pumped through a series of canisters or columns containing activated carbon to which dissolved organic contaminants adsorb. Periodic replacement or regeneration of saturated carbon is required. Wastes produced from the saturated carbon need to be properly managed.	Requires pump and treat for groundwater capture and recovery. Pump and treat is not effective in heterogeneous, low permeability materials.	No

TABLE 3-5

Initial Screening of Remedial Technologies and Process Options

Operable Unit 20 (Site 86)

Feasibility Study

MCIEAST-MCB CAMLEJ, North Carolina

General Response Actions	Remedial Technology Types	Process Options	Descriptions	Comments	Retain for Further Evaluation
Treatment (cont.)	Ex-situ Physical, Chemical Treatment (cont.)	Precipitation	Dissolved contaminants are transformed into an insoluble solid, facilitating the contaminants' subsequent removal from the liquid phase by sedimentation or filtration. Usually includes pH adjustment, addition of a chemical precipitant, and flocculation.	Not applicable for site contaminants.	No
		Incineration	Recovered free product heated to very high temperatures to combust organic contaminants in the presence of oxygen.	Cost prohibitive.	No
	Land Application	Land Application	Liquid wastes that are primarily organic are incorporated into the upper soil horizon so they can be degraded, transformed, or immobilized.	Not applicable for dissolved groundwater contaminants.	No
Disposal	Wastewater Discharge	POTW	Wastewater is discharged to Base wastewater treatment plant. Must comply with Base effluent standards.	Requires pump and treat for groundwater capture and recovery.	No
		Surface Waters	Wastewater is discharged to surface receiving streams. Must comply with NPDES permit standards and sampling requirements.	Requires pump and treat for groundwater capture and recovery.	No
		Reinjection	Treated/amended groundwater is reinjected into on-site wells. Federal and state regulations are very restrictive.	Requires pump and treat for groundwater capture and recovery.	No
		Deep Well Injection	Wastewater is injected into Class I wells. Federal and state regulations are very restrictive.	Requires pump and treat for groundwater capture and recovery.	No
		Evaporation Ponds	Surface impoundments are used to contain treated or untreated wastewater or groundwater until it evaporates.	Not practicable.	No

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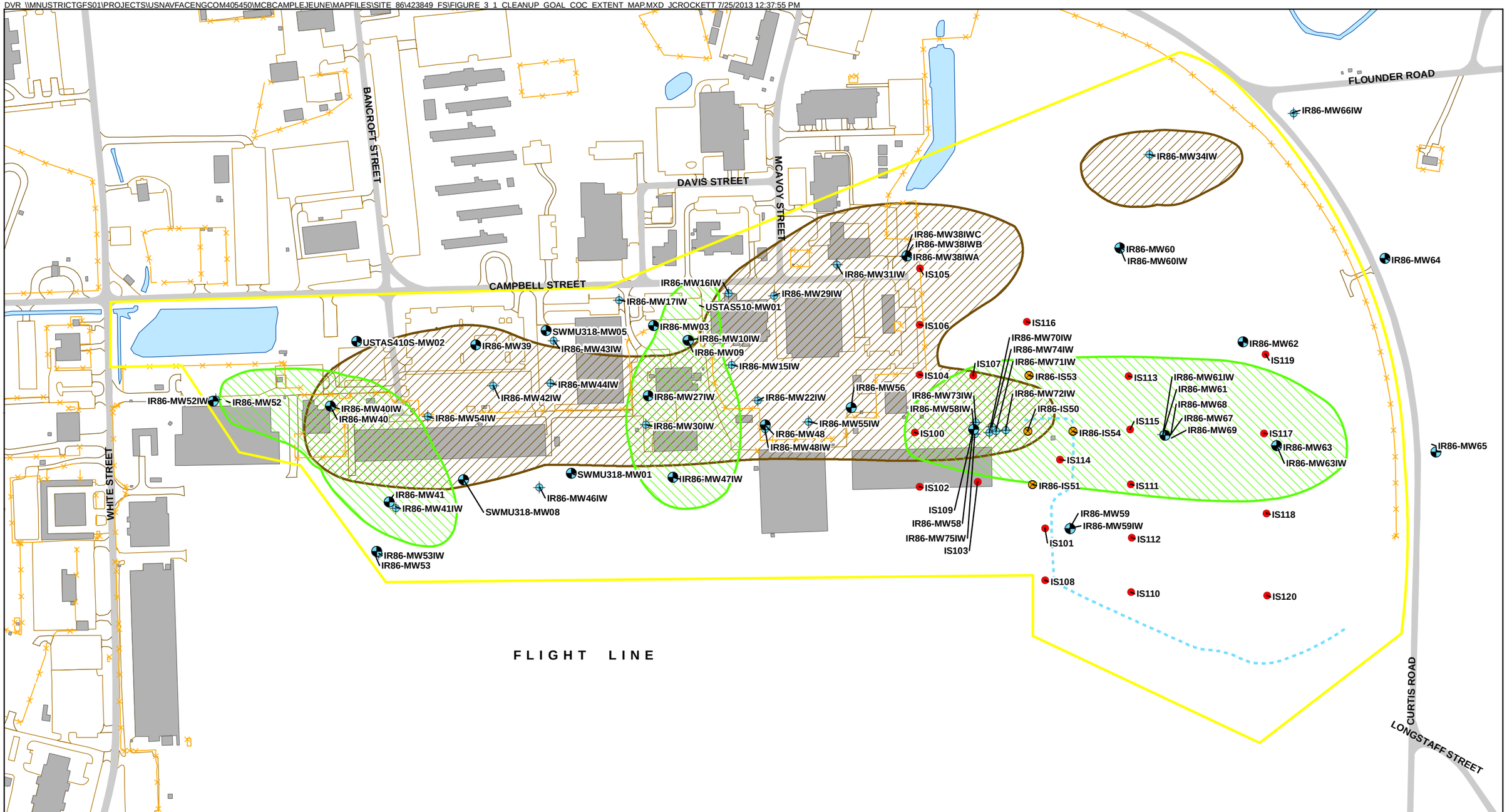

Legend

- Surficial Aquifer Monitoring Well
- Direct Push Sampling Locations (2008)
- Direct Push Sampling Locations (2009)
- Upper Castle Hayne Aquifer Monitoring Well
- Fence Line
- Drainage Ditch
- Surface Water Course Area
- Buildings
- Road
- Vehicle Parking Area
- Vehicle Driveway Area
- Extent of COC Impacted Surficial Groundwater
- Extent of COC Impacted Upper Castle Hayne Groundwater
- Current Site 86 Boundary

COC Plume:
PCE > 0.7 µg/L
TCE > 3 µg/L
cis-1,2 DCE > 70 µg/L
VC > 0.03 µg/L
Benzene > 1 µg/L

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 3-1
Cleanup Goal COC Extent Map
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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SECTION 4

Development and Screening of Alternatives

In this section, the technologies identified for further analysis are developed into remedial alternatives. Section 121(b) of CERCLA identifies the following statutory preferences when developing and evaluating remedial alternatives:

- Remedial actions involving treatment that permanently and significantly reduce the toxicity, mobility, and volume of the COCs are preferred.
- Offsite transport and disposal of COCs without treatment is considered the least favorable remedial action when practical treatment technologies are available.
- Remedial actions that use permanent solutions, alternative treatment technologies, or resource recovery technologies are to be assessed.

4.1 Development of Remedial Alternatives

Remedial alternatives were developed by combining the technologies retained following the screening process presented in **Table 3-5**. All alternatives, with the exception of No Action, meet the RAOs. The alternatives are as follows:

- Alternative 1 – No Action
- Alternative 2 – MNA and LUCs
- Alternative 3 – Air Sparging (AS) with MNA and LUCs
- Alternative 4 – ISCO with MNA and LUCs
- Alternative 5 – ERD with MNA and LUCs

LUCs prohibiting aquifer use and to evaluate and mitigate the potential for future VI pathways will be considered a part of Alternatives 2, 3, 4, and 5. The Department of the Navy (Navy) and MCIEAST-MCB CAMLEJ will implement the following measures as part of the LUCs: (1) file a Notice of Inactive Hazardous Substance or Waste Disposal, (2) file a Notice of Contaminated Site with the Register of Deeds of Onslow County, and (3) incorporate the LUCs into the Base Master Plan.

The remedial alternatives developed in the following subsections are conceptual. Assumptions are provided for each of the alternatives for the purpose of evaluation. However, actual details would be developed during the remedial design phase.

4.1.1 Alternative 1 — No Action

The No Action alternative is required under CERCLA to be evaluated as a baseline for comparing other alternatives. The No Action alternative does not include any LUCs, groundwater monitoring, or active remedial activities to minimize risk to public health or the environment.

4.1.2 Alternative 2 — MNA and LUCs

This alternative includes the periodic monitoring of groundwater to track changes in COC concentrations and geochemical conditions. As discussed in Section 2.6, NA is expected to proceed at Site 86. LUCs would be implemented for areas with groundwater COC concentrations greater than the cleanup levels. MNA is considered part of all alternatives with the exception of the No Action alternative.

Assumptions used in developing the cost estimate for this alternative include the following:

- Monitoring would include the sampling of 30 monitoring wells on an annual basis for 53 years. Proposed analyses include Target Compound List (TCL) VOCs and NAIPs. NAIPs would be collected every 5 years. Field parameters, such as water level, pH, specific conductance, temperature, ORP, DO, and Fe(II), would be measured during sample collection.

- Annual monitoring reports would be submitted to the Base, Navy, USEPA, and NCDENR to document site conditions and evaluate progress toward achieving cleanup levels.
- LUCs would be implemented and maintenance would be performed.
- Five-year Reviews would be completed to assess the protectiveness of the remedy.

The monitoring assumptions, including frequency, duration, and analytical parameters, are included in the cost estimates (**Appendix E**).

4.1.3 Alternative 3 — AS with MNA and LUCs

AS uses air injection into the saturated zone to induce mass transfer (stripping) of VOCs dissolved in groundwater. Gas flow in saturated porous media, driven by buoyancy, occurs as a complex and non-uniform series of finger-like channels, the paths of which are strongly influenced by subsurface heterogeneity.

During sparging, VOCs would be transferred to the vadose zone and subsequently to the atmosphere. Soil vapor extraction (SVE) is not included because displacement of the water table by several feet during sparging is anticipated, which could flood SVE wells. Therefore, vapor accumulation is a potential concern for buildings in the vicinity of the treatment areas. Soil vapor monitoring would be conducted in the surrounding buildings while the AS wells are in operation, as shown on **Figure 4-1**. If vapor accumulations were identified as a potential concern, vapor intrusion mitigation systems (VIMS) would be installed as needed.

The use of horizontal AS wells to distribute air through the treatment area would include the installation of two AS wells in the surficial aquifer and six AS wells in the Upper Castle Hayne aquifer. The design for this AS system was the based on the results of the 2006 Site 86 Air Sparge Pilot Study, which indicated that AS was an effective technology for this site (**Table 2-1**). For clarity, surficial aquifer Treatment Area 2 and upper Castle Hayne Treatment Area 2 well screens will be installed using the same casings and depths, as the 2006 Pilot study indicated that a horizontal well installed at this depth could effectively remediate both the upper Castle Hayne and surficial aquifer zones.

The length and depth of each well are summarized as follows. A single-ended design for each horizontal well was assumed for the cost evaluation. The conceptual layout of the proposed horizontal AS system is shown on **Figure 4-1.**

Assumptions for this alternative include the following:

- Installation and start-up are anticipated to require approximately 60 days.
- Operation of the system will be in a pulsed mode at approximately 1 ft^3 per minute per foot of screen.
- Surficial Treatment Area 1 AS wells will be installed to a depth of 50 feet bgs, and Surficial Treatment Area 2 and Upper Castle Hayne Treatment Area 2 AS wells will be installed to a depth of 70 feet bgs.
- Surficial Treatment Area 1 – Install two horizontal wells to approximately 50 feet bgs with 165-foot screens and 430-foot risers.
- Surficial Treatment Area 2/Upper Castle Hayne Treatment Area 2 AS wells will be installed using the same 1,370-foot casings and running four sets of screens (400-foot sections for Upper Castle Hayne Treatment Area 2 and 275-foot sections for Surficial Treatment Area 2).
- Upper Castle Hayne aquifer Area 1 AS wells will be installed with 350-foot screens and 840-foot risers.
- Operation of the AS systems would continue for up to 5 years. Treatment would be considered complete when COC concentrations are below 100 times the cleanup level.

- Semi-annual groundwater monitoring of existing groundwater monitoring wells IR86-MW10IW, IR86-MW27IW, IR86-MW42IW, IR86-MW42IW, IR86-MW44IW, IR86-MW22IW, and IR86-MW55IW would be performed during system operation (**Figure 4-1**). An additional five monitoring wells would be installed in each treatment area and sampled semi-annually. Groundwater samples would be analyzed for TCL VOCs to evaluate progress toward achieving cleanup goals.
- Three soil vapor monitoring points would be installed in each of the treatment areas and sampled semi-annually for TCL VOCs.
- Up to four VIMS would be installed, based on the results of the VI sampling.
- MNA would initially be implemented outside the treatment areas on select wells, and would later be implemented site-wide after active AS operations ceased. MNA would include the sampling of 30 monitoring wells on an annual basis for 35 years for TCL VOCs and NAIPs. NAIPs would be collected every 5 years. Field parameters, such as water level, pH, specific conductance, temperature, ORP, DO, and Fe(II), would be measured during sample collection.
- An annual monitoring report would be submitted to the Base, Navy, USEPA, and NCDENR to document site conditions and evaluate progress toward achieving cleanup levels.
- LUCs would be implemented and maintenance would be performed.
- Five-year Reviews would be completed to assess the protectiveness of the remedy.

4.1.4 Alternative 4 — ISCO with MNA and LUCs

ISCO uses the injection of chemical oxidants into the subsurface to oxidize target contaminants into innocuous compounds. Intermediates such as acetone and methyl ethyl ketones can form temporarily, but these are oxidized as treatment continues. A number of CVOCs can be successfully treated via chemical oxidation. Key factors influencing the effectiveness of ISCO are the total oxidant demand of the aquifer matrix and contact between the COC and the oxidant. Permanganate is recommended as the oxidant because it is relatively easy to handle in the field, has a greater persistence in the environment than other oxidants, and showed success in previous Pilot Studies at MCIEAST-MCB CAMLEJ. However, multiple treatments may be needed to achieve adequate mass reduction prior to MNA transition.

Although the oxidizing potential of the permanganate anion is less than that of other oxidants such as hydrogen peroxide, persulfate, and ozone, it is still efficient and is kinetically favorable for TCE. The chemistry of permanganate is relatively simple (no catalyst involved), and selective, and its tendency for higher persistence in the subsurface enables longer contact times and transport distances in the subsurface when limited natural oxidant sinks are present.

Based on the access limitations associated with working at Site 86, an injection and extraction (re-circulation) approach was selected for the delivery of the ISCO reagent. The injection and extraction approach would be used to enhance distribution of the permanganate and reduce the number of injection points needed compared to an injection delivery model.

Similar to the recirculation injection and extraction well layout used in the 2011 and 2012 Pilot Study, a configuration of six injection wells along the perimeter of the treatment area and two centrally located recovery wells would be used to deliver the ISCO substrate. **Figure 4-2** depicts this injection and extraction well layout. Based on the radius of influence (ROI) observed during the Pilot Study, the treatment areas would be broken up into smaller recirculation cells where this six injection well and two extraction well configuration can be effectively implemented. The recirculation cells were sized based on an assumed ROI for the extraction wells of 50 feet for the surficial and 75 feet for the upper Castle Hayne aquifer. As a result, each treatment area will be divided into one to four treatment recirculation cells, as summarized in **Table 4-1** and as shown on **Figures 4-3** and **4-4**.

TABLE 4-1
Treatment Area – Treatment Recirculation Cells Summary
Operable Unit 20 (Site 86), MCIEAST-MCB CAMLEJ, North Carolina

Area	Treatment Area Dimensions (feet)	Treatment Grid Dimensions (feet)	Number of Treatment Recirculation cells
Surficial Aquifer			
Area 1	210 (L) X 105 (W)	210 (L) X 105 (W)	1
Area 2	420 (L) X 210 (W)	105 (L) X 210 (W)	4
Upper Castle Hayne Aquifer			
Area 1	420 (L) X 250 (W)	105 (L) X 250 (W)	4
Area 2	500 (L) X 175 (W)	250 (L) X 175 (W)	2

(L)= length, (W)= width

To reduce the need for permanent infrastructure (underground piping to connect extraction and injection wells) and to eliminate the need for four injection and extraction systems, the conceptual design for the ISCO approach is to operate mobile injection extraction system at each of the individual recirculation cells consecutively (11 injection and extraction events, with five in the surficial aquifer and six in the Upper Castle Hayne aquifer). The primary components of the mobile injection extraction system will include a booster pump, cartridge bag filter, a dosing pump, static mixer, and distribution manifold with dedicated flow meters, pressure gauges, and throttling valves enclosed in dual axle trailer. The system will also be equipped with telemetry and fail-safe interlock controls including process line pressure sensors and pressure transducers for each injection well to monitor water levels. All injections would be completed by experienced personnel.

Other assumptions for the ISCO followed by MNA alternative included the following:

- Installation of 68 injection and extraction wells in the surficial and Upper Castle Hayne aquifers is expected to require 7 months.
- One injection and extraction event is assumed, and MNA is expected to be implemented afterwards.
- Injecting and recirculating the permanganate is expected to require 10 months, with an average of 15 days for the recirculation in each of the five surficial aquifer recirculation cells, and 10 days in each of the Upper Castle Hayne aquifer recirculation cells.
- The injection and extraction system would operate at 12 gpm (6 gpm per extraction well and 2 gpm per injection well) for 24 hours per day. The ISCO recirculation system assumes that the surficial aquifer grids would have 15 days of post-injection recirculation and the upper Castle Hayne aquifer treatment grids would have 10 days of post-injection recirculation.
- The surficial aquifer active treatment area is assumed to be approximately 6,055,000 ft^3 of soil with assumed porosities of 20 percent (surficial aquifer) and 25 percent (upper Castle Hayne aquifer), and site-specific average permanganate natural oxidant demand of 6.6 grams per kilogram, for a total injection volume of approximately 3,304,029 gallons of a 4 percent potassium permanganate solution (or roughly 1,102,885 pounds of potassium permanganate).
- Semi-annual groundwater monitoring of existing groundwater monitoring wells IR86-MW10IW, IR86-MW27IW, IR86-MW42IW, IR86-MW42IW, IR86-MW44IW, IR86-MW22IW, and IR86-MW55IW would be performed during system operation (**Figures 4-3** and **4-4**). An additional five monitoring wells would be installed in each treatment area and sampled semi-annually. The location of the additional monitoring

wells would be based on final design of the system, and would be laid out to provide the optimal coverage.

- Groundwater samples would be analyzed for TCL VOCs to evaluate the injection and extraction system performance and the progress toward achieving cleanup goals. Field parameters such as water level, pH, specific conductance, temperature, ORP, DO, permanganate, and Fe(II) would be measured during sample collection.
- MNA would initially be implemented outside the treatment areas on select wells, and would later be implemented site-wide after active treatment. Monitoring would include the sampling of 30 monitoring wells on an annual basis for 35 years. Proposed analyses include TCL VOCs and NAIPs. NAIPs would be collected every 5 years. Field parameters, such as water level, pH, specific conductance, temperature, ORP, DO, and Fe(II), would be measured during sample collection.
- Annual monitoring reports would be submitted to the Base, Navy, USEPA, and NCDENR to document site conditions and evaluate progress toward achieving cleanup levels.
- LUCs would be implemented and maintenance would be performed.
- Five-year Reviews would be completed to assess the protectiveness of the remedy.

4.1.5 Alternative 5 — ERD with MNA and LUCs

ERD promotes the natural degradation of chlorinated solvents through the addition of carbon sources (electron donors). ERD substrates are commonly used electron donors for remediation of CVOCs and can be categorized into slow-releasing (such as emulsified vegetable oil [EVO]) and soluble (such as lactate). Various commercial products are available.

In most natural systems, organic electron donors are in short supply. By adding such donors, natural biodegradation is enhanced. However, insufficient or inappropriate indigenous microbial populations can prevent the complete biodegradation of the chlorinated hydrocarbons. At Site 86, indigenous populations of desirable microbes are present; however, the populations are less than optimal. Thus, the ERD substrate would be amended with a bioaugmentation culture to support the complete biodegradation of the chlorinated hydrocarbons.

For the purposes of this FS, Alternative 5 would include ERD with a suitable substrate to treat the target area. The 2012 Pilot Study demonstrated that lactate could be effectively distributed throughout the treatment area using the injection and extraction method and demonstrated that it could reduce COC concentrations by as much as 93 percent. For full-scale implementation, a slower release substrate could eliminate the need for additional injections, which are estimated to require 10 months to complete. To provide for a sustained substrate that can be effectively delivered to the treatment area, a 50 percent EVO and 50 percent lactate blend substrate was selected. This EVO and lactate blend was shown to be effective during the 2006 Pilot Study completed at Site 89. During the ERD performance monitoring at Site 89, TCE concentrations were reduced by 97.5 percent in samples collected from monitoring wells within the treatment area. The ERD substrate would be injected using the injection and extraction approach detailed in Section 4.1.5. Alternate substrates would be evaluated and discussed in the remedial design.

It is assumed that bioaugmentation culture would be required for all injection wells. Based on the results of the 2012 Pilot Study, it is estimated that approximately 1 liter of culture would be required for every 14,150 ft^3 of treatment area.

All injections would be completed by trained personnel wearing upgraded Level D personal protective equipment (PPE), including nitrile gloves and face shields.

Other assumptions used include the following:

- Well installation is expected to require 7 months.

- One injection event is assumed.
- Injecting and recirculating the ERD substrate is expected to require 10 months.
- The ERD substrate would be injected at 12 gpm for 10 hours per day.
- The injection and extraction system would operate at 12 gpm (6 gpm per extraction well and 2 gpm per injection well) for 24 hours per day, assuming a 15-day recirculation of each surficial aquifer treatment grid and a 10-day recirculation of each upper Castle Hayne aquifer treatment grid.
- The active treatment area is assumed to be approximately 6,055,000 ft^3 of soil with an assumed porosity of 25 percent for approximately 20,000 gallons of an EVO and lactate solution per injection event (or roughly 238,100 pounds).
- The bioaugmentation culture required would be approximately 428 liters.
- Treatment would be considered complete when COC concentrations are below 100 times the cleanup levels.
- Semi-annual groundwater monitoring of existing groundwater monitoring wells IR86-MW10IW, IR86-MW27IW, IR86-MW42IW, IR86-MW42IW, IR86-MW44IW, IR86-MW22IW, and IR86-MW55IW would be performed during system operation. An additional five monitoring wells would be installed in each treatment area and sampled semi-annually. Water samples would be analyzed for TCL VOCs. NAIP parameters chloride, methane, ethene, ethane, TOC, VFAs, and microbial analysis for DHC populations and ERD-related function genes would be monitored, as well as field parameters such as water level, pH, specific conductance, temperature, ORP, DO, and Fe(II).
- MNA would initially be implemented outside the treatment areas on select wells, and would later be implemented site-wide after active treatment. Monitoring would include the sampling of 30 monitoring wells on an annual basis for 35 years. Proposed analyses include TCL VOCs and NAIPs. NAIPs would be collected every 5 years. Field parameters, such as water level, pH, specific conductance, temperature, ORP, DO, and Fe(II), would be measured during sample collection.
- Annual monitoring reports would be submitted to the Base, Navy, USEPA, and NCDENR to document site conditions and evaluate progress toward achieving cleanup levels.
- LUCs would be implemented and maintenance would be performed.
- Five-year Reviews would be completed to assess the protectiveness of the remedy.

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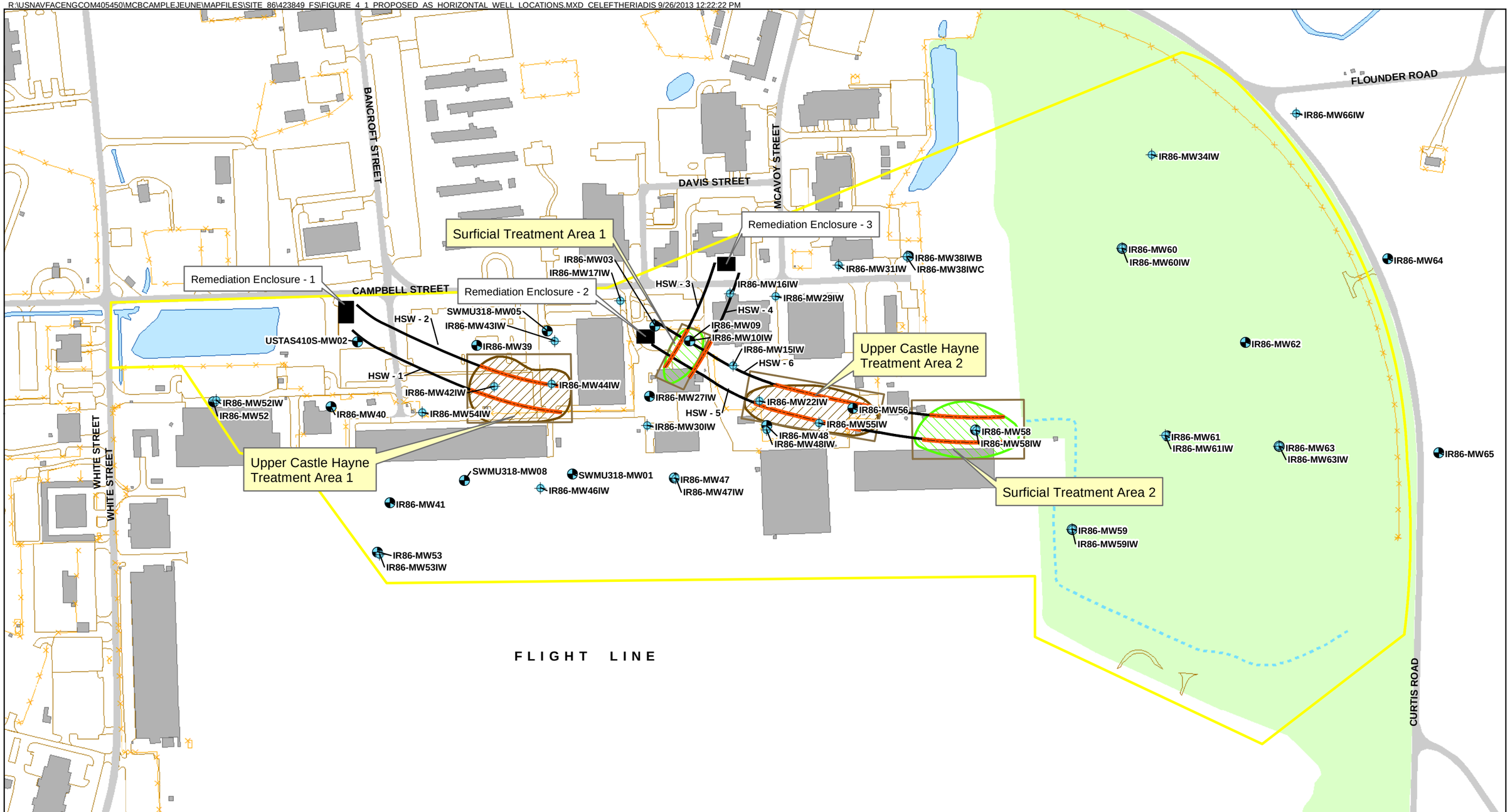

Legend

- Upper Castle Hayne Aquifer Monitoring Well
- Surficial Aquifer Monitoring Well
- Fence Line
- Drainage Ditch
- Surface Water Course Area
- Buildings
- Road
- Vehicle Parking Area
- Extent of COC Surficial Groundwater
- Extent of COC Impacted Upper Castle Hayne Groundwater
- Treatment Areas
- Northeast Grass Area
- Remediation Enclosure
- Current Site 86 Boundary
- Horizontal Sparge Well

COC Plume:
PCE > 0.7 µg/L
TCE > 3 µg/L
cis-1,2 DCE > 70 µg/L
VC > 0.03 µg/L
Benzene > 1 µg/L

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 4-1
Proposed AS Horizontal Well Locations
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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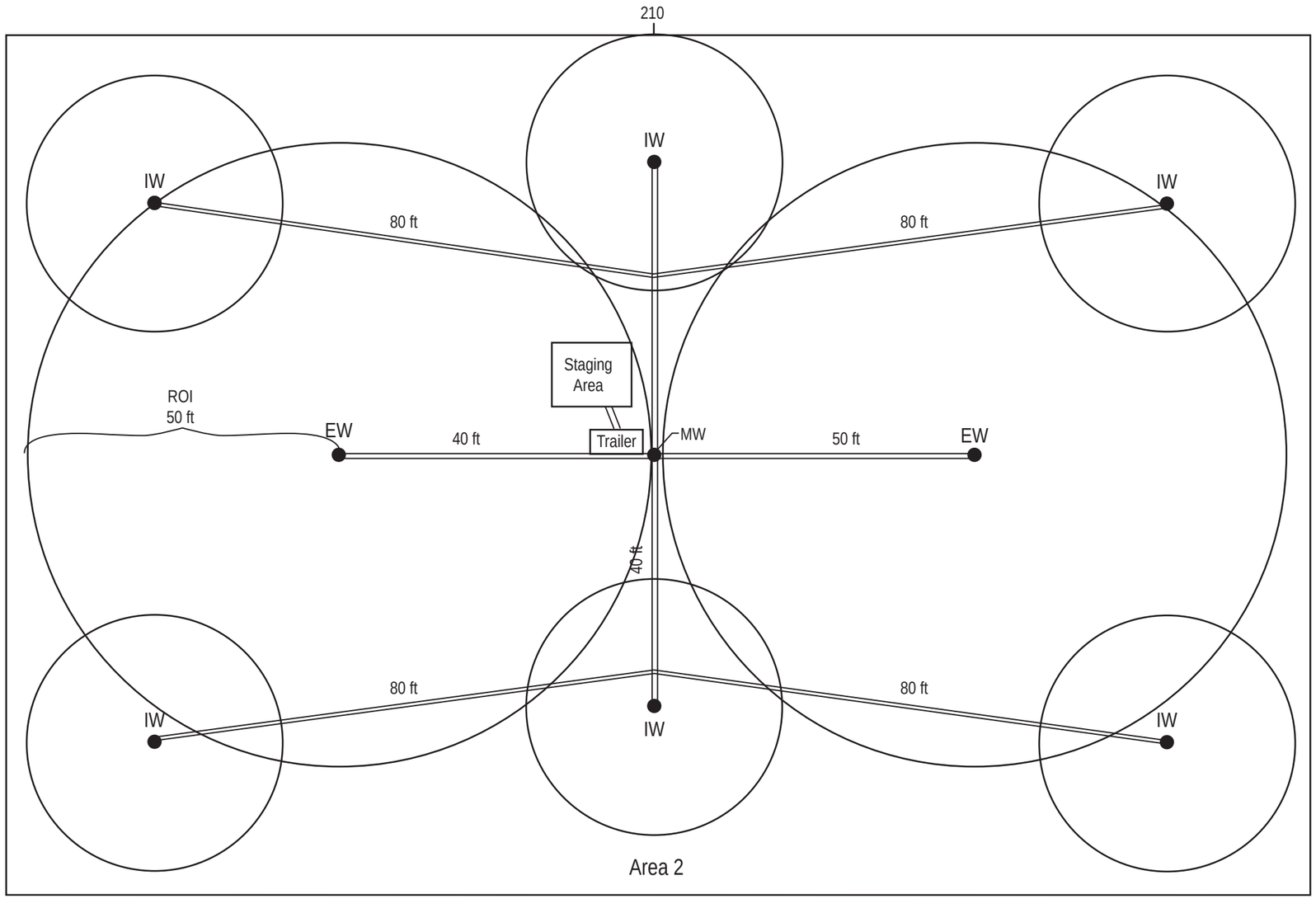

IW = Injection Well
EW = Extraction Well
MW = Monitoring Well
═ Injection/Extraction well plumbing

Figure 4-2
Typical Injection/Extraction Well Layout
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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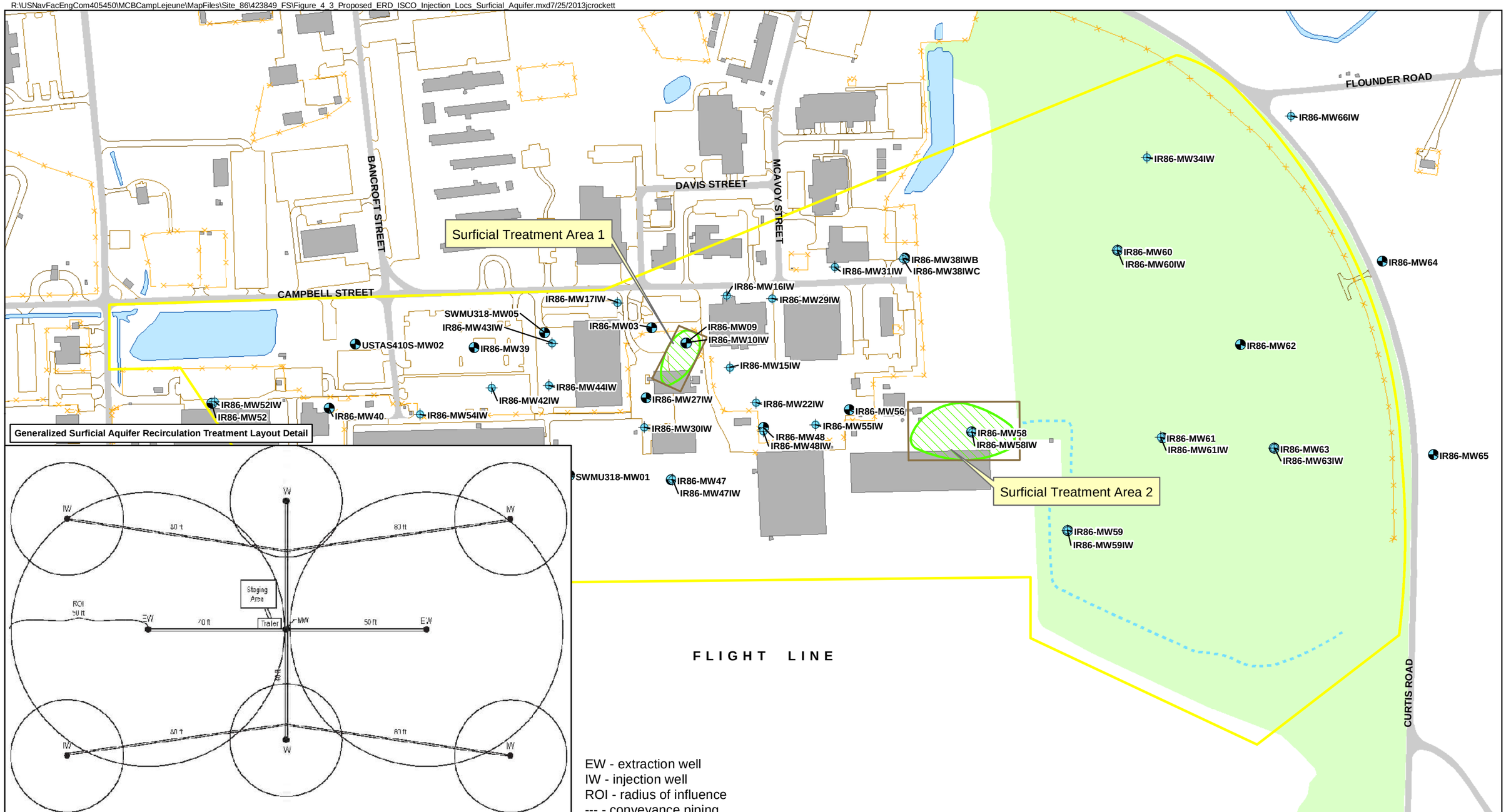

Legend

- Upper Castle Hayne Aquifer Monitoring Well
- Surficial Aquifer Monitoring Well
- Treatment Areas
- Extent of Treatment Goals Surficial Groundwater
- Fence Line
- Drainage Ditch
- Surface Water Course Area
- Road
- Buildings
- Vehicle Parking Area
- Vehicle Driveway Area
- Northeast Grass Area
- Current Site 86 Boundary

Treatment Goals:
PCE > 70 µg/L
TCE > 300 µg/L
cis-1,2 DCE > 7000 µg/L
VC > 3 µg/L
Benzene > 1 µg/L

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 4-3
Proposed ERD/ISCO Injection Locations – Surficial Aquifer
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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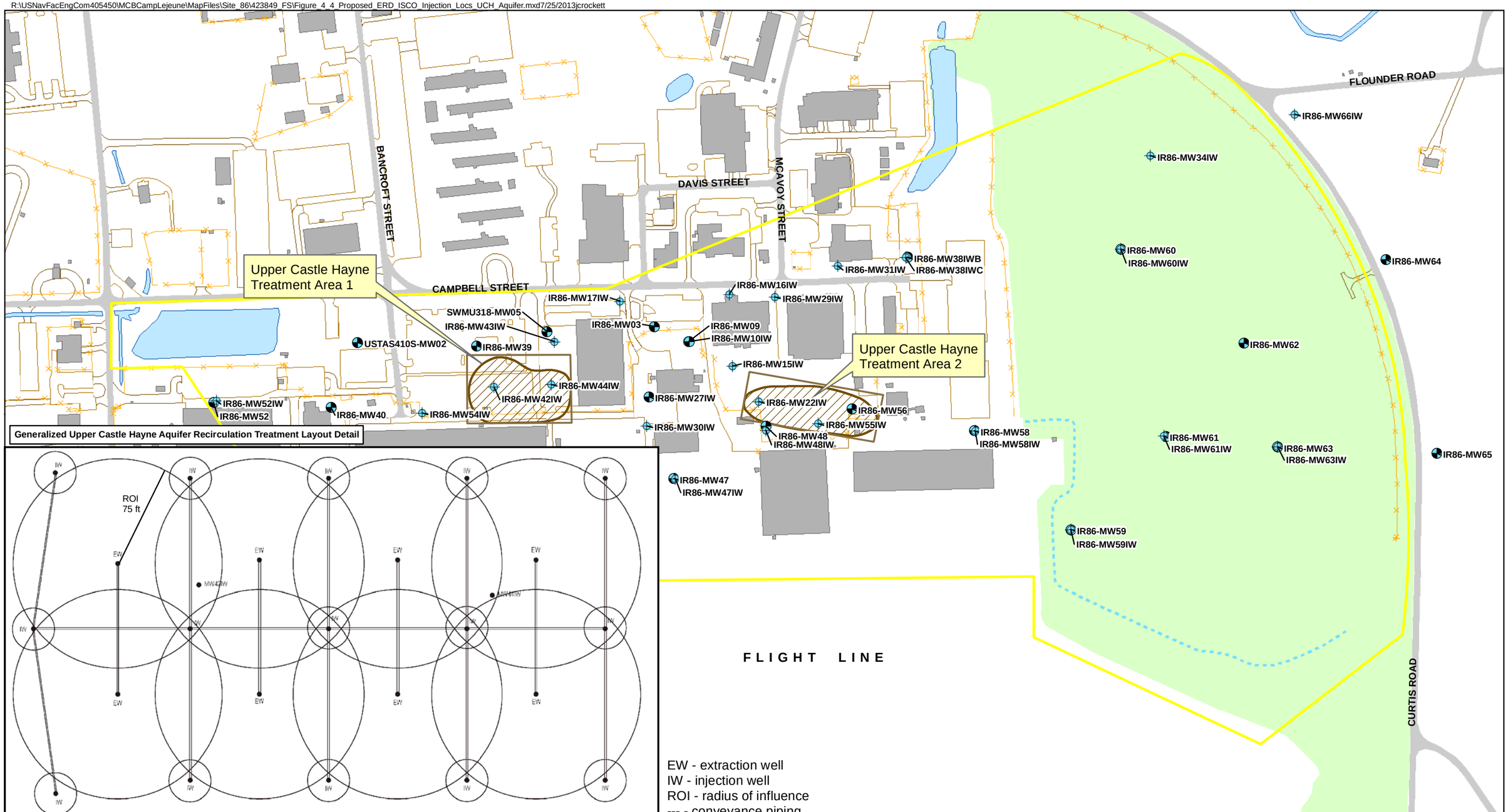

Legend

- Upper Castle Hayne Aquifer Monitoring Well
- Surficial Aquifer Monitoring Well
- Treatment Areas
- Extent of Treatment Goals Upper Castle Hayne Groundwater
- Fence Line
- Drainage Ditch
- Surface Water Course Area
- Buildings
- Road
- Vehicle Parking Area
- Vehicle Driveway Area
- Northeast Grass Area
- Current Site 86 Boundary

Treatment Goals:
PCE > 70 µg/L
TCE > 300 µg/L
cis-1,2 DCE > 7,000 µg/L
VC > 30 µg/L
Benzene > 1 µg/L

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 4-4
Proposed ERD/ISCO Injection Locations – Upper Castle Hayne Aquifer
Feasibility Study
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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SECTION 5

Detailed Analysis of Alternatives

The specific statutory requirements for remedial actions that must be addressed in the Record of Decision (ROD) and supported by this FS include:

- Protect human health and the environment.
- Comply with ARARs or define criteria for invoking a waiver.
- Be cost-effective.
- Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
- Satisfy the preference for treatment that reduces the toxicity, mobility, or volume as a principal element or explain why this is not attainable.
- In addition, CERCLA 121(b)(1)(A) emphasizes evaluating long-term effectiveness and related considerations for each of the alternative remedial actions. These statutory considerations include:
- Long-term uncertainties associated with land disposal
- Goals, objectives, and requirements of the Solid Waste Disposal Act
- Persistence, toxicity, and mobility of hazardous substances and their constituents (and their propensity to bioaccumulate)
- Short- and long-term potential for adverse health effects from human exposure
- Long-term maintenance costs
- Potential for future remedial action costs if the alternative were to fail

Nine evaluation criteria provided by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) to address these statutory requirements and additional technical and policy considerations that are important for a CERCLA remedial action. The nine criteria serve as the basis for conducting the detailed analyses during the FS process and for subsequently selecting an appropriate remedial action. In this section, the remedial alternatives described in Section 4 are discussed individually against these nine evaluation criteria and then comparatively to identify key tradeoffs.

Sustainability is not one of the nine evaluation criteria. However, in support of Navy and USEPA guidance, it is considered during remedial alternative selection. The Navy, in cooperation with the United States Army Engineering and Support Center-Huntsville and Battelle, has developed a tool to incorporate sustainability metrics into the selection of remedial alternatives. SiteWise is a stand-alone tool that assesses the environmental footprint of remedial actions in terms of a consistent set of sustainability metrics: greenhouse gas (GHG) emissions, energy use, criteria air emissions (including nitrogen oxides [NO_x], sulfur oxides [SO_x], and particulate matter less than 10 microns in diameter [PM_{10}]), water consumption, and worker safety. SiteWise provides a comparative assessment of different remedial alternatives based on the significant life-cycle impacts of each alternative, including: material production (polyvinyl chloride, EVO, permanganate, and so forth); transportation of equipment, personnel, and materials to the site; equipment use during implementation; electricity use to run equipment or pumps during the operations phase of a remedy; and residuals handling (Battelle, 2011). A matrix showing how the sustainability metrics relate to the NCP criteria is provided in **Table 5-1**.

SiteWise results can be used to compare the various alternatives. However, many of the assumptions are based on industry standards instead of site-specific or particular remedy equipment and materials information and should not be viewed as relevant to a particular remedy. Rather, they should be used to

make relative comparisons. The full results of the SiteWise model are provided in the Sustainability Analysis Technical Memorandum, included in **Appendix F.**

5.1 Evaluation Criteria

The nine evaluation criteria developed by USEPA are described in the following subsections.

5.1.1 Protection of Human Health and the Environment

The assessment against this criterion evaluates how each alternative, as a whole, achieves and maintains protection of human health and describes how site risks are eliminated, reduced, or controlled through treatment, engineering, or LUCs. This assessment also allows for consideration of whether the alternative poses unacceptable short-term or cross-media impacts.

5.1.2 Compliance with ARARs

This evaluation criterion is used to determine whether an alternative would meet all of its federal, state, and local ARARs, as identified in Section 3.1. The analysis should summarize which requirements are applicable or relevant and appropriate for each alternative and describe the extent to which the alternative meets these requirements. If a waiver is required because an ARAR is not met, the basis for justification should be discussed.

5.1.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence are measured in terms of the risk remaining at the site after response objectives have been met. Alternatives providing the highest degree of long-term effectiveness and permanence are those that leave little or no waste at the site, do not require long-term maintenance and long-term monitoring (LTM), and minimize the need for LUCs. The evaluation of this criterion includes consideration of the following factors:

- The magnitude of residual risk to human and environmental receptors posed by any untreated waste or treatment residues remaining at the conclusion of remedial activities
- The type, degree, and adequacy of long-term controls required to manage untreated waste or treatment residues at the conclusion of remedial activities
- The long-term reliability of engineering and/or institutional actions to provide continued protection from residuals
- The potential need to replace technical components of the alternative and the potential exposure pathway and risks posed should the remedial action need replacement

5.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances. This evaluation focuses on the following factors for each remedial alternative:

- The treatment process the alternative would employ and the materials it would treat
- The amount of hazardous substances that would be destroyed or treated, including how the principal risk(s) would be addressed
- The degree of expected reduction in the toxicity, mobility, or volume measured as a percentage of reduction
- The degree to which the treatment would be irreversible
- The type and quantity of residuals that would remain following treatment
- Whether the alternative would satisfy the statutory preference for treatment as a principal element

5.1.5 Short-term Effectiveness

This evaluation criterion addresses the effects of the alternative during the construction and implementation phase until remedial response objectives are met. The following factors should be addressed for each alternative:

- Short-term risks that may be posed to the community during construction and implementation of an alternative
- Potential adverse impacts to workers that may occur during construction and implementation, including an evaluation of the effectiveness and reliability of any protective measures that would be taken
- Potential adverse environmental impacts that may result from the construction and implementation of an alternative, including an evaluation of the reliability of available mitigation measures in preventing or reducing the potential impacts
- Estimate of the time required to achieve remedial response objectives

5.1.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. The following factors are considered during analysis of this criterion:

- Technical Feasibility
  - Ability to construct and operate
  - Reliability of the technology
  - Ease of undertaking additional remedial action, if needed
  - Ability to monitor effectiveness
- Administrative Feasibility
  - Ability to obtain approvals and coordinate with other agencies
- Availability of Services and Materials
  - Availability of adequate offsite treatment, storage capacity, and disposal services
  - Availability of necessary equipment, specialists, and provisions
  - Availability of services and materials, including the potential for obtaining competitive bids
  - Availability of prospective technologies

5.1.7 Cost

Preliminary cost estimates were developed for each remedial alternative. These cost estimates are used to compare the alternatives, not to bid the work. These estimates were made from available information, (that is, they have an expected accuracy of -30 percent to +50 percent for the scope of action described for each alternative). The estimates are divided into capital costs and operation and maintenance (O&M) costs (which also includes LTM costs), and are based on information from vendors, regulators, and experience from similar projects. The present worth of the O&M and capital costs is included. Details of these cost estimates are included in **Appendix E**. Significant uncertainties that may affect cost are discussed with each alternative.

5.1.8 State Acceptance

This assessment evaluates the technical and administrative issues and concerns the State may have regarding each of the alternatives. NCDENR will review and comment on this FS.

5.1.9 Community Acceptance

This assessment evaluates the issues and concerns the public may have regarding each of the alternatives. As with state acceptance, community concerns were taken into account in evaluating each alternative in this FS. Consistent with the NCP, public comments will be solicited on the selected alternative presented in the Proposed Remedial Action Plan (PRAP). Any comments will be addressed in the ROD and will be considered by USEPA in the selection of the remedy.

5.2 Individual Analysis of Alternatives

Seven of the nine USEPA criteria were used in the detailed analysis of the groundwater alternatives. State and community acceptance will be evaluated for the alternatives following the Public Meeting and the PRAP. The analyses are summarized in **Table 5-2.**

5.2.1 Alternative 1 — No Action

Protection of Human Health and the Environment

The No Action alternative is not protective of human health or the environment. As discussed in Section 2.7.1, the findings of the HHRA indicate that site groundwater would present unacceptable risk if used for potable purposes by residential receptors. This alternative would not provide treatment, engineering, or LUCs that would mitigate exposure risks to receptors.

Compliance with ARARs

This alternative would not meet the action-specific ARAR for LUCs for contamination left in place or the chemical-specific ARARs for groundwater since concentrations exceed applicable NCGWQS or MCLs. There are no location-specific ARARs applicable to this alternative.

Long-term Effectiveness and Permanence

This alternative would not meet the long-term effectiveness criterion because, without monitoring, the site risks are assumed to remain indefinitely. Furthermore, since LUCs would not be put in place, there would be no mechanism for limiting the exposure of potential receptors to contaminated groundwater.

Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative would provide no reduction of toxicity, mobility, or volume. Natural biodegradation would likely occur, but at unmonitored rates and at unknown locations. Therefore, it must be assumed that no COCs would be actively treated under this alternative.

Short-term Effectiveness

There would be no remedial construction and no immediate environmental, worker, or community impacts associated with this remedy in the short-term.

Implementability and Costs

There would be no implementability concerns or costs associated with this remedy.

5.2.2 Alternative 2 — MNA and LUCs

Protection of Human Health and the Environment

Alternative 2 – MNA is protective of human health and the environment because site-related COCs would degrade over time from natural processes, and LUCs would be maintained until RAOs are achieved, mitigating potential human health risks from exposure to impacted site media.

Compliance with ARARs

This alternative would comply with ARARs, as COCs would attenuate below chemical-specific ARARs. LUCs would be in place until RAOs are achieved and MNA would be conducted to monitor COC degradation.

Long-term Effectiveness and Permanence

This alternative would eventually meet the long-term effectiveness and permanence criterion when COCs have naturally attenuated below the NCGWQS or MCL. The timeframe to reach NCGWQS or MCLs, as noted in Section 2, is 53 years and would be an effective remedy, as LUCs would prevent exposure and monitoring would be conducted to evaluate potential plume migration.

Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative would not satisfy the statutory preference for treatment as a principal element. However, this alternative identifies the natural processes (NA), such as biodegradation, adsorption, and dilution that reduces the toxicity, mobility or volume of the plume over time. Short-term Effectiveness

This alternative does not include any initial construction that would put the environment, workers, or the community at risk. However, based on the sustainability analysis, transportation of personnel to and from the site for MNA, and transportation and disposal of investigation-derived waste generated during sampling events, would contribute to environmental (primarily GHG and criteria air pollutants) and worker safety impacts throughout the life of the remedy.

Implementability

This alternative is technically feasible and easily implementable with available services and materials. The existing well network is assumed to be sufficient for MNA. This alternative could be implemented quickly.

Cost

The total 53-year, present-worth cost for this alternative is estimated to be $584,513. The capital cost for this alternative is estimated to be $27,600. The present-worth O&M cost is estimated to be $556,913. Capital costs associated with this alternative include LUC implementation activities and annual costs are driven by MNA costs.

5.2.3 Alternative 3 — AS with MNA and LUCs

Protection of Human Health and the Environment

The AS alternative is protective of human health and the environment because site-related COCs would be physically removed. However, since AS is not a destructive technology, contaminant mass would be mobilized and the remedy could create risk to workers via VI within Site 86 buildings. VIMS may need to be installed in Site 86 buildings to mitigate the potential VI risk. LUCs and groundwater monitoring would be maintained until RAOs are achieved, mitigating potential human health risks from exposure to impacted site media.

Compliance with ARARs

This alternative would comply with chemical-specific ARARs by reducing the concentrations of COCs in groundwater through volatilization and MNA. Air monitoring of the nearest occupied structures would be required to ensure that vapor concentrations do not exceed applicable regulatory standards. Location-specific ARARs and action-specific ARARs, including well installation, subsurface injections, potential air emissions, and waste handling ARARs, would be complied with throughout implementation of this alternative.

Long-term Effectiveness and Permanence

This alternative is considered to meet the long-term effectiveness and permanence criterion. Operation of the AS system would be expected to require 5 years to reduce COC concentrations below target treatment concentrations, and NA processes would be expected to reduce COC concentrations below NCGWQS after the completion of active treatment in approximately 40 years. The AS system relies on regular maintenance of equipment and could potentially involve replacement of parts to keep the system operational. Additionally, regular monitoring after system shutdown would be required to assess any rebounding.

Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative would reduce toxicity and volume of the plume in the target treatment area. However, because AS is not a destructive process, most of the volatilized VOCs would be released into the atmosphere. This alternative would satisfy the statutory preference for treatment as a principal element.

Short-term Effectiveness

The short-term effectiveness of this alternative would be contingent on engineering controls to protect the environment, workers, and the community during well installation and operations. This alternative employs AS within the target area to volatilize VOCs from the groundwater, thereby reducing the toxicity, mobility, and volume of contaminants, but potentially creating VI issues. AS of VOCs is primarily a mass-transfer (volatilization) process, with the potential for some biodegradation; therefore, vapors would be produced during the process. VIMS would be installed to mitigate any potential VI issues.

The results of the sustainability assessment indicated that the operations phase is the driver for overall environmental impacts of this alternative. Electricity to power the compressor for 5 years accounted for the majority of environmental impacts, and transportation of personnel to the site for O&M accounted for the majority of worker safety impacts. Field implementation would be anticipated to take approximately 3 months to install the AS wells and begin operation of the AS system. Operation of the system and routine O&M would be conducted for 5 years.

Implementability

This alternative would be implementable with readily available services and materials. Qualified horizontal directional drilling companies and AS components are readily procurable. Horizontal AS has been successfully implemented at Site 86 as part of the 2006 Pilot Study.

Costs

The total present-worth cost for this alternative is estimated to be $5,460,507. The capital cost for this alternative is estimated to be $3,418,502. The total present-worth O&M and MNA cost is estimated to be $2,042,005.

5.2.4 Alternative 4 — ISCO with MNA and LUCs

Protection of Human Health and the Environment

The ISCO alternative is protective of human health and the environment because groundwater contaminants would be oxidized to innocuous compounds, thereby reducing groundwater contamination over time. Because ISCO is a destructive technology, it is not likely to create short- or long-term VI issues. LUCs would remain in place until RAOs have been met, mitigating potential human health risks from exposure to impacted media.

Compliance with ARARs

This alternative would comply with chemical-specific ARARs by reducing the concentrations of COCs through chemical oxidation and MNA. Location-specific ARARs and action-specific ARARs, including injection well installation, subsurface injections, and waste handling ARARs, would be complied with throughout implementation of this alternative.

Long-term Effectiveness and Permanence

This alternative would be expected to meet the long-term effectiveness and permanence criterion. However, there is a possibility of rebound: when contaminants are treated in readily accessed flow paths, residual contaminants can be left in place and either sorbed to the soil or trapped in less transmissive zones. In these cases, after active treatment is complete, the residual contaminants can re-enter the aquifer through diffusion and dissolution. The treatment effectiveness is immediate and considered permanent upon contact of the oxidant with contaminants in groundwater for ISCO. After completion of active treatment, NA processes would be expected to reduce COC concentrations below NCGWQS. In addition, with any injection technology, subsurface distribution is uncertain.

Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative would permanently reduce the toxicity and volume of COCs through the permanent oxidation of chemicals into innocuous compounds. This alternative would satisfy the statutory preference for treatment as a principal element.

Short-term Effectiveness

The short-term effectiveness of this alternative would be contingent on engineering controls to protect the environment, workers, and the community during implementation. Permanganate is a strong oxidant and poses risks to site workers during injection. However, assuming appropriate PPE is worn at all times by workers, permanganate solution can be safely handled and injected by workers in the field. Engineering controls would be required to protect the environment from spills. Additional risks to worker safety include operating drill rigs to install the injection wells and exposure to COCs from residuals handling. The results of the sustainability assessment indicate that the overall environmental impacts are primarily associated with the manufacture and transportation of permanganate and equipment and material use for the installation of injection wells. The installation of the injection wells and injection of the ISCO substrate would be anticipated to take approximately 17 months to complete.

Implementability

This alternative would be technically feasible and implementable with available services and materials. One of the primary factors in any injection technology is distribution within the contaminated media. Thin clay lenses throughout the surficial aquifer may cause preferential flow paths and impede reagent distribution. This could limit ISCO's effectiveness, as it relies on direct contact between the oxidant and the COCs.

Costs

The total present-worth cost for this alternative is estimated to be $7,910,878. The capital cost for this alternative is estimated to be $7,375,790. The total present-worth O&M and MNA cost is estimated to be $535,088.

5.2.5 Alternative 5 — ERD with MNA and LUCs

Protection of Human Health and the Environment

The ERD alternative is protective of human health and the environment because groundwater contamination would be reduced within the target area by promoting biological degradation of COCs. LUCs would remain in place until RAOs have been met, mitigating potential human health risks from exposure to impacted media.

Compliance with ARARs

This alternative would comply with chemical-specific ARARs by reducing the concentrations of COCs through active bioremediation. Location-specific ARARs and action-specific ARARs, including injection well installation, subsurface injections, and waste handling ARARs, will be complied with throughout implementation of this alternative.

Long-term Effectiveness and Permanence

This alternative is expected to meet the long-term effectiveness and permanence criterion. However, similar to ISCO, there is a possibility of rebound. However, because ERD is not as reliant on direct contact with the contaminant to be effective, the ability to treat in low permeability zones may reduce the risk of contaminant rebound. After active treatment is complete, the residual contaminants re-enter the aquifer through diffusion and dissolution. Additional substrate may be required based on performance monitoring results. The permanent risk reduction time line is determined by the time required for biodegradation of VOCs. It should be noted that benzene may not be treated by this technology.

Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative is expected to reduce the toxicity, mobility, or volume of the COCs in groundwater through stimulation of the biological degradation of contaminants. With biological degradation, there is a possibility that degradation would stall and an accumulation of harmful daughter products such as VC would occur. Monitoring of biological populations and bioaugmentation (addition of suitable microbial populations into the system) may be required.

Short-term Effectiveness

The short-term effectiveness of this alternative is contingent on engineering controls to protect the environment, workers, and the community during well installation and injection activities. There are few to no risks to site workers if they come into contact with the substrate during injection activities. Releases of the ERD substrate are possible if the injectant follows any preferential pathways to the ground surface. To prevent exposure, engineering and safety controls would be in place to protect site workers and the environment.

The results of the sustainability assessment indicate that transportation (of personnel, materials, and equipment) would contribute the highest proportion of GHG and total energy footprints. Drilling and pump operation would contribute the majority of the criteria air pollutant footprints. The primary factors contributing to the footprint for risk of injury or fatality from accidents are transportation of personnel and equipment, as well as onsite labor hours.

Implementability

This alternative is technically feasible and implementable with available services and materials. One of the primary factors in any injection technology is distribution within the contaminated media. Based on the Pilot Study, ERD distribution was effective in the upper Castle Hayne aquifer. However, there is potential that thin clay lenses throughout the surficial aquifer may cause preferential flow paths and impede ERD distribution. This could limit the effectiveness of ERD.

Costs

The total present-worth cost for this alternative is estimated to be $3,650,874. The capital cost for this alternative is estimated to be $2,954,156. The total present-worth O&M and MNA cost is estimated to be $696,718.

5.3 Comparative Analysis of Alternatives

In the following subsections, the alternatives are comparatively analyzed using the nine USEPA criteria. The analyses are summarized in **Table 5-2**. Comparative analyses of groundwater are included in **Table 5-3**. The No Action alternative does not comply with the evaluation criteria and is not included in the comparative analysis.

5.3.1 Overall Protection of Human Health and the Environment

All of the alternatives screened, with the exception of the No Action alternative, are protective of human health and the environment by reducing or controlling risks posed by the site through treatment and/or LUCs and could achieve the RAOs.

Alternatives 3 (AS), 4 (ISCO), and 5 (ERD) provide active treatment to reduce the concentrations of COCs in groundwater, expediting the NA process that is Alternative 2 (MNA). Monitoring and LUCs are included in each alternative and would provide protection until RAOs are achieved.

5.3.2 Compliance with ARARs

All alternatives, except No Action, have common chemical-specific ARARs that are expected to be met. However, Alternatives 3 (AS), 4 (ISCO), and 5 (ERD) employ active mass transfer and treatment and will therefore comply with the cleanup levels in approximately 40 years, whereas Alternative 2 (MNA) relies on natural degradation and is expected to meet cleanup levels in 53 years. Alternatives 3 (AS), 4 (ISCO), and

5 (ERD) have common location and action-specific ARARs associated with groundwater treatment for installation of horizontal and vertical injection wells, subsurface injections, potential air emissions, and waste handling.

5.3.3 Long-term Effectiveness and Permanence

Each alternative, except the No Action alternative, provides some degree of long-term protection that increases if mass transfer and treatment components are included. The effectiveness and permanence of Alternative 2 (MNA) is dependent entirely upon NA, whereas Alternatives 3 (AS), 4 (ISCO), and 5 (ERD) employ active treatment and mass transfer to reduce the concentrations of COCs in groundwater to below 100 times the cleanup levels in the target treatment areas, and rely on MNA to reduce COCs in groundwater to their respective cleanup levels. Therefore, Alternatives 3 (AS), 4 (ISCO), and 5 (ERD) will reach the cleanup levels in shorter timeframe than Alternative 2 (MNA).

Rebound is a potential issue with any injection or AS scenario; therefore, subsurface distribution is the key to effectiveness and treatment timeframe. Due to the possibility of rebound, multiple injections (or system restart for AS) may be required for Alternatives 3 (AS), 4 (ISCO), and 5 (ERD). However, Alternative 5 (ERD) may have a slightly higher long-term effectiveness because it may provide a longer, more sustained treatment of potential contaminant rebound as bioaugmentation will likely increase the biodegradation potential of the aquifer after the initial substrate injection and extraction.

Reviews conducted at least every 5 years, as required, would be necessary to evaluate the effectiveness of any of the alternatives because hazardous substances would remain onsite at concentrations above levels that allow for unlimited use and unrestricted exposure.

5.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 3 (AS), 4 (ISCO), and 5 (ERD) would reduce toxicity, mobility, and volume through treatment. These technologies are effective at reducing the concentrations of CVOCs in groundwater; however, AS and MNA are typically more effective technologies when treating benzene. ISCO and ERD are typically less effective treatment options for the reduction of benzene concentrations in groundwater. Thus, Alternative 4 (ISCO) and Alternative 5 (ERD) will address the reduction of benzene concentrations through MNA. Although MNA does not include treatment, it relies on the natural reduction of contaminant concentrations through a variety of physical, chemical, or biological activities over time.

Alternative 4 (ISCO) is expected to provide the fastest reduction in toxicity and volume of CVOCs in groundwater through chemical oxidation, while with Alternative 5 (ERD) would provide for reduction at a slower rate because it is dependent on biological processes. Alternative 3 (AS) would reduce toxicity and volume; however, AS is not a destructive process and the transferred mass of VOCs, if not biodegraded aerobically in the vadose zone, would release into the atmosphere. Therefore, Alternatives 4 (ISCO) and 5 (ERD) provide the highest reduction of toxicity, mobility, and volume through treatment followed by Alternative 3 (AS).

5.3.5 Short-term Effectiveness

The period of time and risks to the environment, workers, and the community would be lowest for Alternative 2 (MNA), as no construction is involved with the implementation of the remedy. Alternative 5 (ERD) would have slightly higher risks to workers and a longer period of time associated with remedy implementation because it involves the installation of injection and extraction wells and the injection and recirculation of a carbon substrate and bioaugmentation culture.

Although the period of time to implement Alternative 3 (AS) and 4 (ISCO) are similar to Alternative 5 (ERD), the risks to workers are generally higher. This is due to increased labor required to perform O&M to the air sparge system, the elevated risks associated with handling a strong oxidant during the ISCO injection and recirculation activities, and the potential for AS to increase risks to Base workers from VI into occupied buildings.

Alternative 4 (ISCO) has the highest short-term risk to workers because of the use of oxidants and strongly corrosive chemicals and the possibility of re-injection. While Alternative 5 (ERD) would incur similar installation and injection impacts as Alternative 4 (ISCO), the ERD substrate is not harmful, reducing risk of injury to workers and the environment. Alternative 3 (AS) has the highest GHG emissions, energy use, water impacts, and criteria pollutant emissions because of the electricity used to power the AS system for 5 years. Alternative 2 has the lowest environmental footprint for the viable groundwater alternatives, as no active treatment would be performed, only annual performance monitoring. A summary of the relative rankings for the sustainability metrics related to the short-term effectiveness criterion is provided in **Table 5-4**, as follows.

TABLE 5-4
Short-Term Effectiveness and Sustainability Rankings
Operable Unit 20 (Site 86), MCIEAST-MCB CAMLEJ, North Carolina

Remedial Alternatives	GHG Emissions	Total Energy Used	Water Consumption	NOx Emissions	SOx Emissions	PM10 Emissions	Accident Risk Fatality	Accident Risk Injury
	metric ton	MMBTU	gallons	metric ton	metric ton	metric ton		
Alternative 1 - No Action	Low	Low	Low	Low	Low	Low	Low	Low
Alternative 2 - MNA and LUCs	Low	Low	Low	Low	Low	Low	Low	Low
Alternative 3 - Air Sparge via Horizontal Injection with MNA and LUCs	High	High	High	High	High	Medium	Medium	Medium
Alternative 4 - ISCO via Vertical Injection and Recirculation with MNA and LUCs	Low	Low	Medium	Low	Low	High	High	High
Alternative 5 - ERD via Vertical Injection and Recirculation with MNA and LUCs	Low	Low	Low	Low	Low	Medium	High	High

The relative impact is a qualitative assessment of the relative footprint of each alternative; a rating of High for an alternative is assigned if it is 70 percent of the maximum footprint, a rating of Medium is assigned if it is between 30 and 70 percent of the maximum footprint, and a rating of Low is assigned if it is less than 30 percent of the maximum footprint.

Notes:

MMBTU - million British Thermal Unit

5.3.6 Implementability

Each alternative is technically and administratively feasible with services and materials required to implement the remedy readily available. Alternative 2 (MNA) has the highest implementability of all the remedies evaluated because it requires no construction and the site labor is limited to sampling activities. However, the implementability of Alternative 3 (AS), 4 (ISCO), and 5 (ERD) decrease significantly because Site 86 is located on an active military flight line with multiple areas of limited or restricted access that may preclude the installation of a site-wide remediation system infrastructure. These alternatives involve drilling, construction, and maintenance activities that will likely disrupt flight line operations. Additionally, the logistics of working on the active air station increases the difficulty of implementing AS, ISCO, or ERD. Therefore, Alternative 3 (AS), 4 (ISCO), and 5 (ERD) are considered to have similar moderate implementability.

5.3.7 Cost

Table 5-5 summarizes the direct and indirect capital costs, as well as long-term O&M costs (as applicable) for the alternatives. The detailed cost estimates are provided in **Appendix E**.

Costs for Alternative 3 (AS) are nearly twice as high as those for Alternative 5 (ERD), and Alternative 4 (ISCO) is more than twice the cost of Alternative 5 (ERD). However, costs for Alternative 2 (MNA) are significantly lower than for Alternative 5 and for Alternative 3 and Alternative 4.

5.3.8 State Acceptance

State involvement has been solicited throughout the CERCLA process. Acceptance from NCDENR, as the designated state support agency in North Carolina, would be likely for all alternatives except No Action.

5.3.9 Community Acceptance

Community review acceptance will be solicited during the PRAP. Based upon prior experience with similar sites, it is anticipated that community acceptance is likely for all of the proposed action alternatives, Alternatives 2 through 5, but not for the "No Action" Alternative 1.

TABLE 5-1

NCP Criteria and Sustainability Metrics

Operable Unit 20 (Site 86)

Feasibility Study

MCIEAST-MCB CAMLEJ, North Carolina

NCP Critieria	Subcriteria	Sustainability Metrics					
		Energey Consumption	GHG Emissions	Criteria Pollutants Emission	Resource Consumption	Worker Impact	Community Impacts
Protection of Human Health and the Environment	Protection of Human Health and Environment						
Compliance with ARARs	Compliance with ARARs						
	Compliance with Chemical-Specific ARARs						
	Compliance with Action-Specific ARARs						
	Compliance with Location-Specific ARARs						
	Compliance with other criteria, advisories, and guidance						
	Long-Term Effectiveness and Permanence						
Long-Term Effectiveness and Permanence	Magnitude of Residual Risk		E	E			
	Adequacy and reliability of controls						
Reduction in Toxicity, Mobility, and Volume	Treatment Process used and materials treated						
	Amount of Hazardous materials destroyed or treated						
	Degree of Expected Reductions in Toxicity, Mobility, and Volume						
	Degree of which treatment is irreversible						
	Type and Quantity of Residual Remaining After Remedial Action						
Short-Term Effectiveness	Protection of Community During Remedial Action						A
	Protection of Workers During Remedial Action					B	
	Environmental Impacts	F	E	D	C		
	Time until RAOs are achieved						
Implementability	Ability to construct and operate the Technology						
	Reliability of the Technology						
	Ease of undertaking additional remedial actions, if necessary						
	Ability to Monitor Effectiveness of Remedy						
	Ability to obtain approvals from other agencies						
	Coordination with other agencies						
	Availability of offsite treatment, storage, and disposal services and capacity						
	Availability of necessary equipment and specialists						
	Availability of Prospective Technologies						
Cost	Capital Costs						
	Operating and Maintenance Costs						
	Present Worth Costs						

Legend:

A - Compliments NCP criteria but also addresses risks to community in terms of potential for injury or fatality associated with traffic

B - Compliments NCP criteria but also addresses potential for injury or fatality associated with total hours worked

C - Use of non-renewable energy (coal for power requirements [fuel])

D - Impacts associated with release of VOCs to the atmosphere

E - Some emissions persist only in the short term; others last for decades and may persist after RAOs have been achieved

F - Environmental impacts associated with energy extraction from earth resources

TABLE 5-2

Summary of Groundwater Remedial Alternatives Evaluated Against the Seven Criteria

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Evaluation Criteria	Alternative 1 No Action	Alternative 2 MNA and LUCs	Alternative 3 Air Sparging with MNA and LUCS	Alternative 4 ISCO with MNA and LUCS	Alternative 5 ERD with MNA and LUCs
Overall Protection of Human Health and the Environment	Will not meet RAOs. Human health risks associated with potential receptors and the potential future use of groundwater as a potable source.	Will eventually meet RAOs. Prolonged period of time required to meet RAOs due to reliance on natural processes.	Will meet RAOs via mass transfer by volatilizing dissolved phase VOCs. MNA will be conducted after the completion of active treatment to ensure that RAOs are met. May require VIMS to mitigate VI issues.	Will meet RAOs via oxidation of VOCs within the target area and reduce plume migration towards the New River. MNA will be conducted after the completion of active treatment to ensure that RAOs are met.	Will meet RAOs by promoting reductive dechlorination within the target area and mitigate potential offsite migration of COCs.
Compliance with ARARs	Does not comply with chemical-specific or location-specific ARARs.	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.
Long-term Effectiveness and Permanence	Will not reduce risk; therefore, is not effective in the long term. Additionally, no mechanism is in place to monitor (1) attenuation of VOCs and (2) limit exposure of potential receptors to contaminants in groundwater	Expected to be an effective remedy for treatment of groundwater if land use controls are in place and groundwater is monitored evaluate plume migration.	Expected to be an effective remedy for treatment of groundwater contaminated with VOCs if land use controls are in place and the groundwater is monitored to evaluate plume migration.	Expected to be an effective remedy for treatment of groundwater contaminated with VOCs if land use controls are in place and the groundwater is monitored to ensure the plume is attenuating and not migrating.	Expected to be an effective remedy for treatment of chlorinated solvent impacted groundwater if land use controls are in place and groundwater is monitored to evaluate plume migration.
Reduction of Toxicity, Mobility or Volume Through Treatment	No treatment is involved, so it does not meet this criterion.	Reduces toxicity, mobility, and volume over a prolonged period of time by naturally degrading contaminants.	Reduces toxicity, mobility, and volume through mass transfer to volatilize dissolved phase VOCs.	Reduces toxicity, mobility, or volume through chemical oxidation of dissolved phase VOCs to carbon dioxide, water and chloride.	Reduces toxicity, mobility, or volume through promotion of biologically mediated reductive dechlorination.
Short-term Effectiveness	No short-term impacts because nothing is implemented.	Monitoring and land use controls would be required during the duration of remediation.	Short-term impacts include the potential to generate VOC vapors from sparging that are not captured as no SVE system will be implemeted. The duration of air sparging needed in order to meet treatment goals is expected to be 5 years or more. Ambient air monitoring will be required to ensure vapor concentrations do not exceed applicable regulatory standards during remediation.	Chemical oxidation is a relatively fast process with high contaminant reduction expected in the treatment area over short duration. Monitoring would be required during the duration of remediation. Safety controls required due to the use of oxidants and corrosive materials to protect worker safety.	Requires engineering controls during injection to protect environment, and safety controls to protect workers. Monitoring would be required during the duration of remediation.
Implementability	No construction or operation.	Services and materials are available; and the technology is easily implementable.	Services and materials are available; and the technology is easily implementable. This technology has been proved successful at Site 86. Permanent construction and electricity service would be required.	This alternative is technically challenging, but easily implementable with available services and materials. Substrate distribution issues are possible with any injection technology. Health and safety precautions would be required handling the oxidant.	This alternative is implementable with available services and materials. Substrate distribution issues are possible with any injection technology. An ERD pilot study has been succesfully implented at Site 86.
Cost	$0	$27,600[a]; $584,513[b]	$3,418,502[a]; $5,460,507[b]	$7,375,790[a]; $7,910,878[b]	$2,954,156[a]; $3,650,874[b]

[a]Total Capital Costs

[b]Total Present Worth Cost

TABLE 5-3

Groundwater - Comparative Analysis of Alternatives

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

CERCLA Criteria	No Action (1)	MNA and LUCs (2)	AS, MNA, and LUCs (3)	ISCO, MNA, and LUCs (4)	ERD, MNA, and LUCs (5)
Threshold Criteria					
Protection of Human Health and the Environment	❍	●	●	●	●
Compliance with ARARs	❍	●	●	●	●
Primary Balancing Criteria					
Long-term Effectiveness and Permanence	❍	○	○	●	●
Reduction in Toxicity, Mobility, or Volume through Treatment	❍	❍	●	●	●
Short-Term Effectiveness	❍	●	○	○	●
Implementability	●	●	○	○	○
Present-Worth Cost	$0	$584,513	$5,460,507	$7,910,878	$3,650,874

Relative Ranking: ● High ○ Moderate ❍ Low

Rankings are provided as qualitative descriptions of the relative compliance of each alternative with the criteria

TABLE 5-5

Summary of Cost Analysis - Groundwater

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

General Response Action	Alternative 2 MNA and LUCs[a]			Alternative 3 AS, MNA, and LUCs			Alternative 4 ISCO, MNA, and LUCs			Alternative 5 ERD, MNA, and LUCs		
	-30%	Estimate	+50%	-30%	Estimate	+50%	-30%	Estimate	+50%	-30%	Estimate	+50%
Total Capital Costs	**$19,320**	**$27,600**	**$41,400**	**$2,392,951**	**$3,418,502**	**$5,127,752**	**$5,163,053**	**$7,375,790**	**$11,063,685**	**$2,067,909**	**$2,954,156**	**$4,431,233**
Subsequent Years' Costs	$389,839	$556,913	$835,369	$1,429,404	$2,042,005	$3,063,008	$374,562	$535,088	$802,633	$487,703	$696,718	$1,045,077
Total Present Worth Costs[a]	**$409,159**	**$584,513**	**$876,769**	**$3,822,355**	**$5,460,507**	**$8,190,760**	**$5,537,615**	**$7,910,878**	**$11,866,317**	**$2,555,612**	**$3,650,874**	**$5,476,311**

[a] Includes 7% discount rate

SECTION 6

References

Baker Environmental, Inc. (Baker). 1996. *Final Remedial Investigation Report, Operable Unit No. 6 (Site 86), Marine Corps Base Camp Lejeune, North Carolina.* August.

Baker. 1998. *Final Feasibility Study Report, Operable Unit No. 6. (Site 86).* June.

Battelle. 2011.

Cardinell, A. P., S. A. Berg, and O. B. Lloyd, Jr. 1993. *Hydrogeologic Framework of U.S. Marine Corps Base at Camp Lejeune, North Carolina.* Water Resources Investigations Report 93-4049. U.S. Geological Survey.

CH2M HILL. 2006a. *SWMUs 303/318 RCRA Facility Investigation Report.* Marine Corps Base Camp Lejeune, North Carolina. March.

CH2M HILL. 2006b. *Pilot Study Report, Site 86, Operable Unit No. 20, Marine Corps Base, Camp Lejeune, North Carolina*. September.

CH2M HILL. 2011a. *Expanded Supplemental Remedial Investigation, Site 86, Operable Unit No. 20, Marine Corps Base, Camp Lejeune, North Carolina.*

CH2M HILL. 2011b. *Phase III Vapor Intrustion Evaluation Report, Volume 2 of 5 - Mainside, Marine Corps Base, Camp Lejeune, North Carolina Report: Prepared for Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia.*

CH2M HILL. 2011c. *Final Expanded Soil Background Study Report, Marine Corps Installations East-Marine Coprs Base Camp Lejeune, Jacksonville, North Carolina.*October

CH2M HILL, AGVIQ. 2009. *Vapor Intrusion Evaluation Report, Volume 4 of 6 – Marine Corps Air Station, New River.* November.

CH2M HILL, Baker Environmental, Inc., and CDM (CH2M HILL/Baker/CDM). 2003. *Final Amended Remedial Investigation, Operable Unit No. 20, Site 86- Tank Area AS419-AS421, Marine Corps Base Camp Lejeune, North Carolina.* May.

Dewberry & Davis. 1991. *Technical Memorandum No. 2 Results of Field Investigation. Marine Corps Base, Camp Lejeune, North Carolina.* January.

Harbaugh, A.W., E.R. Banta, M.C. Hill, and M.G. McDonald. 2000. *MODFLOW-2000, The U.S. Geological Survey Modular Ground-Water Model – User Guide to Modularization Concepts and the Ground-Water Flow Process.* USGS Open-File Report 00-92.

O'Brien & Gere, Inc. 1992. *Site Assessment of Tanks AS419 - AS421, Marine Corps Air Station, New River, North Carolina*. Project No. 62470-90-R-76. June.

Shaw Environmental and Infrastructure, Inc. (Shaw). 2006. *Interim Measure.*

United States Environmental Protection Agency (USEPA). 1998. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water.* EPA 600-R-98-128. September.

USEPA. 2004. *Performance Monitoring of MNA Remedies for VOCs in Groundwater*.

Wiedemeier, Todd, et al. 1996. *Draft Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater*. Air Force Center for Environmental Excellence. San Antonio, Texas, November 1996.

Zheng, C., and P. P. Wang. 1999. MT3DMS: *A Modular Three-Dimensional Multispecies Transport Model for Simulation of Advection, Dispersion, and Chemical Reactions of Contaminants in Groundwater Systems; Documentation and User's Guide.* Contract Report SERDP-99-1.

Appendix A
Site 86 Pilot Study Report

Pilot Study Report
Site 86, Operable Unit No. 20

Marine Corps Installations East—Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Contract Task Order WE-09

September 2013

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Acronyms and Abbreviations

bgs	below ground surface
°C	degrees Celsius
cis-1,2-DCE	cis-1,2-dichloroethene
CLEAN	Comprehensive Long-term Environmental Action—Navy
CO_2	carbon dioxide
CTO	Contract Task Order
CVOC	chlorinated volatile organic compound
1,1-DCE	1,1-dichloroethene
DO	dissolved oxygen
DPT	direct-push technology
ERD	enhanced reductive dechlorination
ESRI	Expanded Supplemental Remedial Investigation
ft^3	cubic foot/feet
ft/day	feet per day
ft^2/day	square feet per day
ft/ft	feet per foot
GAC	granular activated carbon
gc/mL	gene copies per milliliter
gpm	gallons per minute
IP	Implementation Plan
ISCO	in-situ chemical oxidation
$KMnO_4$	potassium permanganate
MCAS	Marine Corps Air Station
MCIEAST-MCB CAMLEJ	Marine Corps Installations East-Marine Corps Base Camp Lejeune
µg/L	micrograms per liter
mg/L	milligrams per liter
MnO_2	manganese dioxide
MnO_4^-	permanganate
mS/cm	miliSiemens per centimeter
mV	millivolt
$NaMnO_4$	sodium permanganate
NAVFAC	Naval Facilities Engineering Command
NOD	natural oxidant demand
NOM	natural organic matter
ORP	oxidation-reduction potential
OU	Operable Unit
PCE	tetrachloroethene
PRB	permeable reactive barrier
PVC	polyvinyl chloride
RD	reductive dechlorination
RI	Remedial Investigation

SAP	Sample Analysis Plan
SRPC	slow-release permanganate candle
TCE	trichloroethene
TOC	total organic carbon
TSI DC	Terra Systems Incorporated *Dehalococcoides* Culture
UFP	Uniform Federal Policy
VC	vinyl chloride
VFA	volatile fatty acid
VOC	volatile organic compound

SECTION 1

Introduction

This Pilot Study Report presents the field activities, data, results, and conclusions of the pilot studies conducted at Operable Unit (OU) No. 20, Site 86, Marine Corps Air Station (MCAS) New River, Jacksonville, North Carolina (**Figure 1-1**). This Pilot Study Report has been prepared under the Naval Facilities Engineering Command (NAVFAC)—Mid-Atlantic, Comprehensive Long-term Environmental Action—Navy (CLEAN) 8012 Contract N62470-11-D-8012, Contract Task Order (CTO) WE-09.

The pilot studies were conducted to evaluate the performance and design criteria of two remedial technologies:

1. Enhanced reductive dechlorination (ERD) using a sodium lactate solution (WilClear) manufactured by JRW Bioremediation LLC, supplemented with a Terra Systems Incorporated *Dehalococcoides* Bioaugmentation Culture (TSI DC).
2. In-situ chemical oxidation (ISCO) using Slow-Release Permanganate Candles (SRPCs) manufactured by the Carus Corporation.

Site background information and the selection process for the pilot study technologies are presented in the following sections.

1.1 Site Background

Site 86 is located on Marine Corps Air Station (MCAS) New River. Most of the site is developed and contains aircraft hangars, aircraft support buildings, and concrete or asphalt paved areas. A large open area, known as the northeast grass, is present in the eastern portion of the site.

During the Remedial Investigation (RI) (Baker Environmental, Inc., 1996), several volatile organic compounds (VOCs) were identified in groundwater, including trichloroethene (TCE) and its associated daughter products—cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC)—as well as 1,1-dichloroethene (1,1-DCE). Subsequent RI activities were conducted from 1997 through 2002 to assess the horizontal and vertical extents of the VOC impacts. Based on these subsequent investigations, the Site 86 boundaries were expanded in August 2006 to include most of the industrial area north of the MCAS New River flight line (**Figure 1-2**).

In 2009 and 2010, Site 86 was assessed further during an Expanded Supplemental Remedial Investigation (ESRI) (CH2M HILL, 2011a). During the ESRI, an additional VOC plume consisting of TCE, cis-1,2-DCE, VC, and 1,1-DCE was identified. The plume extended into the grassy area west of Curtis Road and east of the 2006 Site 86 boundary (**Figure 1-2**). In 2010, the Site 86 boundary was expanded to include the northeast area (**Figure 1-2**). The eastern portion of Site 86 includes an unlined stormwater drainage ditch that collects runoff from the developed portion of Site 86, including the industrial area and hangars, and discharges to the New River.

The highest concentrations of VOCs in the surficial and upper Castle Hayne aquifers were detected in different areas of Site 86. Based on the data presented in the ESRI report, the Marine Corps Installations East-Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ) Partnering Team agreed in May 2011 to conduct a 6-month pilot study, which would include the installation of an ERD injection/extraction recirculation system in the upper Castle Hayne aquifer at a location identified as the Zone 1 pilot study site and an injection of an ERD substrate in the surficial aquifer at an area identified as the Zone 2 pilot study site (**Figure 1-2**).

Based on logistical challenges faced with substrate injections in the surficial aquifer at the Zone 2 pilot study site (such as flight line access and security issues, potential surfacing, and implementation time), an ISCO pilot study using SRPC technology was recommended in lieu of ERD substrate injections. The MCIEAST-MCB CAMLEJ Partnering Team approved the recommendation in July 2011.

1.2 Pilot Study Objectives

The primary objectives of the pilot studies were:

- To evaluate the injection/extraction approach as a method for distributing the ERD substrate in areas where access is limited
- To evaluate the overall effectiveness of ERD in terms of reducing contaminant mass in Zone 1
- To evaluate the overall effectiveness of SRPC technology as a passive remediation remedy in Zone 2
- To obtain sufficient performance data and results to refine remedial alternatives for preparation of a Feasibility Study
- To reduce VOC mass within Zones 1 and 2

1.3 Description of Pilot Study Areas

The Zone 1 and Zone 2 pilot study areas are described in this section. Zone 1 and Zone 2 pilot study area features are depicted in **Figures 1-3** and **1-4**, respectfully.

1.3.1 Zone 1 ERD and Bioaugmentation Pilot Study Area

The Zone 1 pilot study area encompasses a 0.3-acre footprint that includes a drainage swale, portions of an asphalt parking lot, hangar support structures, security fencing, and a grass area (**Figure 1-3**).

1.3.1.1. Geology

The geology of the Zone 1 pilot study area was evaluated during pilot study drilling. During the drilling, geologic descriptions were recorded on soil boring logs, which are presented in **Appendix A**. Two geologic cross-sections, A-A' and B-B', were interpreted based on the geologic descriptions presented in the Zone 1 soil boring logs (**Appendix A)**. The locations of geologic cross-sections A-A' and B-B' are shown on **Figure 1-5** and geologic cross-sections A-A' and B-B' are depicted in **Figures 1-6** and **1-7**, respectively**.** As depicted in **Figures 1-6** and **1-7**, the geology of the pilot study targeted interval of the upper Castle Hayne aquifer consists of a partially cemented sandy limestone.

The groundwater elevation within Zone 1 is approximately 7 feet (ft) above mean sea level. Based on groundwater elevation data collected in October 2011, groundwater flow in the targeted interval of the upper Castle Hayne aquifer is to the east, with an approximate horizontal hydraulic gradient of 0.003 feet/foot (ft/ft). The horizontal hydraulic gradient is based on the groundwater elevation change between monitoring wells IR86-MW58IW (7.03 ft above mean seal level) and IR86-MW74IW (6.84 ft above mean seal level) which are located 63 ft apart along the predicted groundwater flow path. A potentiometric surface map of the upper Castle Hayne aquifer within Zone 1 is depicted on **Figure 1-8.**

1.3.1.2. Hydrology

The hydraulic conductivity of the upper Castle Hayne aquifer within Zone 1 was assessed in October 2011 by performing slug tests on monitoring and injection wells. A pump test also was performed in October 2011 to assess the transmissivity of the upper Castle Hayne aquifer and to assess an effective pumping rate for the ERD extraction wells. Slug test and pump test data were evaluated using the aquifer testing software package AQTESOLV Pro 4.0. Slug test data were calculated using the Bouwer and Rice algorithm (Bouwer and Rice, 1976) for an unconfined aquifer with a partially penetrating test well. Pump test data were calculated using the Neuman algorithm (Neuman, 1974) for an unconfined aquifer with a partially penetrating pumping and observation well.

Zone 1 slug test and pump test results are summarized in **Table 1-1** and **Table 1-2**, respectively, with AQTESOLV Pro 4.0 outputs provided in **Appendix B.** Hydraulic conductivity over the screened intervals of the tested wells ranged from 1.44 to 24.78 ft per day (ft/d) with a mean hydraulic conductivity of 13.04 ft/d. Limestone-type aquifers, such as the upper Castle Hayne aquifer at Site 86, typically exhibit highly variability hydraulic conductivity due to diagenesis of the limestone (dissolution and precipitation of calcium carbonate, which affects porosity).

Transmissivity and specific storage information was obtained from data collected during the pump test. As shown in **Table 1-4**, transmissivity calculated at injection well IR86-IW03 and monitoring wells IR86-MW71IW and IR86-MW72IW ranged from 1046.5 to 3042.1 square ft per day (ft^2/d), with a mean value of 2042 ft^2/d. The specific storage of the upper Castle Hayne aquifer was approximated to be 6×10^{-4} ft^{-1}.

Based on the mean hydraulic conductivity identified in tested wells (13.04 ft/d), the approximate horizontal hydraulic gradient (0.003 ft/ft), and an approximate effective porosity of 0.25, the mean horizontal linear groundwater velocity within is estimated to be 0.16 ft/d. The horizontal linear groundwater velocity is based on the Darcy equation described below.

$$V_L = \frac{Ki}{n_e}$$

Where:

V_L = the horizontal linear groundwater velocity (ft/d)
K = the aquifer's hydraulic conductivity (ft/d)
i = the horizontal hydraulic gradient (ft/ft, or dimensionless)
n_e = the effective porosity of the aquifer

1.3.1.3. Baseline Groundwater Conditions

Before initiating the pilot study, baseline groundwater samples were collected from monitoring wells installed to assess the performance of the pilot study (well installation activities are discussed in **Section 2.2.2**).

The results of the October 2011 baseline groundwater sampling in Zone 1 support the findings of the ESRI that TCE, cis-1,2-DCE, VC, and 1,1-DCE were present in groundwater within the Zone 1 pilot study area. The results of subsequent groundwater sampling events conducted during the pilot study are discussed in **Section 3**. A summary of Zone 1 VOC baseline data collected in October 2011 is provided in **Table 1-3.**

TABLE 1-3
Summary of Zone 1 Baseline Groundwater VOC Concentrations

Well ID	TCE (µg/L)	cis-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)	1,1-DCE (µg/L)
IR86-MW58IW	170	120	19	62
IR86-MW70IW	110	78	14	5.5
IR86-MW71IW	130	74	6.7	7.1
IR86-MW72IW	220	100	8.1	7.3
IR86-MW73IW	150	220	15	32
IR86-MW74IW	210	120	15	26
IR86-MW75IW	230	120	12	5.6

Notes:
µg/L – micrograms per liter

The water quality parameters of upper Castle Hayne groundwater measured while purging Zone 1 monitoring wells during the baseline sampling event are summarized in **Table 1-2**. These parameters indicate that aquifer conditions are generally favorable for the reductive dechlorination (RD) of chlorinated VOCs. Conditions favorable for RD include temperature > 20° C, dissolved oxygen (DO) < 0.5 mg/L, pH between 6 and 8, and oxidation/reduction potential (ORP) < 50 mV. As shown in **Table 1-2**, groundwater temperatures measured during the baseline event were > 20° C; the average DO concentration was 0.49 mg/L (DO ranged from 0.27 to 0.87); pH ranged from 6.60 to 6.82; and ORP averaged -103.7 mV (ORP ranged from -82.6 to -125.9 mV).

TABLE 1-4
Summary of Zone 1 Baseline Groundwater Quality Parameters

Well ID	Temperature (°C)	Specific Conductivity (mS/cm)	DO (mg/L)	pH	ORP (mV)
IR86-MW58IW	20.13	0.676	0.27	6.82	-93.1
IR86-MW70IW	20.92	0.787	0.61	6.65	-109.3
IR86-MW71IW	20.61	0.845	0.34	6.67	-109.5
IR86-MW72IW	21.03	0.703	--	6.60	-94.3
IR86-MW73IW	21.36	0.788	0.87	6.71	-125.9
IR86-MW74IW	20.17	0.825	0.49	6.62	-82.6
IR86-MW75IW	20.54	0.869	0.37	6.74	-111.4

Notes:

-- DO was not collected from groundwater sampled from IR86-MW72IW during baseline sampling because of a DO probe failure.

°C – Degrees Celsius

mS/cm – milliSiemens per centimeter

mg/L – milligrams per Liter

mV – milliVolt

1.3.2 Zone 2 Slow-Release Permanganate Candle Pilot Study Area

The Zone 2 pilot study area encompasses a 0.15-acre treatability footprint and addressed the VOC plume within the surficial aquifer, located in the northeast grass east of the flight line, as shown in **Figure 1-2.**

1.3.2.1. Geology

The geology of the pilot study area was evaluated during pilot study drilling. During the drilling, geologic descriptions were recorded on soil boring logs, which are presented in **Appendix A**. A geologic cross-section through the pilot study area, cross-section A-A', was interpreted based on the geologic descriptions presented in the soil boring logs. The location of cross-section A-A' is shown on **Figure 1-8. Figure 1-9** depicts the subsurface geology within the pilot study area along the cross-section A-A'. As shown in **Figure 1-9**, the geology of the surficial aquifer consists of sand and clayey lithologies to approximately 30 ft bgs, which are mantled above the sandy limestone of the upper Castle Hayne aquifer.

1.3.2.2. Hydrogeology

The groundwater elevation in Zone 2 is approximately 5 ft above mean sea level. Based on the relatively small scale of the pilot study area, an adequate hydraulic gradient could not be assessed and a localized potentiometric map of the screened interval of the surficial aquifer could not be developed. Based on data generated during the ESRI, groundwater in the surficial aquifer is estimated to flow in an easterly direction with an estimated horizontal hydraulic gradient of 0.003 ft/ft.

The hydraulic conductivity of the targeted treatment zone of the surficial aquifer was assessed in October 2011 by performing slug tests on monitoring well IR86-MW61 and monitoring wells IR86-MW66 through IR86-MW69. Slug test data were processed as described in **Section 1.3.1**. AQTESOLV PRO 4.0 outputs are presented in **Appendix B**. Slug test results are presented in **Table 1-5**. The hydraulic conductivity over the 10-ft screened intervals of the tested wells ranged from 1.19 to 10.43 ft/d, with a mean hydraulic conductivity of 4.5 ft/d.

The mean horizontal groundwater linear velocity was approximated using the Darcy equation described in **Section 1.3.1**. Based on the mean hydraulic conductivity identified from the slug testing (4.5 ft/d), an approximate horizontal hydraulic gradient of 0.003 ft/ft, and an approximated effective porosity of 0.25, the mean horizontal linear groundwater velocity is estimated to be 0.05 ft/d.

1.3.2.3. Baseline Groundwater Conditions

As in the Zone 1 pilot study, baseline groundwater samples were collected from monitoring wells within the Zone 2 pilot study area to obtain baseline VOC concentrations to serve as a datum for evaluating the pilot study's effectiveness to remove VOC mass. The results of the October 2011 baseline groundwater sampling event indicate that TCE, cis-1,2-DCE, and 1,1-DCE were present in surficial groundwater within the pilot study area. Details of the October 2011 baseline and subsequent groundwater sampling events are discussed in detail in **Section 3**. A summary of VOC baseline data collected in October 2011 is provided in **Table 1-6.**

TABLE 1-6
Summary of Zone 2 Baseline Groundwater Volatile Organic Compound Detections

Well ID	TCE (µg/L)	cis-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)	1,1-DCE (µg/L)
IR86-MW61	200	66	< 1.0	5.6
IR86-MW66	62	26	< 1.0	2.5
IR86-MW67	57	30	< 1.0	1.9
IR86-MW68	96	38	< 1.0	3.8
IR86-MW69	71	37	< 1.0	3.2

Notes:
< 1.0 – Vinyl chloride was not detected above the method reporting limit of 1.0 µg/L

1.4 Rationale for Technology Selection

1.4.1 Enhanced Reductive Dechlorination with Bioaugmentation

ERD is a bioremediation technology used for treating chlorinated volatile organic compounds (CVOCs) in groundwater by adding electron donors such as lactate, acetate, molasses, vegetable oil, and other commercially available carbon sources. ERD accelerates the naturally occurring process of reductive dechlorination, wherein chlorinated solvents in groundwater are biodegraded by indigenous and/or supplemented anaerobic bacteria. Anaerobic bacteria take electrons from small organic compounds and produce hydrogen; this process is known as fermentation. The anaerobic bacteria then use the electron in the hydrogen to replace a chlorine atom in the CVOC.

The principal anaerobic biodegradation pathway for reductive dechlorination of TCE, cis-1,2-DCE, and VC is:

$$\text{TCE} \rightarrow \text{cis-1,2-DCE} \rightarrow \text{VC} \rightarrow \text{ethene}$$

The transformation rates for each step vary but tend to become slower with progress along the breakdown sequence, often resulting in accumulation of cis-1,2-DCE and VC. Further breakdown from cis-1,2-DCE and VC to ethene varies and is based on site-specific conditions.

Biodegradation of CVOCs can be achieved by adding a suitable ERD amendment to the subsurface. The ERD amendment serves two purposes: (a) depleting the supply of competing electron acceptors and creating strongly reducing conditions and (b) providing an electron donor source for reductive dechlorination.

The ERD amendment selected for the Zone 1 pilot study was a sodium lactate solution. Sodium lactate was selected based on its chemical properties (such as a higher water solubility to improve distribution) and its ability to be used for ERD faster than oil-based substrates. Once in the aquifer, lactate ferments into acetate and hydrogen. The hydrogen functions as the primary electron donor. The lactate also releases ethanol, which also functions as an electron donor.

Bioaugmentation is the introduction or supplementation of bacteria into the subsurface to treat contaminated soil or groundwater. Bioaugmentation is used to enhance the biodegradation of contaminants, particularly cis-1,2-DCE and VC. The bioaugmentation culture injected into the upper Castle Hayne aquifer within Zone 1 contained the *Dehalococcoides* bacteria. *Dehalococcoides* bacteria are the only known organisms capable of dechlorinating

TCE to ethane. In the absence of *Dehalococcoides*, dechlorination of TCE may only progress to cis-1,2-DCE and VC. Bioaugmentation has been demonstrated to work with most commonly used electron donors, including lactate, vegetable oils, and slow-release compounds.

1.4.2 Chemical Oxidation using Slow-Release Permanganate Candles

ISCO delivers chemical oxidants into soil or groundwater to completely oxidize organic contaminants into carbon dioxide (CO_2). A number of chemical oxidants successfully degrade CVOCs via chemical oxidation. The success factor of an ISCO treatment is dependent on how effectively the chemical oxidant contacts the targeted contaminant.

Permanganate (MnO_4^-) is a chemical oxidant with a proven history of effectively oxidizing CVOCs to CO_2. MnO_4^- is a common chemical oxidizing agent with strong oxidation potential, predictable chemistry, good stability, and non-toxic byproducts. MnO_4^- is very effective at oxidizing organic compounds containing carbon-carbon double bonds, aldehyde groups, and hydroxyl groups. Research has shown that MnO_4^- is attracted to the negative charge associated with the pi electrons of chlorinated alkenes such as tetrachloroethene (PCE), TCE, cis-1,2-DCE, and VC. MnO_4^- degrades chlorinated alkenes using a bridged oxygen compound (hypomanganate diester) with intermediate products degrading by hydroxylation, hydrolysis, or cleavage to drive the reaction to CO_2, chloride, and manganese dioxide (MnO_2) (Yan and Schwartz, 1999).

The greatest advantage of MnO_4^- over other chemical oxidants is its stability. Generally, the use of MnO_4^- enables long contact times and transport distances (USEPA, 2006). The oxidation strength and specificity of the MnO_4^- ion improves its longevity compared to non-specific oxidizers such as hydroxyl radicals and ozone.

MnO_4^- was delivered to the subsurface at Zone 2 using SRPCs. This delivery method was chosen because of site access and security issues, reduced delivery time with respect to oxidant injections, and on the basis that injections are often unsuccessful because the injectant fails to meet distribution goals.

The idea of slow release oxidants for remediation was inspired by the pharmaceutical and agricultural industries, which were field testing the slow release of drugs and fertilizers/pesticides, respectively. In the mid-2000s, two laboratory studies (Kang et al., 2004, and Ross et al., 2005) first began to explore the idea of encapsulated potassium permanganate ($KMnO_4$) in waxes and resins on a micrometer scale. These small microcapsules were designed for injection-type delivery methods.

From 2007 through 2009, the Ohio State University conducted research on a monolithic controlled release approach (Lee and Schwartz, 2007a; Lee and Schwartz, 2007b; Lee et al., 2008a; Lee et al., 2008b; Lee et al., 2009) that could be used as a passive remediation technology, such as a permeable reactive barrier (PRB). Researchers used a monolithic cylinder of $KMnO_4$ within a polymer matrix designed to be deployed into wells. During this research, a flow-tank study was conducted in which water spiked with TCE was introduced into a tank filled with sand, and flowed though a barrier of offset controlled release permanganate cylinders. The flow-tank study showed that the monolithic controlled release permanganate cylinders were effective at reducing TCE mass and may provide a practical and sustained approach for groundwater remediation.

The University of Nebraska (Christenson, 2011) was the first to field test SRPCs. The test site was a former landfill with TCE-affected groundwater. The SRPC approach was applied due to the low permeability of the treatment area where traditional injections were not feasible. During this field study, SRPCs were manufactured in the university's Soil Environmental Chemistry Laboratory by mixing $KMnO_4$ in a paraffin wax matrix. Three-inch-diameter SRPCs were deployed in 4-inch monitoring wells and 2-inch SRPCs were deployed into DPT borings. After approximately 1 year (342 days), TCE concentrations decreased between 64 and 82 percent, providing proof of concept that SRPCs could effectively remove TCE and associated daughter products in the field over a sustained period of time.

The SRPCs used during the Zone 2 pilot study were similar to those used by the University of Nebraska and consisted of $KMnO_4$ crystals in a paraffin wax matrix. As the paraffin wax slowly dissolves and degrades, the $KMnO_4$ crystals become exposed, resulting in the molecular diffusion of MnO_4^- into passing groundwater. The SRPCs used during the ISCO pilot study were 3 ft long by 1.5 inches in diameter and contained approximately 3.44 pounds of $KMnO_4$ (2.55 pounds of MnO_4^-) and 0.86 pound of paraffin wax.

The advantage of SRPCs over traditional injection delivery methods is that they treat groundwater passively, meaning the contaminated groundwater comes in contact with the SRPC under normal groundwater flow conditions and natural gradients. SRPCs can be easily deployed and present a low risk to site workers compared to traditional MnO_4^- injections because there is no risk of $KMnO_4$ dust, MnO_4^- spills/splashing from field mixing $KMnO_4$ or liquid sodium permanganate ($NaMnO_4$). There are also no risks resulting from injecting permanganate (for example, surfacing, pressurized lines). There were no operating or maintenance costs associated with the SRPCs other than the initial purchase and installation expenses.

SRPCs treat groundwater as it passes through and does not require pushing MnO_4^- through the aquifer, resulting in less MnO_4^- mass required to effectively treat VOC-affected groundwater. In traditional MnO_4^- injections, significant MnO_4^- mass can be consumed by an aquifer's natural oxidant demand (NOD) as the MnO_4^- is pushed through the aquifer. NOD generally consists of dissolved phase reduced minerals, solid (sorbed) phase minerals, and dissolved and sorbed phase natural organic matter (NOM) (Haselow et al., 2003). NOD, depending on contaminant concentrations, may consume a significantly higher amount of MnO_4^- mass than what may be consumed by dissolved and sorbed phase contaminants.

TABLE 1-1

Zone 1 Pilot Study Slug Test Results

Site 86 Pilot Study Report

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Well ID	Hydraulic Conductivity (K)							
	K (ft/d) Test 1	K (cm/sec) Test 1	K (ft/d) Test 2	K (cm/sec) Test 2	K (ft/d) Test 3	K (cm/sec) Test 3	K (ft/d) Mean	K (cm/sec) Mean
IR86-IW01	19.24	6.79E-03	19.74	6.96E-03	21.26	7.50E-03	20.08	7.08E-03
IR86-IW02	5.07	1.79E-03	4.12	1.45E-03	5.72	2.02E-03	4.97	1.75E-03
IR86-IW04	17.59	6.21E-03	18.59	6.56E-03	20.28	7.15E-03	18.82	6.64E-03
IR86-IW05	13.44	4.74E-03	13.65	4.82E-03	16.62	5.86E-03	14.57	5.14E-03
IR86-IW06	26.85	9.47E-03	25.91	9.14E-03	21.47	7.57E-03	24.74	8.73E-03
IR86-MW70IW	18.13	6.40E-03	18.69	6.59E-03	16.12	5.69E-03	17.65	6.23E-03
IR86-MW71IW	4.88	1.72E-03	6.38	2.25E-03	7.26	2.56E-03	6.17	2.18E-03
IR86-MW72IW	4.99	1.76E-03	--	--	7.20	2.54E-03	6.10	2.15E-03
IR86-MW73IW	16.56	5.84E-03	16.96	5.98E-03	14.73	5.20E-03	16.08	5.67E-03
IR86-MW74IW	12.95	4.57E-03	12.63	4.46E-03	13.01	4.59E-03	12.86	4.54E-03
IR86-MW75IW	1.40	4.94E-04	1.37	4.83E-04	1.55	5.47E-04	1.44	5.08E-04

Notes:
-- Data not analyzed
cm - centimeter
ft - foot or feet
sec - second
d - day

TABLE 1-2

Zone 1 Pilot Study Pump Test Results

Site 86 Pilot Study Report

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Well ID	Transmissivity (T) (ft^2/d)	Specific Storage (S) (1/ft)	Approximate Aquifer Thickness (b) (ft)	Hydraulic Conductivity (K) or (T/b) (ft/d)
IR86-IW03	3042.10	6.4×10^{-4}	150	20.28
IR86-MW71IW	2037.20	6.3×10^{-4}	150	13.58
IR86-MW72IW	1046.50	6.1×10^{-4}	150	6.98

Notes:
ft - foot or feet
d - day

TABLE 1-6

Zone 1 Pilot Study Slug Test Results

Site 86 Pilot StudyReport

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Well ID	Hydraulic Conductivity (K)							
	K (ft/d) Test 1	K (cm/sec) Test 1	K (ft/d) Test 2	K (cm/sec) Test 2	K (ft/d) Test 3	K (cm/sec) Test 3	K (ft/d) Mean	K (cm/sec) Mean
IR86-MW61	10.61	3.74E-03	10.44	3.68E-03	10.23	3.61E-03	10.43	3.68E-03
IR86-MW66	3.78	1.33E-03	4.41	1.56E-03	4.38	1.55E-03	4.19	1.48E-03
IR86-MW67	1.32	4.66E-04	0.97	3.42E-04	1.27	4.48E-04	1.19	4.19E-04
IR86-MW68	3.44	1.21E-03	3.15	1.11E-03	4.02	1.42E-03	3.54	1.25E-03
IR86-MW69	2.86	1.01E-03	3.14	1.11E-03	2.99	1.05E-03	3.00	1.06E-03

Notes:
cm - centimeter
ft - foot or feet
sec- second
d - day

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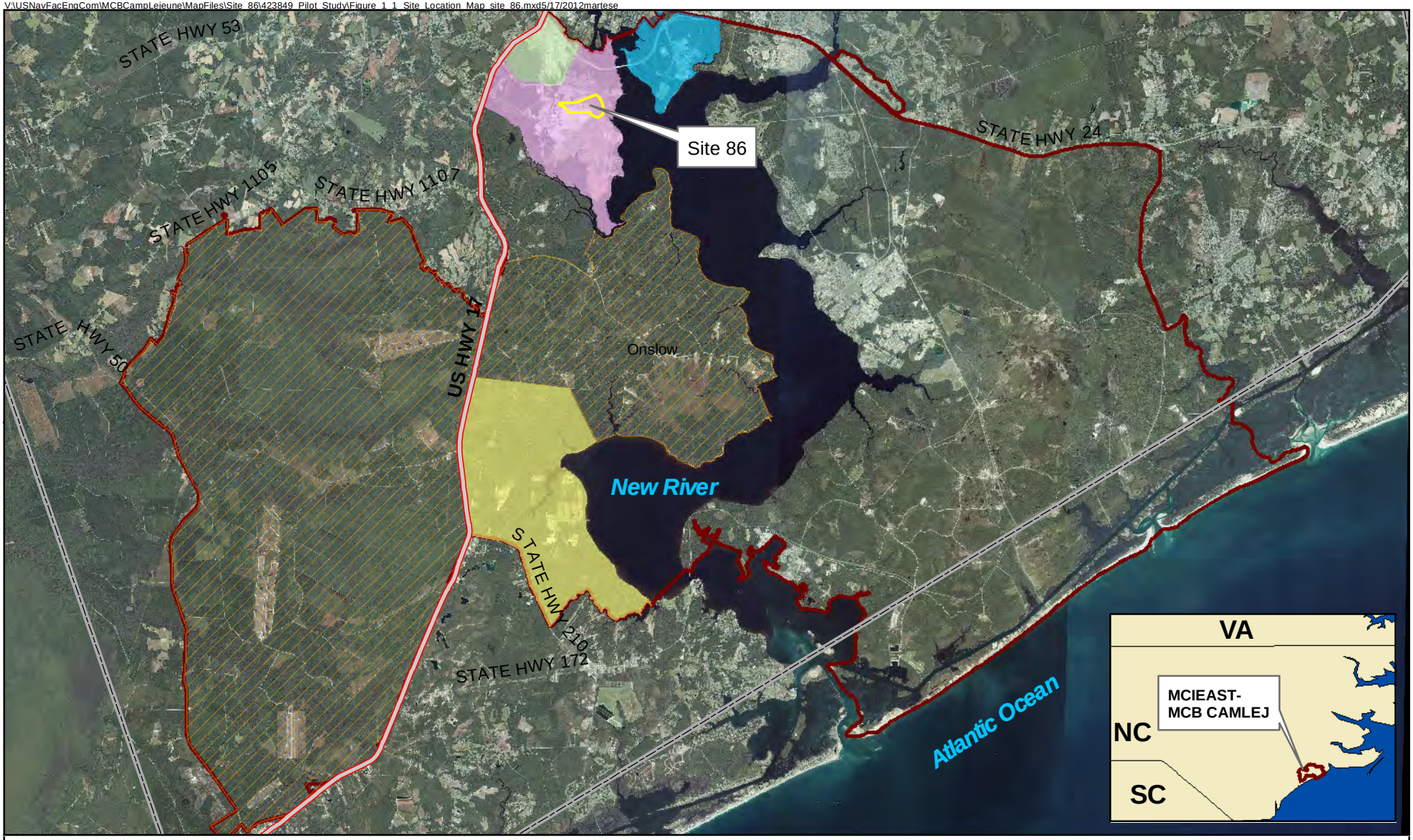

Legend

- Highways
- Greater Sandy Run Training Area
- Stone Bay Rifle Range
- Camp Geiger
- Camp Johnson
- MCAS New River
- Site 86
- Onslow County
- Installation Boundary

N

0 7,500 15,000 30,000 Feet

1 inch = 15,000 feet

Figure 1-1
Site Location Map
Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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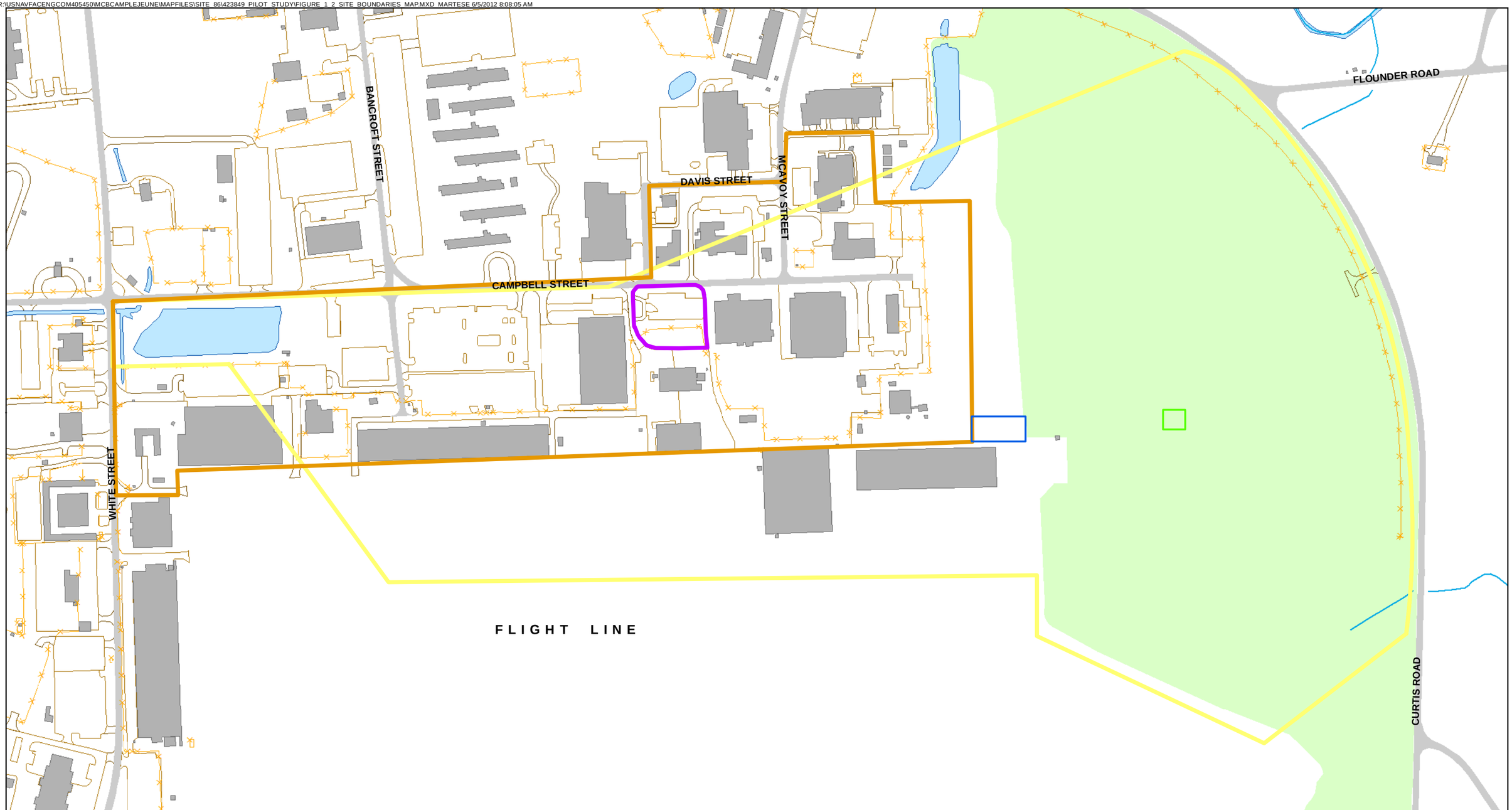

Legend

- Fence Line
- Drainage Ditch
- Surface Water Centerline
- Surface Water Body Area
- Buildings
- Road
- Vehicle Driveway Area
- Vehicle Parking Area
- Original Site 86 Boundary
- August 2006 Site 86 Boundary
- March 2010 Site 86 Boundary
- Northeast Grass Area
- Zone 1 Pilot Study Area
- Zone 2 Pilot Study Area

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 1-2
Site Boundaries Map
Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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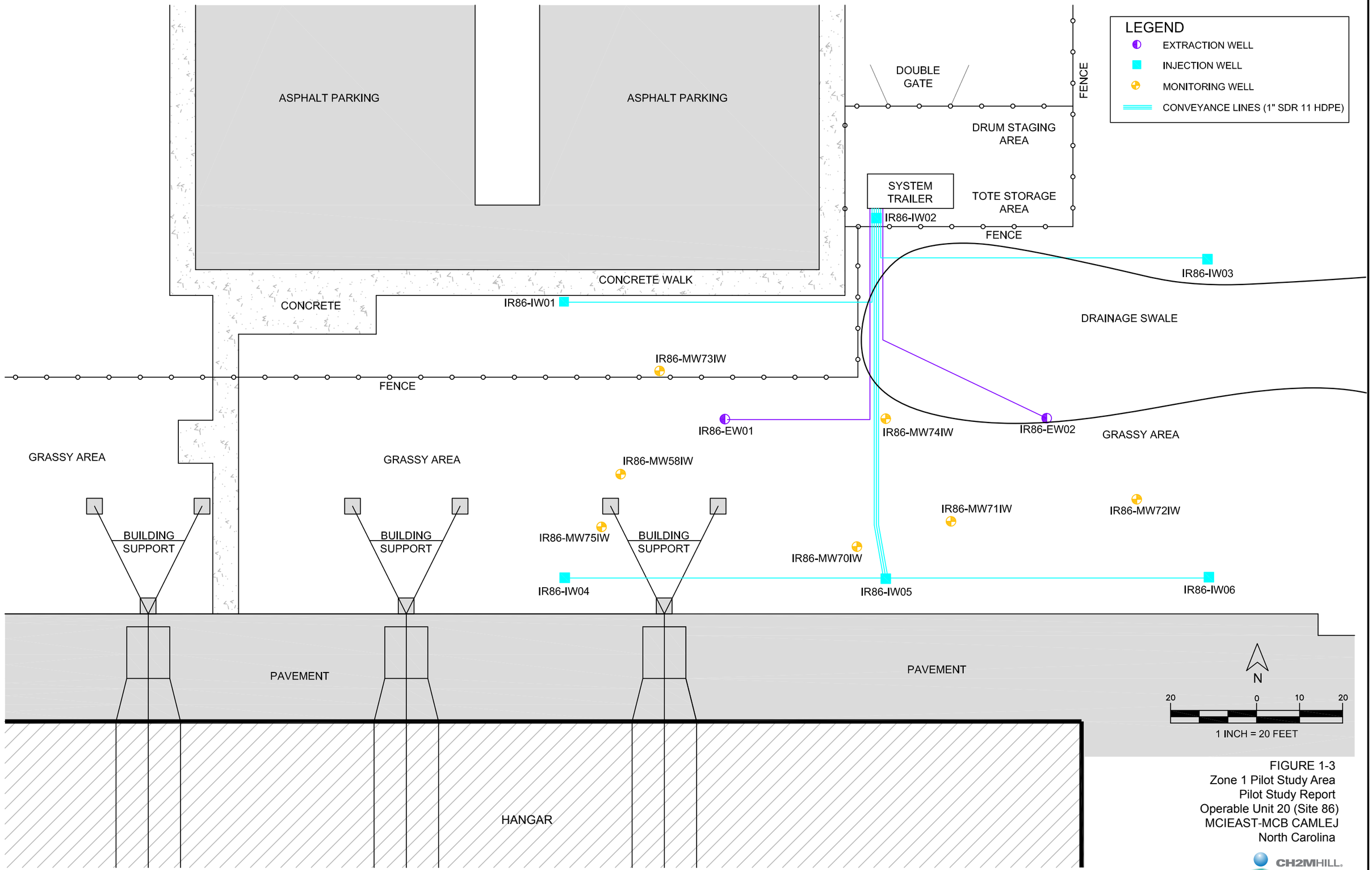

FIGURE 1-3
Zone 1 Pilot Study Area
Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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ES022112162539MKE

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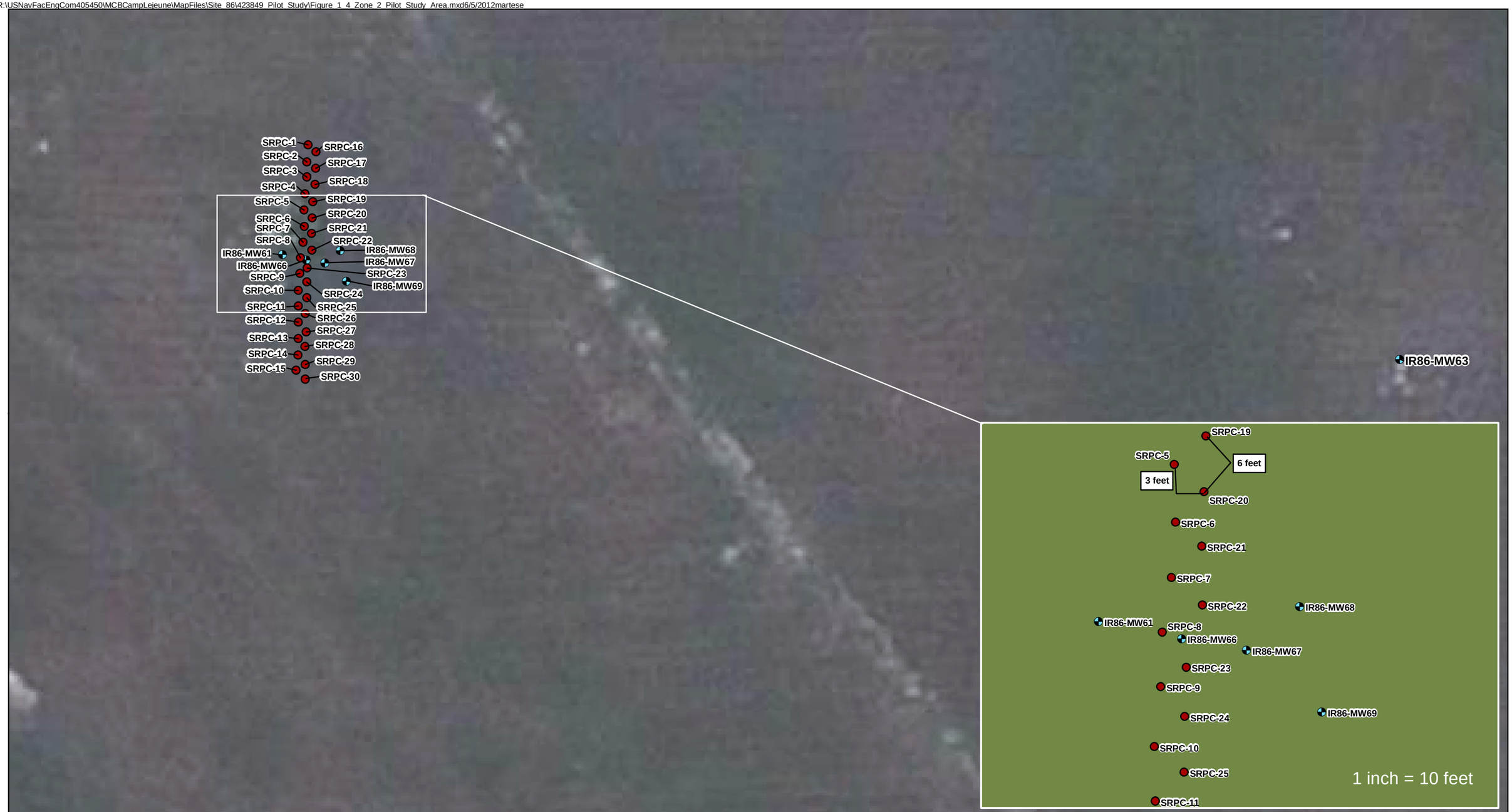

Legend

- Slow Release Permanganate Candles
- Monitoring Wells

N

0 35 70 Feet

1 inch = 35 feet

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Figure 1-4
Zone 2 Pilot Study Area
Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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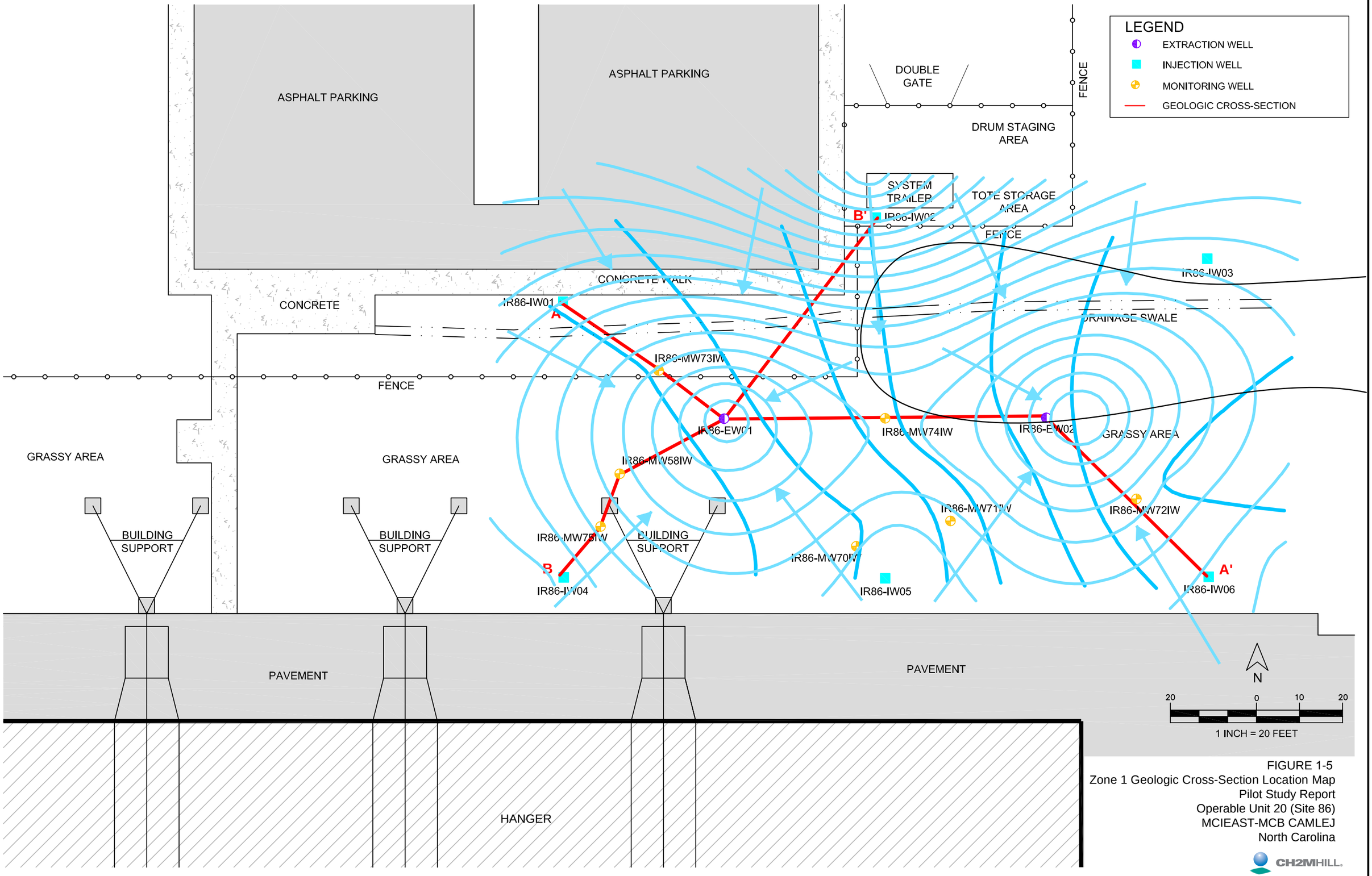

FIGURE 1-5
Zone 1 Geologic Cross-Section Location Map
Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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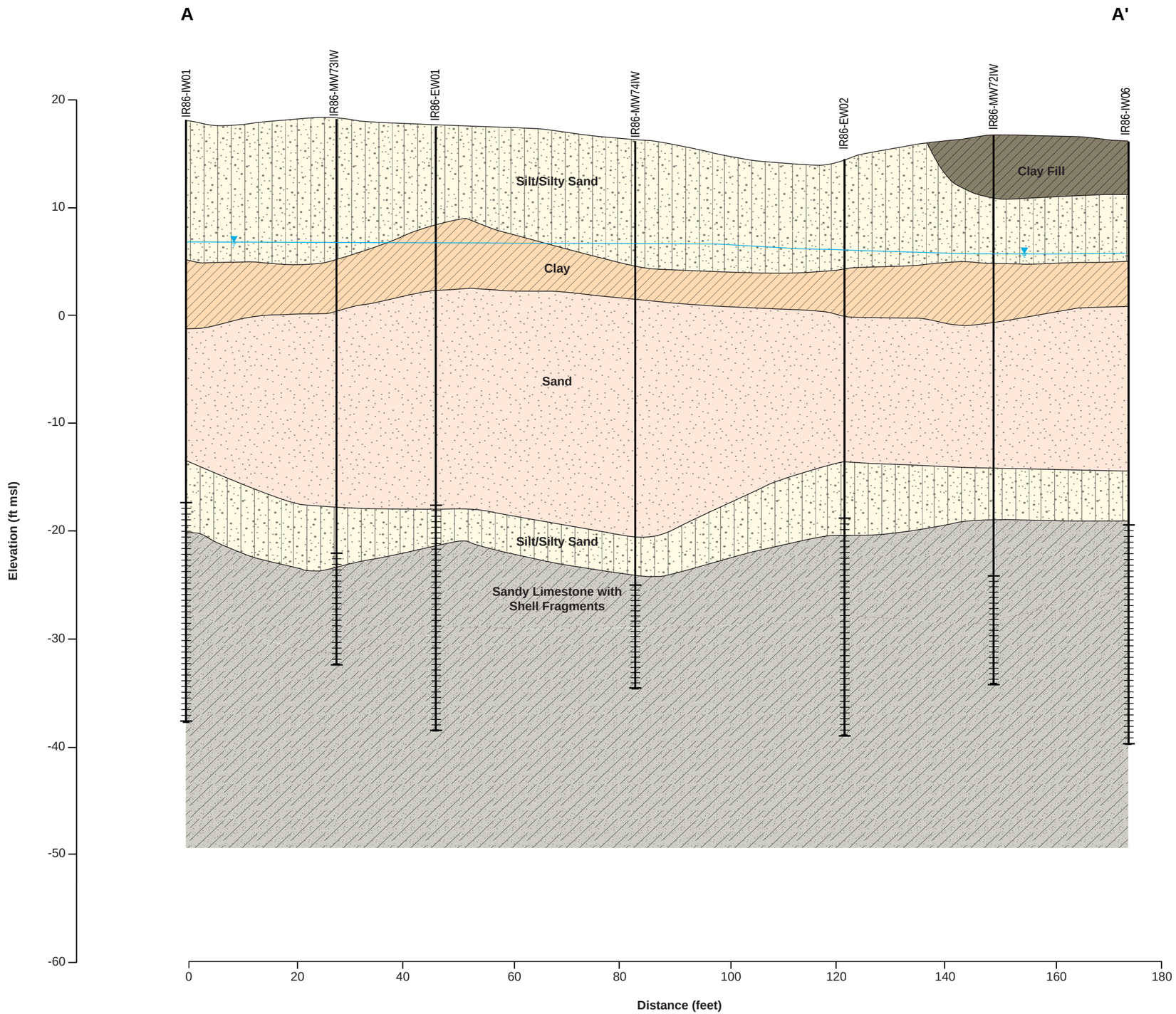

Horizontal: 1" = 20'
Vertical: 1" = 10'
V.E. = 2x

LEGEND

- Silt/Silty Sand
- Clay
- Sand
- Partially to Completely Cemented Sandy Limestone with Shell Fragments
- Clay Fill
- Screened Interval
- Soil Boring
- Groundwater Potentiometric Surface

Note

The depth and thickness of the subsurface strata indicated on this section (profile) were generalized from and interpolated between test locations. Subsurface conditions occurring at the other locations may differ from conditions occurring at indicated locations.

Figure 1-6
Zone 1 Geologic Cross Section A-A'
Site 86 Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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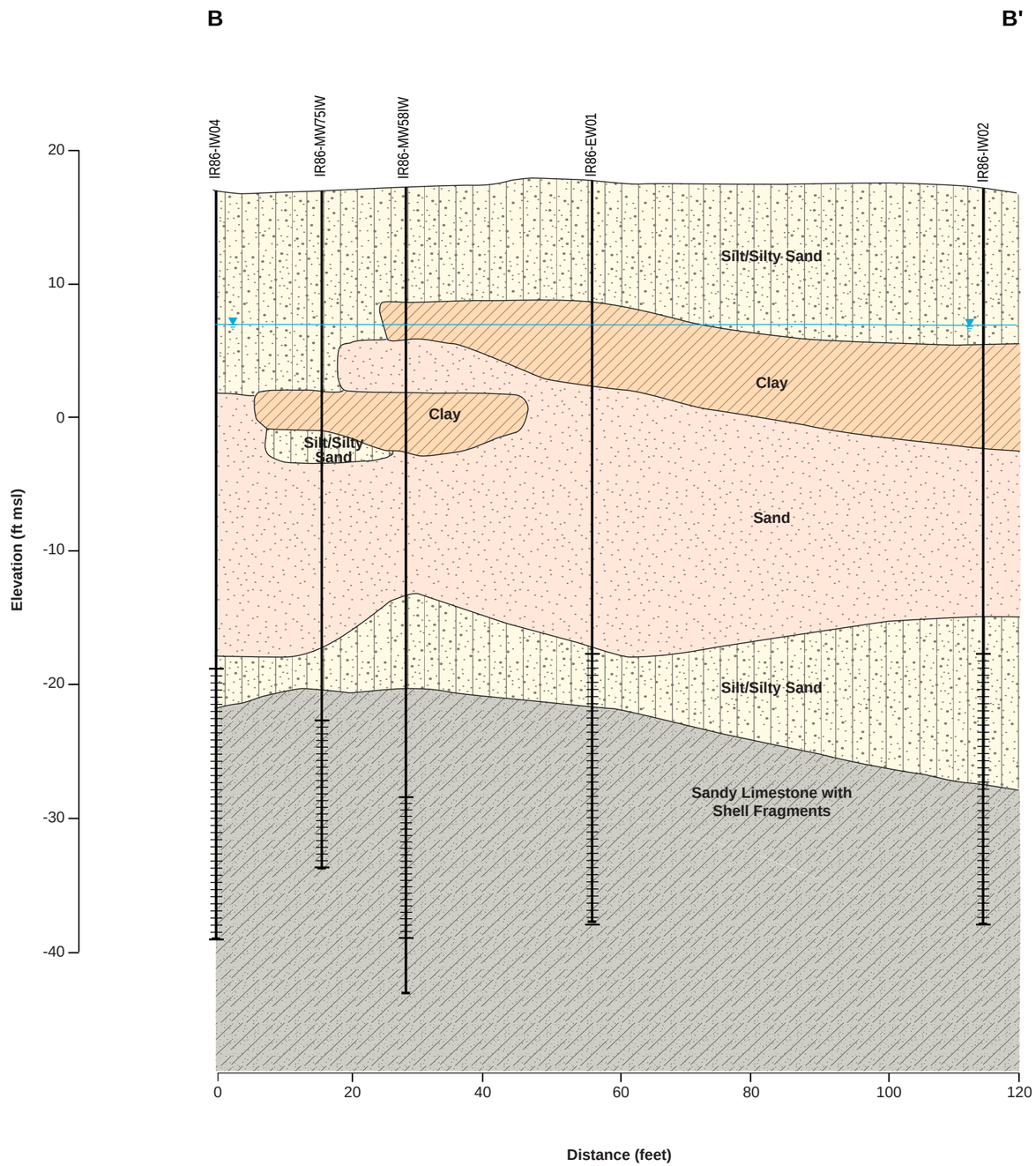

Horizontal: 1" = 20'
Vertical: 1" = 10'
V.E. = 2x

LEGEND

- Silt/Silty Sand
- Clay
- Sand
- Partially to Completely Cemented Sandy Limestone with Shell Fragments
- Screened Interval
- Soil Boring
- Groundwater Potentiometric Surface

Note

The depth and thickness of the subsurface strata indicated on this section (profile) were generalized from and interpolated between test locations. Subsurface conditions occurring at the other locations may differ from conditions occurring at indicated locations.

Figure 1-7
Zone 1 Geologic Cross Section B-B'
Site 86 Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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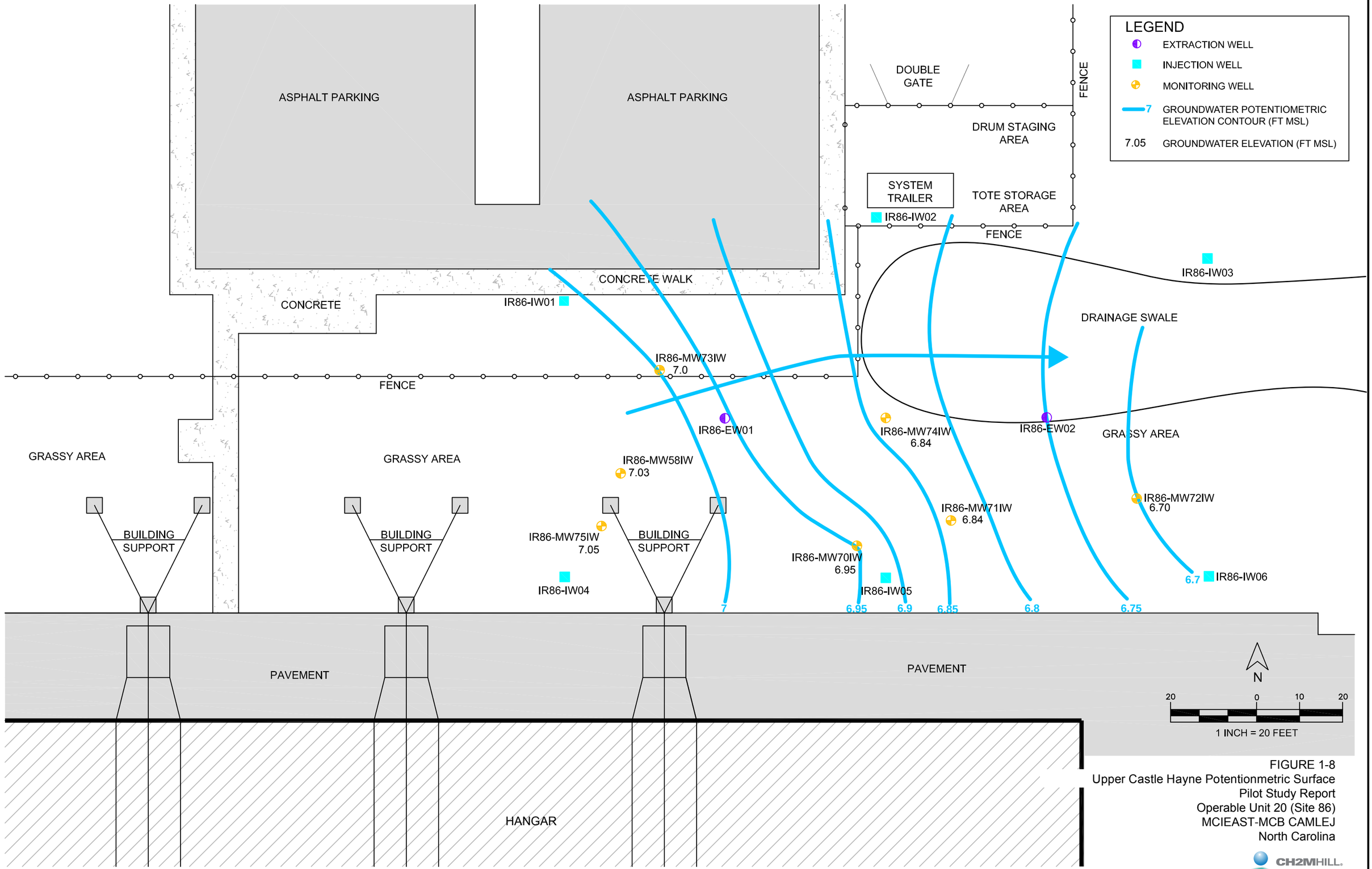

FIGURE 1-8
Upper Castle Hayne Potentionmetric Surface
Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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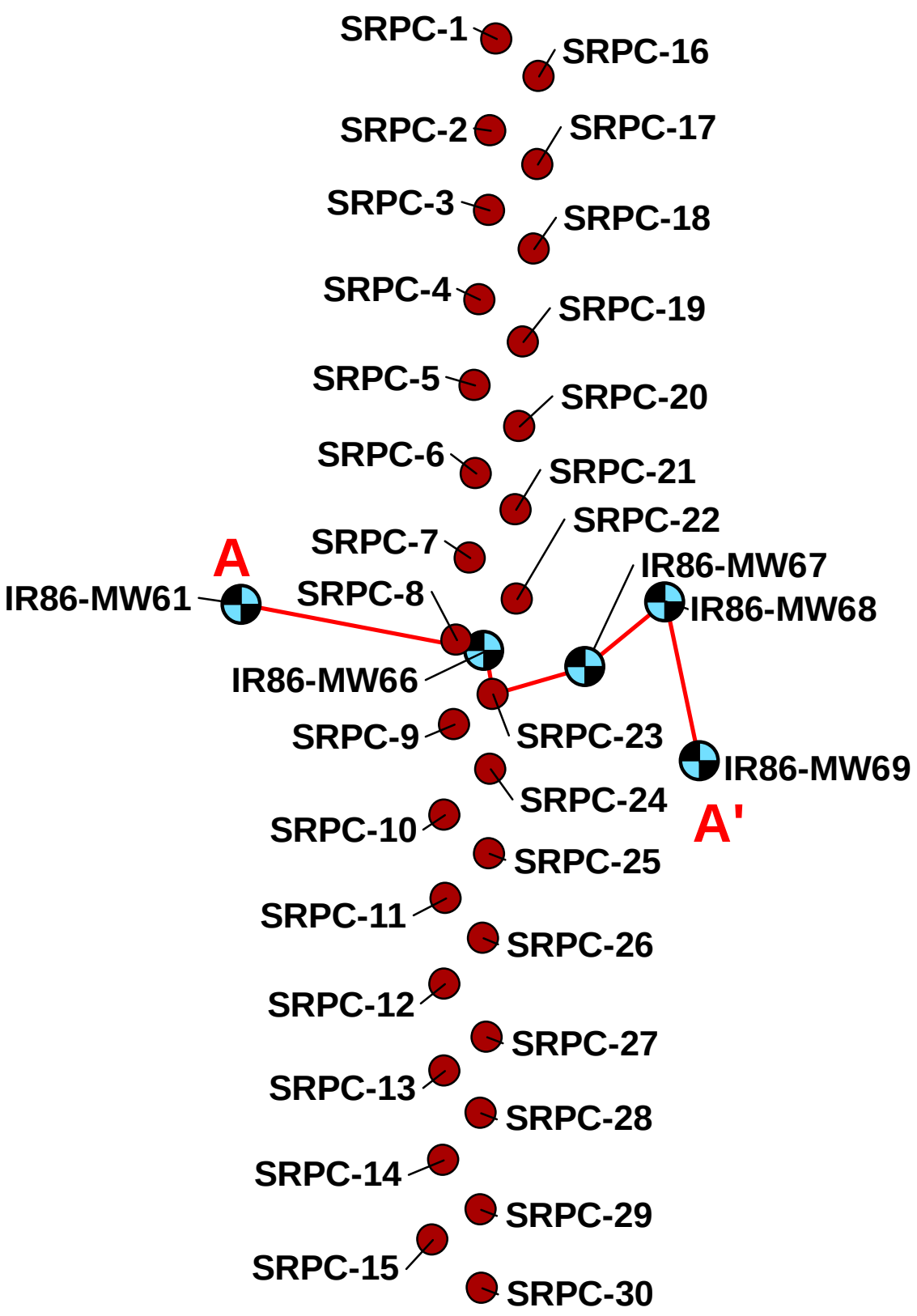

Legend

- Slow Release Permanganate Candle
- Monitoring Well
- Geologic Cross-Section

N

0 12.5 25 50 Feet

1 inch = 25 feet

FIGURE 1-9
Zone 2 Geologic Cross-Section Location Map
Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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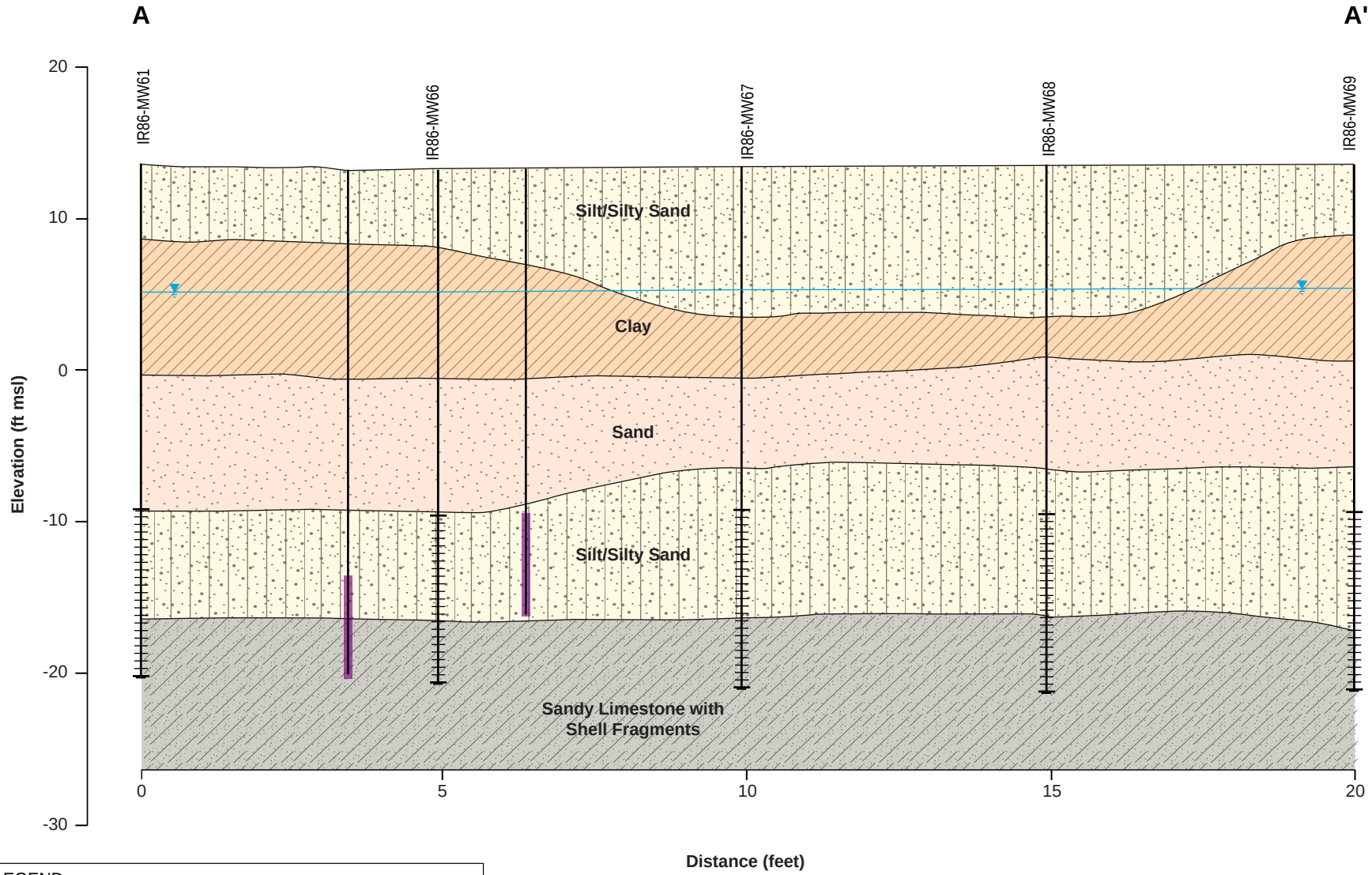

LEGEND

- Silt/Silty Sand
- Clay
- Sand
- Partially to Completely Cemented Sandy Limestone with Shell Fragments
- Screened Interval
- Soil Boring
- Groundwater Potentiometric Surface
- Permanganate Candle (SRPC)

Horizontal: 1" = 2.5'
Vertical: 1" = 10'
V.E. = 0.25x

Note

The depth and thickness of the subsurface strata indicated on this section (profile) were generalized from and interpolated between test locations. Subsurface conditions occurring at the other locations may differ from conditions occurring at indicated locations.

Figure 1-10
Zone 2 Geologic Cross Section A-A'
Site 86 Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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SECTION 2

Pilot Study Implementation

This section describes the tasks completed to implement the Zone 1 and Zone 2 pilot studies. Tasks common to both pilot study areas are summarized below. Details specific to the Zone 1 and Zone 2 pilot study areas are provided in the subsequent sections.

2.1 Utility Location

Prior to performing intrusive activities, the North Carolina One-Call Center and MCIEAST-MCB CAMLEJ utilities were contacted to inform them of the proposed intrusive locations and drilling dates. CH2M HILL additionally subcontracted East Coast Locating Services of Erwin, North Carolina, to locate subsurface utilities within the Zone 1 and Zone 2 pilot study areas before conducting intrusive activities. Subsurface utilities were identified using radio frequency and line tracing instrumentation. In order to confirm that drilling locations were clear of subsurface utilities, each boring was hand cleared to a depth of 5 ft using a hand auger.

2.2 Surveying

CH2M HILL also subcontracted East Coast Locating Services to survey the horizontal and vertical coordinates of the Zone 1 and Zone 2 pilot study area wells and 30 SRPC borings within the Zone 2 pilot study area. A depth-to-groundwater measuring point (top of casing) was established for each pilot study area well.

Survey points were referenced both horizontally and vertically to North American Datum 1983 (NAD83) and North American Vertical Datum 1988 (NAVD 88), with ties to the South Carolina State Plane Coordinate System, Zone 3900. Ground surface and monitoring well top-of-casing vertical control was surveyed to the nearest 0.01 ft, and the horizontal control was to the nearest 0.10 ft.

2.3 Zone 1 ERD Pilot Study Implementation

The ERD Recirculation System pilot study involved the injection of sodium lactate solution into six periphery injection wells, with simultaneous recovery using two centrally located extraction wells. The following tasks were performed to facilitate the ERD pilot study.

2.3.1 Groundwater Modeling

Groundwater modeling was performed to optimize the ERD treatability study footprint by varying the number, location, pumping rates, and spacing of the injection and extraction well configuration. The model accounted for lateral and vertical groundwater flow to forecast the three-dimensional distribution of substrate over a variety of injection arrays. Based on the groundwater modeling results, a double five-die pattern, as shown in **Figure 1-3,** was selected as the optimal substrate delivery array. A technical memorandum detailing the groundwater modeling results was presented in the Site 86 Pilot Study Implementation Plan (IP) (CH2M HILL, 2011b).

2.3.2 Well Installation

Six 4-inch injection wells (IR86-IW01 through IR86-IW06), two 4-inch extraction wells (IR86-EW01 and IR86-EW02), and six 2-inch monitoring wells (IR86-MW70IW through IR86-MW75IW) were installed using a Geoprobe model 8140 DT rotosonic drill rig. A summary of well construction details is provided in **Table 2-1,** and **Figure 1-3** depicts the location of each well.

As shown on **Figure 1-3**, the injection wells were installed with a row of three wells positioned to the north of existing monitoring well IR86-MW58IW, with a second row of three injection wells positioned south of IR86-MW58IW. Based on the results of the groundwater modeling, the injection wells were spaced approximately 75 ft apart and installed to a depth of 55 ft bgs, with 20 ft of 4-inch-outer-diameter, 0.020-inch slot “vee-wire” (semi-continuous slot) polyvinyl chloride (PVC) screen.

The extraction wells were installed at the midpoint between the injection wells, arranged to complete a five-die pattern between the injection wells (**Figure 1-3**). Based on the results of the groundwater modeling, extraction

wells IR86-EW01 and IR86-EW02 were spaced approximately 75 ft apart and installed to a depth of 55 and 53 ft bgs, respectively. Extraction wells were constructed using 20 ft of 4-inch-outer-diameter 0.020-inch slot "vee-wire" PVC screen.

To monitor the effectiveness of the system and lactate distribution throughout the target interval of the upper Castle Hayne aquifer, six monitoring wells were installed as shown on **Figure 1-3**. Five of the six monitoring wells were placed at varying distances in line with the predicted groundwater flow path, between an injection well and an extraction well to evaluate lactate distribution, breakthrough, and radius of influence. The sixth well was installed at the midpoint between the two extraction wells to monitor lactate distribution between the two extraction wells. Monitoring wells were installed to a depth of approximately 50 ft bgs and were constructed using 2-inch schedule 40 PVC with 10 ft of 2-inch schedule 40, 0.010-inch slot PVC screen.

TABLE 2-1
Zone 1 Pilot Study Well Construction Details

Well ID	Well Diameter (inches)	Total Well Depth (feet)	Screen Length (feet)
IR86 – IW01	4	55	20
IR86 – IW02	4	55	20
IR86 – IW03	4	55	20
IR86 – IW04	4	55	20
IR86 – IW05	4	55	20
IR86 – IW06	4	55	20
IR86 – EW01	4	55	20
IR86 – EW02	4	53	20
IR86 – MW70IW	2	50	10
IR86 – MW71IW	2	50	10
IR86 – MW72IW	2	50	10
IR86 – MW73IW	2	50	10
IR86 – MW74IW	2	50	10
IR86 – MW75IW	2	50	10

2.3.3 Site Work

Upon completion of the well installation activities, A&D Environmental of High Point, North Carolina, was subcontracted to perform the site work preparation for the ERD injection/extraction system. Tasks associated with the site work included:

- Installation of a 240-volt single-phase power source and two electrical poles
- Excavation of trenches to bury high-density polyethylene system extraction/injection line piping
- Installation of a Grundfos 15SQ submersible pump in each of the two extraction wells
- Plumbing of injection and extraction lines to a manifold
- Installation of recirculation system trailer

2.3.4 Substrate Distribution System Layout and Components

The ERD substrate recirculation system site layout is depicted on **Figure 1-3**. A process flow diagram of the recirculation system components is depicted on **Figure 2-1**. As shown on **Figure 2-1**, the primary components of the substrate distribution system were two submersible pumps, a booster pump, cartridge bag filter, two-stage granular activated carbon (GAC) beds containing 500 pounds of GAC each, a dosing pump, static mixer, and six-leg

distribution manifold with dedicated flowmeters, pressure gauges, and throttling valves. The system had fail-safe interlock controls, including process line pressure sensors and pressure transducers for each injection well to monitor water levels.

2.3.5 ERD Substrate and Bioaugmentation Injection

The WilClear ERD substrate (a 60 percent soluble sodium lactate solution) was injected into the upper Castle Hayne aquifer on three separate events: November 8 and 9, 2011; January 10 and 11, 2012; and March 5 and 6, 2012. During each injection event, approximately 10,000 pounds of WilClear was injected into the upper Castle Hayne aquifer within the pilot study area. Analytical data obtained from the WilClear product indicated a total organic carbon (TOC) concentration of 240,000 mg/L.

During each WilClear injection event, groundwater was extracted from upper Castle Hayne aquifer extraction wells IR86-EW01 and IR86-EW02 at a rate averaging 7.5 gallons per minute (gpm), respectively, using an electric submersible pump. Extracted groundwater was routed through a filter vessel to remove sediment, followed by the GAC beds. Extracted groundwater was then amended with WilClear through a dosing pump at a rate of 1.65 gpm to maintain an approximate 5.9 percent sodium lactate injectate solution, as specified in the IP.

The 5.9 percent sodium lactate solution was pumped through a six- leg injection manifold and 1-inch-diameter high-density polyethylene conveyance lines to each of the six injection wells. A pressure transducer was installed in each injection well to suspend system operation in case of excessive groundwater mounding and/or pressure increases within the injection well as a result of well efficiency decline caused by biofouling of the injection well screen.

In order to assess the lactate distribution throughout the pilot study area, TOC samples were periodically collected from monitoring wells and the two extraction wells. TOC data collected during the pilot study are included in **Table 2-2**. TOC data suggested that the lactate was effectively distributed (> 20 mg/L) in the extraction wells, after 1 week of recirculation. In order to prevent biofouling and the removal of TOC from the recirculated groundwater, the GAC beds were bypassed after 1 week of system startup and remained bypassed throughout the pilot study.

Approximately 2 weeks after the initial lactate injection, when TOC was effectively distributed and aquifer conditions (DO and ORP) were conducive for bioaugmentation, 33.3 liters of TSI DC (D*ehalococciodes* bioaugmentation culture) was directly injected into each of the six upper Castle Hayne aquifer injection wells to facilitate the complete reductive dechlorination of TCE and associated daughter products.

2.4 Zone 2 Slow-Release Permanganate Candle Permeable Reactive Barrier Pilot Study Implementation

2.4.1 Well Installation

In order to assess the effectiveness of the SRPC PRB, four downgradient monitoring wells, IR86-MW66 through IR86-MW69, were installed approximately 0, 3, 10, and 15 ft downgradient of the SRPC PRB to a depth of 33 ft bgs. Each monitoring well was constructed using 2-inch schedule 40 PVC with 10 ft of 2-inch schedule 40, 0.010-inch slot PVC screen. Zone 2 well construction details are provided in **Table 2-3** and the locations of the monitoring wells are shown on **Figure 1-4.**

TABLE 2-3
Zone 2 Pilot Study Well Construction Summary

Well ID	Well Diameter (inches)	Total Well Depth (feet)	Screen Length (feet)
IR86-MW66	2	33	10
IR86-MW67	2	33	10
IR86-MW68	2	33	10
IR86-MW69	2	33	10

2.4.2 SRPC Deployment

Sixty SRPCs were installed at 30 locations within the Zone 2 pilot study area using a Geoprobe model 7720 DT direct-push technology (DPT) drill rig. As shown on **Figure 1-4**, the SRPCs were installed along two 80-ft-long transects. Each transect consisted of 15 SRPC borings installed every 6 ft. The two transects were offset by 3 ft so that a SRPC was positioned every 3 ft (**Figure 1-4**).

Along the easternmost transect, SRPCs were installed to a depth of 33 ft bgs and encompassed the depth interval of 33 to 27 ft bgs. Along the westernmost transect, SRPCs were installed to a depth of 29 ft bgs and encompassed the depth interval of 29 to 23 ft bgs. The two transects were staggered vertically to bracket the 10-ft screened intervals of the Zone 2 monitoring wells, as shown on **Figure 1-10**.

At each SRPC boring, the DPT drill rig advanced a 3-inch steel casing to the desired depth, which ranged from 27 to 33 ft bgs. Once the casing was advanced to the desired depth, a thin layer (~ 0.5 ft) of sodium bentonite was placed into the bottom of the borehole to mitigate density-driven flow of MnO_4^- at the borehole. A thin layer (~0.5 ft) of Driller Services, Inc. GP2 sand was placed above the bentonite, and two 3-foot-long SRPCs were carefully lowered in the casing onto the GP2 sand, stacked on top of each other, to encompass a total of 6 feet.

Once the SRPCs were installed, the casing was extracted and the formation was allowed to collapse around the annular space between the SRPC and formation wall. Sodium bentonite was added to each SRPC borehole above the collapsed formation to properly seal the boring.

2.5 Groundwater Monitoring

Groundwater samples were collected from monitoring wells within the Zone 1 and Zone 2 pilot study areas to monitor the effectiveness of the respective treatment technologies. Groundwater sampling was conducted in accordance with the IP. Details associated with groundwater monitoring for each of the two pilot studies are provided below.

2.5.1 Zone 1 Groundwater Monitoring

Groundwater samples were collected from the following upper Castle Hayne aquifer monitoring wells associated with the Zone 1 ERD pilot study area: IR86-MW55IW, IR86-MW58IW, IR86MW59IW, IR86MW61IW, and IR86-MW70IW through IR86-MW75IW. Groundwater samples associated with the Zone 1 pilot study area were analyzed by ENCO laboratories for VOCs, volatile fatty acids (VFAs), and TOC to evaluate the effectiveness of the lactate and bioaugmentation treatments. Bioassay samples were also collected from select monitoring wells and submitted for quantitative real-time polymerase chain reaction-ribonucleic acid expression analysis to assess the performance of the bioaugmentation culture and to track the bacterial populations within the Zone 1 pilot study area. Four groundwater sampling events were conducted over the course of the Zone 1 pilot study: baseline, 1 month, 3 months, and 6 months.

2.5.2 Zone 2 Groundwater Monitoring

Groundwater samples were collected from the following surficial aquifer monitoring wells associated with the Zone 2 SRPC pilot study area including: IR86-MW61, IR86-MW63, and IR86-MW66 through IR86-MW69 (**Figure 1-4**).

Groundwater samples were analyzed for VOCs by ENCO laboratories, as specified in the IP. Four groundwater sampling events were conducted over the course of the Zone 2 pilot study: baseline, 1 month, 3 months, and 6 months.

2.6 Zone 1 Recirculation System Decommissioning

The groundwater recirculation system was decommissioned in May 2012. During the decommissioning, submersible groundwater extraction pumps and pressure transducers were removed from their respective wells. Electricity was removed from the system trailer and the system trailer was removed from the site. HDPE lines were capped and buried.

TABLE 2-2

Temporal Changes in Total Organic Carbon Concentrations - Zone 1 Pilot Study

Site 86 Pilot Study Report

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Well ID	IR86-MW70IW	IR86-MW71IW	IR86-MW72IW	IR86-MW73IW	IR86-MW74IW	IR86-MW75IW	IR86-EW01	IR86-EW02
Sample Date	**Total Organic Carbon Concentrations (mg/L)**							
10/18/2011	2.8	2.6	3	2.3	2.6	4.1	NA	NA
11/16/2011	14	190	400	4.8	12	1900	300	85
12/1/2011	23	200	2600	7.5	35	3100	270	250
12/12/2011	27	310	400	330	270	260	NA	NA
1/5/2012	17	38	100	5.6	14	180	38	240
1/23/2012	670	720	970	780	1200	840	NA	NA
2/17/2012	84	320	510	8.6	36	640	96	720
3/1/2012	66	140	360	3.3	210	120	71	550
4/10/2012	1600	3200	330	14	800	280	60	23
5/1/2012	790.0	650	820	140	670	160	NA	NA

Notes:
NA - Not Analyzed
Lactate injections were administered on 11/9/2011, 1/10/2012, and 3/7/2012.

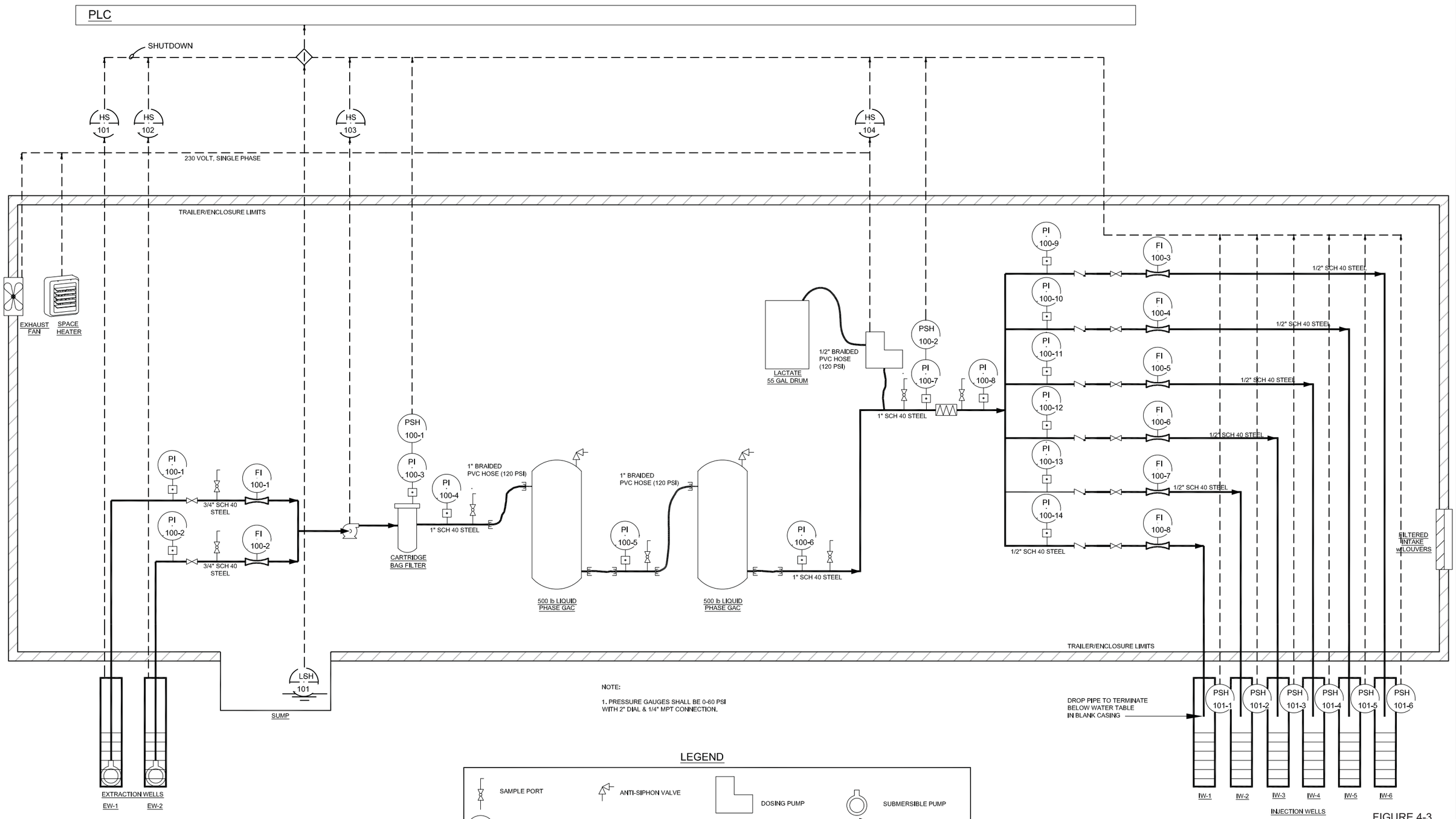

FIGURE 4-3
PROCESS FLOW DIAGRAM
PILOT STUDY IMPLEMENTATION PLAN
SITE 86 (OU 20)
MCB CAMP LEJEUNE
NORTH CAROLINA

CH2MHILL.

EBL\Navy Clean\OU 20(Site 86)\2010 Pilot Study\Working Figures

SECTION 3

Pilot Study Results

This section discusses the results of both the Zone 1 and Zone 2 pilot studies. Groundwater analytical laboratory results obtained throughout the two pilot studies are provided as **Appendix C**.

3.1 Zone 1 ERD and Bioaugmentation Pilot Study Area Results

3.1.1 Recirculation System Capture Zone

During system operation, groundwater was extracted from each extraction well (IR86-EW01 and IR86-EW02) at a rate of approximately 7.5 gpm. The combined 15 gpm flow was amended with 1.65 gpm of the lactate amendment, mixed through a static mixer, and injected into each of the six peripheral injection wells (IR86-IW01 through IW86-IW06) at a rate of approximately 2.78 gpm.

On November 16, 2011, after 1 week of recirculation, the monitoring, extraction, and injection wells were gauged to assess the effective capture zone of the recirculation system. The wells were gauged during system operation and the gauging data and well survey data were used to obtain groundwater elevations, which in turn were used to plot a potentiometric surface map of the upper Castle Hayne aquifer within the pilot study area. The November 16, 2011 groundwater gauging data from the post-recirculation system startup is presented in **Table 3-1**. The potentiometric surface map is presented as **Figure 3-1** and represents the aquifer's response to the recirculation system. Based on the potentiometric surface map, an extraction rate of approximately 7.5 gpm from each of the two extraction wells appeared to be more than sufficient to capture upper Castle Hayne groundwater within the 0.3-acre pilot study area footprint. Based on the geometry of the capture zone, the extraction wells appeared to hydraulically contain (capture) pilot study groundwater within at least a 60-ft radius of each extraction well. The capture zone likely extended greater than 60 ft from each extraction well; however, groundwater elevation data greater than 60 ft was not available.

3.1.2 Lactate Distribution

Approximately 30,000 pounds of sodium lactate was injected into the upper Castle Hayne aquifer over three separate injection events. During each injection event, 10,000 pounds of 60 percent sodium lactate was dosed into extracted groundwater to yield an injected lactate concentration of approximately 5.9 percent sodium lactate. The sodium lactate amendment, before mixing with site groundwater, contained 240,000 mg/L TOC. The TOC concentration injected in the injection wells after mixing with site groundwater contained a TOC concentration of approximately 14,163 mg/L (240,000 mg/L * 5.9 percent).

Groundwater samples were collected throughout the pilot study and analyzed for TOC to evaluate the lactate distribution, as well as the rate of lactate consumption (**Table 2-2**). TOC was detected in extraction wells IR86-EW01 and IR86-EW02 at a concentration greater than 20 mg/L (distribution goal specified in the IP) within 1 week of recirculation, indicating that 10,000 pounds were sufficient to treat the total volume within the pilot study area, estimated to be 330,000 cubic ft (ft^3) (24,750 $ft^3$of soil and 82,500 $ft^3$of groundwater).

Although lactate distribution goals were achieved based on TOC concentrations detected in IR86-EW01 and IR86-EW02 after 1 week of recirculation, TOC concentrations in groundwater samples collected from the monitoring wells ranged from 4.8 to 1,900 mg/L. This variance is likely attributed to preferential pathways, due to the variability of hydraulic conductivity in the upper Castle Hayne aquifer as confirmed by the slug tests. The recirculation system operated for an additional 1 to 2 weeks after the distribution goal was achieved to increase the distribute of lactate in areas of reduced hydraulic conductivity.

Concentrations of TOC measured in groundwater did not reach the 14,163 mg/L injection concentrations. This is likely due to fermentation/consumption, borehole mixing, and bifurcation into preferential pathways. **Figure 3-2** shows the temporal changes in TOC concentrations throughout the duration of the pilot study.

3.1.3 Dechlorinating Bacteria Trends

Bacterial populations in groundwater sampled throughout the pilot study are summarized in **Table 3-2.** The total *Dehalococciodes* populations in groundwater sampled during the baseline groundwater sampling ranged from 1.8 to 7.89 x 10^{1} gene copies per milliliter (gc/mL). The total *Dehalococciodes* populations in groundwater sampled during the 6-month groundwater sampling event were significantly higher and ranged from 6.95 x 10^{5} to 6.52 x 10^{6} gc/mL, an increase in five to six orders of magnitude compared to the baseline. *Vinyl Chloride Reductase*, the *Dehalococciodes* gene capable of converting VC to ethene, also increased four orders of magnitude throughout the pilot study. *Vinyl Chloride Reductase* populations grew from a mean concentration of 0.5 gc/mL detected in baseline groundwater to a mean concentration of 1.4 x 10^{4} gc/mL detected in groundwater sampled during the 6-month sampling event. **Figure 3-4** shows the temporal changes in dechlorinating bacteria concentrations throughout the duration of the pilot study.

3.1.4 Volatile Fatty Acids

As lactate ferments, hydrogen and VFAs, including acetate and propionate, are produced. Propionate can also ferment, generating additional hydrogen as well as acetate. Hydrogen is the dominant electron donor used to support biotic reductive dechlorination of chlorinated VOCs. Acetate is not fermentable; however, it can support the growth of methanogens, helping to maintain reducing conditions, which is essential for an ERD system.

Elevated concentrations (tens to hundreds of mg/L) of VFAs should be expected along with fermentation and consumption of lactate after implementation of ERD. Simultaneous decreasing trends of lactate concentration and increasing trends of its fermentation products in the treatment area is a good indicator of bacterial consumption of the injected substrate and the health of the bacterial consortium.

VFA monitoring data in the Zone 1 pilot study area are summarized in **Table 3-3. Figure 3-3** shows the temporal changes in VFA concentrations throughout the duration of the pilot study. The total VFA concentrations increased from a mean baseline value of 0.97 mg/L to more than 500 mg/L after 1 month, and sustained at a mean concentration of approximately 1,000 mg/L after 3 months and 6 months. This indicates that lactate was effectively distributed in the pilot study area, and the rapid appearance of elevated concentrations of acetate and propionate indicates that the lactate was readily fermentable.

3.1.5 Groundwater Quality Parameter Trends

Groundwater quality parameters were generally consistent throughout the pilot study, except for DO and conductivity. Temporal changes in groundwater quality parameters are presented in **Table 3-4.**

Baseline groundwater DO concentrations within the pilot study area ranged from 0.27 to 0.87 mg/L, with a mean concentration of 0.49 mg/L. DO concentrations below 0.5 mg/L are generally required for anaerobic bacteria to thrive. As shown in **Table 3-4**, decreases in DO concentrations were observed throughout the Zone 1 pilot study area, generally maintaining a groundwater DO concentration of < 0.5 mg/L.

Baseline groundwater conductivity measured during the baseline groundwater sampling event ranged from 0.676 to 0.869 mS/cm, with a mean value of 0.785 mS/cm. As shown in **Table 3-4**, groundwater conductivity increased 2.5 to more than 3.5 times baseline over the course of the pilot study. An increase in groundwater conductivity after an injection event is expected due to the increase in ion concentrations in groundwater. This increase in groundwater conductivity is further evidence that lactate was effectively distributed throughout the Zone 1 pilot study area.

3.1.6 Volatile Organic Contaminant Trends

VOC concentrations in groundwater sampled throughout the pilot study are summarized in **Table 3-5.** Temporal changes in VOCs detected in groundwater samples are depicted on **Figure 3-5**. Baseline TCE concentrations in groundwater sampled from Zone 1 monitoring wells ranged from 110 to 220 µg/L, with a mean concentration of approximately 171 µg/L. TCE concentrations in groundwater sampled from Zone 1 monitoring wells during the 6-month sampling event ranged from below the 1 µg/L detection limit to 31 µg/L. TCE concentrations were below detection limits in groundwater sampled from three of the seven monitoring wells (IR86-MW70IW through IR86-MW72IW) located within Zone 1. The mean concentration of TCE detected in groundwater sampled from Zone 1

monitoring wells during the 6-month groundwater sampling event was 12.2 µg/L. Based on the mean concentrations of TCE in groundwater during the baseline sampling (171 µg/L) and the 6-month groundwater sampling event (12.2 µg/L), approximately 93 percent of the TCE mass present in the upper Castle Hayne aquifer in Zone 1 has been removed.

Concentrations of cis-1,2-DCE detected in groundwater sampled from monitoring wells during the baseline sampling event ranged from 74 to 220 µg/L, with a mean concentration of approximately 133 µg/L. Concentrations of cis-1,2-DCE in groundwater sampled from monitoring wells during the 6-month sampling event ranged from below the detection limit (1 µg/L) to 58 µg/L, below the North Carolina Groundwater Quality Standard of 70 µg/L.

VC concentrations detected in groundwater sampled from monitoring wells during the baseline sampling event ranged from 6.7 to 43 µg/L, with a mean concentration of approximately 14 µg/L. As shown in **Table 3-5** and depicted on **Figure 3-5**, concentrations of VC increased over the first 3 months of the pilot study because of the reductive dechlorination of TCE and cis-1,2-DCE. VC concentrations in groundwater sampled from monitoring wells during the 6-month sampling event ranged from below the detection limit (1 µg/L) to 76 µg/L µg/L. Based on the populations of *Dehalococciodes*, specifically the *Vinyl Chloride Reductase* gene; concentrations of VC are expected to continually decrease over time.

3.2 Zone 2 Slow-Release Permanganate Candle Pilot Study Area Results

3.2.1 Slow-Release Permanganate Candle Diffusion

Groundwater samples were collected from a sample port within the SRPC 8 borehole to assess MnO_4^- diffusion and MnO_4^- concentrations throughout the duration of the pilot study. Groundwater samples were collected at 1, 6, 24, 48, and 72 hours, then again 35, 91, 134, and 187 days after SRPC deployment. A summary of temporal changes in MnO_4^- concentrations released from SRPC 8 is provided in **Table 3-6**. MnO_4^- concentrations quickly peaked to just under 9,000 mg/L as the $KMnO_4$ crystals exposed on the outside of the paraffin wax matrix dissolved (**Table 3-6**). The initial spike in MnO_4^- concentration is consistent with the studies identified in **Section 1.4.2**.

SRPC 8 was evaluated after 35 days of deployment to allow the exposed crystals to fully dissolve and to allow the SRPC to stabilize. On day 35, the MnO_4^- concentration at SRPC 8 was detected at 965 mg/L. Subsequent samples were also collected from SRPC 8 throughout the pilot study to evaluate the longevity of the SRPCs under Site 86 specific conditions. As shown in **Table 3-6**, MnO_4^- concentrations slowly decreased over time.

TABLE 3-6
Temporal Changes in Permanganate Concentrations Released from SRPC 8

Date	Elapse Time	MnO_4^- Concentration at SRPC 8 (mg/L)
10/26/2011	1 hour	3,086
10/26/2011	6 hours	8,765
10/27/2011	24 hours	8,934
10/28/2011	48 hours	8,593
10/29/2011	72 hours	7,309
11/30/2011	35 days	965
1/25/2012	91 days	850
3/7/2012	134 days	675
4/30/2012	187 days	542

Using MnO_4^- concentration and elapsed time data, a data plot was generated to predict future MnO_4^- concentrations and SRPC longevity under Site 86 specific conditions, such as PNOD, groundwater velocity, temperature, and VOC concentrations. A data plot of measured MnO_4^- concentrations and elapsed time data, and predicted MnO_4^- concentrations at 250, 300, and 350 days are shown in **Figure 3-7**. Yan and Schwartz (1999) showed that a permanganate concentration of 120 mg/L can completely degrade TCE at a concentration as high 1 mg/L. Based on the data presented by Yan and Schwartz (1999) and the concentrations predicted in **Figure 3-7**, the SRPCs should effectively remove VOCs from affected groundwater through mid-September 2012, an effective lifespan of nearly 1 year.

3.2.2 Permanganate Distribution

MnO_4^- was not detected in IR86-MW66 (within SRPC PRB) or downgradient monitoring wells IR86-MW67 through IR86-MW69. The lack of MnO_4^- detections in downgradient monitoring wells is likely attributed to one or more of the following causes: consumption by the PNOD as groundwater flowed downgradient (most likely), bifurcation throughout higher conductive lenses in the aquifer, dilution due to borehole mixing during groundwater sampling.

3.2.3 Groundwater Quality Parameter Trends

Groundwater quality parameters were generally consistent throughout the pilot study with the exception of DO. Temporal changes in groundwater quality parameters are presented in **Table 3-7.**

Baseline groundwater DO concentrations within the Zone 2 pilot study area ranged from 0.57 to 3.36 mg/L, with a mean concentration of 1.44 mg/L. As shown in **Table 3-7**, discernable decreases in DO concentrations were observed throughout the Zone 2 pilot study area. DO concentrations measured in groundwater sampled from Zone 2 monitoring wells during the 6-month groundwater sampling event ranged from 0.10 to 0.61 mg/L, with a mean concentration of 0.27 mg/L.

3.2.4 Volatile Organic Contaminant Trends

TCE, cis-1,2-DCE, and 1,1-DCE concentrations decreased in all groundwater samples collected from monitoring wells downgradient of the SRPC PRB within the Zone 2 pilot study area, with VC concentrations remaining below analytical detection limits. Baseline 1,1-DCE concentrations in groundwater were below the NCGWQS of 7 µg/L, and concentrations were reduced to below analytical detection limits within 1 month of SRPC deployment. **Table 3-8** summarizes the VOC concentrations detected in groundwater samples collected during the Zone 2 pilot study and **Figure 3-7** shows the temporal changes in VOC concentrations in groundwater throughout the pilot study.

As shown in **Table 3-8**, the TCE concentration in groundwater sampled from IR86-MW66, located within the SRPC PRB, decreased from a background concentration of 62 µg/L to 13 µg/L during the 3-month sampling event. TCE was detected at a slightly higher concentration of 44 µg/L in groundwater sampled from IR86-MW66 during the 6-month groundwater sampling event. TCE concentrations in groundwater collected from downgradient wells IR86-MW67, IR86-MW68, and IR86-MW69 were also reduced after 3 months, as shown in **Table 3-8** but exhibited the same increasing trend identified in IR86-MW66. This increase in TCE concentrations could be caused by natural conditions (such as seasonal variations), or, the increase could be due to the reduced dissolved permanganate within the PRB. TCE concentrations in groundwater collected from IR86-MW68 exhibited a downward decrease throughout the full 6-month pilot study.

Concentrations of cis-1,2-DCE in groundwater sampled from IR86-MW66 through IR86-MW69 decreased over the course of the pilot study. Cis-1,2-DCE concentrations in groundwater sampled from IR86-MW66 through IR86-MW69 continually declined over 3 months but exhibited the same increasing trend after the 6-month groundwater sampling event (**Figure 3-7**). Cis-1,2-DCE concentrations remain below the NCGWQS of 70 µg/L.

An additional groundwater sampling event will be conducted in July 2012 to continue to monitor VOC concentrations in groundwater and to monitor the permanganate concentrations released from SRPC-8.

TABLE 3-1

3-1 Groundwater Elevations Post Recirculation System Start-Up

Site 86 Pilot Study Report

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

WELL ID	Top of Casing Elevation (ft msl)	Depth to Water November 16, 2011 (ft btoc)	Groundwater Elevation November 16, 2011 (ft msl)
IR86-MW58IW	16.89	--	--
IR86-MW70IW	16.78	10.35	6.43
IR86-MW71IW	16.36	10.13	6.23
IR86-MW72IW	16.24	10.04	6.20
IR86-MW73IW	18.14	11.54	6.60
IR86-MW74IW	16.44	10.21	6.23
IR86-MW75IW	17.12	10.41	6.71
IR86-IW01	18.34	11.08	7.26
IR86-IW02	17.72	8.74	8.98
IR86-IW03	15.54	8.59	6.95
IR86-IW04	16.94	9.84	7.10
IR86-IW05	16.47	9.71	6.76
IR86-IW06	16.12	9.25	6.87
IR86-EW01	17.54	12.12	5.42
IR86-EW02	14.68	9.54	5.14

Notes:
-- - Data not available
ft msl - ft mean sea level
ft btoc - feet below top of casing

TABLE 3-2

Temporal Changes in Dechlorinating Bacteria Concentrations - Zone 1 Pilot Study

Site 86 Pilot Study Report

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Well ID	IR86-MW58IW				IR86-MW70IW				IR86-MW71IW			
Date	10/18/2011	12/12/2011	1/24/2012	5/1/2012	10/18/2011	12/12/2011	1/24/2012	5/1/2012	10/18/2011	12/13/2011	1/24/2012	5/1/2012
Dehalococcoides , Total (gc/mL)	7.89E+01	NA	6.78E+05	6.52E+06	5.77E+01	NA	2.32E+06	1.40E+06	2.00E+00	2.38E+04	1.36E+06	6.97E+05
Dehalococcoides , Vinyl Chloride Reductase (gc/mL)	1.20E+00	NA	1.20E+00	6.33E+04	< 0.5	NA	2.04E+03	1.05E+03	< 0.5	4.74E+02	2.67E+03	1.60E+03
Dehalobacter (gc/mL)	2.71E+03	NA	2.39E+05	2.86E+04	1.96E+02	NA	1.05E+05	1.24E+03	1.37E+04	1.29E+04	4.90E+04	3.37E+04
Desulfuromonas (gc/mL)	6.35E+02	NA	1.00E+04	1.39E+02	1.89E+02	NA	2.31E+04	2.91E+03	2.93E+03	1.60E+03	2.91E+03	1.98E+02

Well ID	IR86-MW72IW				IR86-GW74IW			IR86-MW75IW	
Date	10/18/2011	10/18/2011	12/13/2011	5/1/2012	10/18/2011	12/13/2011	5/1/2012	10/18/2011	12/13/2011
Dehalococcoides , Total (gc/mL)	1.80E+00	1.80E+00	1.24E+03	9.07E+05	3.66E+01	2.80E+04	1.26E+06	7.40E+00	2.92E+06
Dehalococcoides , Vinyl Chloride Reductase (gc/mL)	< 0.25	< 0.5	4.10E+00	2.75E+03	4.00E-01 J	6.40E+00	2.56E+03	< 0.5	4.08E+04
Dehalobacter (gc/mL)	1.44E+03	1.44E+03	2.45E+04	1.34E+04	2.89E+03	6.78E+03	9.91E+03	7.54E+02	2.22E+04
Desulfuromonas (gc/mL)	6.08E+02	6.08E+02	3.04E+02	9.79E+02	2.79E+03	3.20E+03	5.08E+02	2.56E+02	1.22E+03

Notes:

gc/mL - gene copies per milliliter

< - Bacteria was not detected above the minimum reporting limit of 0.5 gc/mL.

J - Concentration is approximate

NA - Not analyzed

TABLE 3-3

Temporal Changes in Volatile Fatty Acid Concentrations - Zone 1 Pilot Study

Site 86 Pilot Study Report

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Well ID	IR86-MW58IW				IR86-MW70IW				IR86-MW71IW				IR86-MW72IW			
Date	10/18/2011	12/12/2011	1/24/2012	5/1/2012	10/18/2011	12/12/2011	1/24/2012	5/1/2012	10/18/2011	12/13/2011	1/24/2012	5/1/2012	10/18/2011	12/13/2011	1/24/2012	5/1/2012
Acetic Acid (mg/L)	0.96	200	110	450	1.4	16	460	690	0.82	190	520	580	1.4	250	700	710
Butyric Acid (mg/L)	< 0.070	5.1	1.3	14	< 0.070	< 0.070	6.2	16	< 0.070	2.1	9.6	13	< 0.070	3.5	15	15
Propionic Acid (mg/L)	0.19	380	190	660	0.18	28	670	810	0.27	320	770	690	0.24	460	970	850
Pyruvic Acid (mg/L)	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070
Lactic Acid/HIBA (mg/L)	0.21	0.3	0.21	<0.14	0.19 J	0.083 J	6.1	0.13 J	0.31	0.069 J	4.6	0.081 J	0.21	<0.14	130	0.099 J

Well ID	IR86-MW73IW				IR86-MW74IW				IR86-MW75IW			
Date	10/18/2011	12/14/2011	1/23/2012	5/2/2012	10/18/2011	12/13/2011	1/24/2012	5/1/2012	10/18/2011	12/13/2011	1/23/2012	5/1/2012
Acetic Acid (mg/L)	0.73	200	550	130	0.96	160	580	570	1.7	170	600	130
Butyric Acid (mg/L)	< 0.070	1.5	9.3	2.1	< 0.070	0.84	8.3	13	< 0.070	2.3	11	3.1
Propionic Acid (mg/L)	0.13	340	760	150	0.2	280	930	670	0.16	290	890	190
Pyruvic Acid	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070	1.7	< 0.070	< 0.070	< 0.070	< 0.070	< 0.070
Lactic Acid/HIBA (mg/L)	0.11 J	< 0.14	77	< 0.14	0.10 J	0.2	970	0.11 J	0.096 J	0.14 J	57	0.18 J

Notes:

J - Concentration is approximate

< - Analyte not detected above the method reporting limit

mg/L - miligrams per liter

TABLE 3-4

Temporal Changes in Water Quality Parameters - Zone 1 Pilot Study

Site 86 Pilot Study Report

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Well ID	IR86-MW55IW*				IR86-MW58IW				IR86-MW59IW*				IR86-MW61IW*				IR86-MW70IW			
Date	10/18/2011	12/12/2011	1/23/2012	NS	10/18/2011	12/12/2011	1/24/2012	5/1/2012	10/18/2011	12/12/2011	1/24/2012	5/2/2012	10/18/2011	12/12/2011	1/25/2012	5/2/2012	10/18/2011	12/12/2011	1/24/2012	5/1/2012
Temperature (°C)	22.72	22.06	21.22	--	20.13	17.61	19.8	19.87	19.5	18.39	18.81	18.65	19.54	17.87	18.34	18.86	20.92	18.94	20.46	21.22
Conductivity (mS /cm)	0.717	0.605	0.586	--	0.676	1.26	0.999	1.868	0.447	0.336	0.385	0.354	1.103	1.054	0.899	0.927	0.787	0.782	2.054	2.426
DO (mg/ L)	0.42	0.05	0.29	--	0.27	0.19	0.11	0.12	0.21	0.09	0.13	0.13	1.06	0.1	0.17	0.12	0.61	0.08	0.12	0.39
pH	6.81	6.64	6.8	--	6.82	6.52	6.51	6.42	7.24	6.99	7.08	7.14	6.45	6.4	6.5	6.47	6.65	6.67	6.38	7.02
ORP (mV)	-101.7	121.10	-63.9	--	-93.1	-89.8	-116.3	-77.7	-126.5	-60.5	-135.5	-119.8	-74.0	-100.6	-47.6	-67.4	-109.3	-153.8	-28.8	-78.4

Well ID	IR86-MW71IW				IR86-MW72IW				IR86-MW73IW				IR86-MW74IW				IR86-MW75IW			
Date	10/18/2011	12/13/2011	1/24/2012	5/1/2012	10/18/2011	12/13/2011	1/24/2012	5/1/2012	10/18/2011	12/14/2011	1/23/2012	5/2/2012	10/18/2011	12/13/2011	1/24/2012	5/1/2012	10/18/2011	12/13/2011	1/23/2012	5/1/2012
Temperature (°C)	20.61	18.77	19.5	20.53	21.03	19.53	19.05	19.72	21.36	19.5	18.9	20.44	20.17	19.62	19.35	20.11	20.54	17.35	18.69	20.00
Conductivity (mS /cm)	0.845	1.454	2.189	2.096	0.703	1.394	2.612	2.438	0.788	1.483	2.295	1.03	0.825	1.367	3.048	2.05	0.869	1.227	2.437	1.02
DO (mg/ L)	0.34	0.23	0.21	0.43	--	0.14	0.09	0.09	0.87	0.07	0.62	0.09	0.49	0.12	0.8	0.53	0.37	0.29	0.17	0.42
pH	6.67	6.52	6.36	7.12	6.6	6.46	6.39	6.38	6.71	6.4	6.44	6.58	6.62	6.5	6.32	7.03	6.74	6.37	6.47	6.53
ORP (mV)	-109.5	-160.1	-45.8	-97.4	-94.3	1.6	-124.1	-74.5	-125.9	-187.7	-122.7	-136.1	-82.6	-169.8	-71.2	-88.9	-111.4	-133.3	-185.9	-85.0

Notes:

-- - DO not recorded.

* - Monitoring well is located outside of Zone 1 Pilot Study Area.

NS - IR86-MW55IW was not sampled during the 6-month sampling event due to construction activities located in the immediate vicinity of the monitoring well.

TABLE 3-5

Temporal Changes in Volatile Organic Carbon Concentrations - Zone 1 Pilot Study

Site 86 Pilot Study Report

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Well ID	IR86-MW55IW*			IR86-MW58IW				IR86-MW59IW*				IR86-MW61IW*				IR86-MW70IW			
Date	10/18/2011	12/12/2011	1/23/2012	10/18/2011	12/12/2011	1/24/2012	5/1/2012	10/18/2011	12/12/2011	1/24/2012	5/2/2012	10/18/2011	12/12/2011	1/25/2012	5/2/2012	10/18/2011	12/12/2011	1/24/2012	5/1/2012
Vinyl Chloride (µg/L)	87	45	64	19	24	210	76	< 1	< 1	< 1	<1	< 1	< 1	< 1	< 1	14	13	110	< 1
1,1 -Dichloroethene (µg/L)	14	5.4	8.3	62	28	43	9.9	< 1	< 1	< 1	<1	2.9	1.7	2	2.3	5.5	7.2	2.9	< 1
cis - 1,2 - Dichloroethene (µg/L)	240	210	290	120	230	470	100	< 1	< 1	< 1	<1	35	34	35	45	78	560	53	< 1
Trichloroethene (µg/L)	< 1	< 1	< 1	170	110	79	32	< 1	< 1	< 1	<1	44	45	50	51	110	600	< 1	< 1
Tetrachloroethene (µg/L)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	<1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

Well ID	IR86-MW71IW				IR86-MW72IW				IR86-MW73IW				IR86-MW74IW				IR86-MW75IW			
Date	10/18/2011	12/13/2011	1/24/2012	5/1/2012	10/18/2011	12/13/2011	1/24/2012	5/1/2012	10/18/2011	12/14/2011	1/23/2012	5/2/2012	10/18/2011	12/13/2011	1/24/2012	5/1/2012	10/18/2011	12/13/2011	1/23/2012	5/1/2012
Vinyl Chloride (µg/L)	6.7	24	51	< 1	8.1	22	24	1.2 J	23	43	31	15	14	34	86	9.2	12	16	43	12
1,1 -Dichloroethene (µg/L)	7.1	<1	<1	< 1	7.3	1.9	< 1	< 1	36	2.4	<1	1.4 J	25	5.8	3.1	< 1	5.6	< 1	< 1	< 1
cis - 1,2 - Dichloroethene (µg/L)	74	12	13	< 1	100	170	3.4	< 1	220	100	31	40	190	190	51	16	150	76	15	20
Trichloroethene (µg/L)	130	0.74 J	< 1	< 1	220	1.3	< 1	< 1	150	13	9.1	5.4	210	19	12	5.5	230	16	4.5	6.1
Tetrachloroethene (µg/L)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

Notes:
< 1 - Analyte not detected above the method reporting limit of 1 µg/L.
* - Monitoring well is located outside of Zone 1 Pilot Study Area.
J - Concentrations is approximate
µg/L - micrograms per liter

TABLE 3-7

Temporal Changes in Water Quality Parameters - Zone 2 Pilot Study

Site 86 Pilot Study Report

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Well ID	IR86-MW61				IR86-MW63*			IR86-MW66			
Date	10/19/2011	11/30/2012	1/25/2012	5/2/2012	10/18/2011	1/25/2012	5/2/2012	10/19/2011	11/29.2011	1/25/2012	4/30/2012
Temperature (°C)	20.83	18.31	18.43	19.17	18.57	17.52	19.1	22.25	18.25	17.76	18.33
Conductivity (mS /cm)	1.042	0.707	0.791	0.882	0.604	0.466	0.488	0.960	0.661	0.543	0.690
DO (mg/ L)	0.73	0.11	0.20	0.26	0.38	0.10	1.71	3.36	0.18	0.18	0.10
pH	6.39	7.02	6.48	6.42	6.78	6.70	5.74	6.67	6.74	6.84	6.68
ORP (mV)	-42.3	-81.3	-33.4	-50.2	-109.4	-74.9	9.1	-58.8	-112.8	-79.8	-94.9

Well ID	IR86-MW67				IR86-MW68				IR86-MW69			
Date	10/17/2011	11/30/2011	1/25/2012	5/2/2012	10/17/2011	11/30/2011	1/25/2012	4/30/2012	10/17/2011	11/30/2011	1/25/2012	4/30/2012
Temperature (°C)	19.38	18.17	18.61	19.84	20.24	18.13	18.76	18.67	19.71	18.29	18.93	19.4
Conductivity (mS /cm)	0.662	0.676	0.699	0.609	0.760	0.850	0.734	0.705	0.732	0.868	0.729	0.647
DO (mg/ L)	1.64	0.15	0.17	0.61	0.57	0.08	0.04	0.12	0.91	0.06	0.05	0.27
pH	6.58	6.80	6.67	7.36	6.59	6.86	6.62	6.67	6.63	6.87	6.62	6.81
ORP (mV)	-115.2	-113.9	-59.8	-97.8	-186.7	-71.7	-107.4	-83.4	-206.4	-84.0	-110.4	-75.8

Note:
°C - Degrees Celsius
mS /cm - milliSiemens per centimeter
mg/L - milligrams per Liter
mv - millivolt
* - IR86-MW63 is located outside of the Zone 2 pilot study area.
IR86-MW63 was not sampled during the December sampling event.

TABLE 3-8

Temporal Changes in Volatile Organic Compound Concentrations - Zone 2 Pilot Study

Site 86 Pilot Study Report

Operable Unit 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Well ID	IR86-MW61				IR86-MW63*			IR86-MW66			
Distance	3ft upgradient				400 ft downgradient			Between SPRCs			
Date	10/18/2011	12/7/2011	1/25/2012	5/2/2012	10/18/2011	1/25/2012	5/2/2012	10/18/2011	12/7/2011	1/25/2012	4/30/2012
Vinyl Chloride (µg/L)	< 1	< 1	< 1	<1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1 - Dichloroethene (µg/L)	5.6	2.6	2.4	3.4	< 1	< 1	< 1	2.5	< 1	< 1	1.1 J
cis-1,2 - Dichloroethene (µg/L)	66	54	46	64	4.7	3.4	6	26	12	4.5	21
Trichloroethene (µg/L)	200	160	150	170	7.5	4.9	6.1	62	31	13	44
Tetrachloroethene (µg/L)	< 1	< 1	< 1	<1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

Well ID	IR86-MW67				IR86-MW68				IR86-MW69			
Distance	5 ft downgradient				10 ft downgradient				15 ft downgradient			
Date	10/18/2011	12/7/2011	1/25/2012	5/2/2012	10/18/2011	12/7/2011	1/25/2012	4/30/2012	10/18/2011	12/7/2011	1/25/2012	4/30/2012
Vinyl Chloride (µg/L)	< 1	< 1	< 1	<1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1 - Dichloroethene (µg/L)	1.9	< 1	< 1	0.94 J	3.8	1.6	1.2	1.1	3.2	1.5	1.1	1.9 J
cis-1,2 - Dichloroethene (µg/L)	30	18	11	19	38	34	19	22	37	31	22	38
Trichloroethene (µg/L)	57	30	21	34	96	83	51	39	71	53	31	46
Tetrachloroethene (µg/L)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

Notes:

* IR86-MW63 is located outside of the Zone 2 pilot study site

IR86-MW63 was not sampled during the December sampling event

< 1 - Analyte not detected above the method reporting limit of 1 µg/L

µg/L - micrograms per liter

J - Concentration is approximate

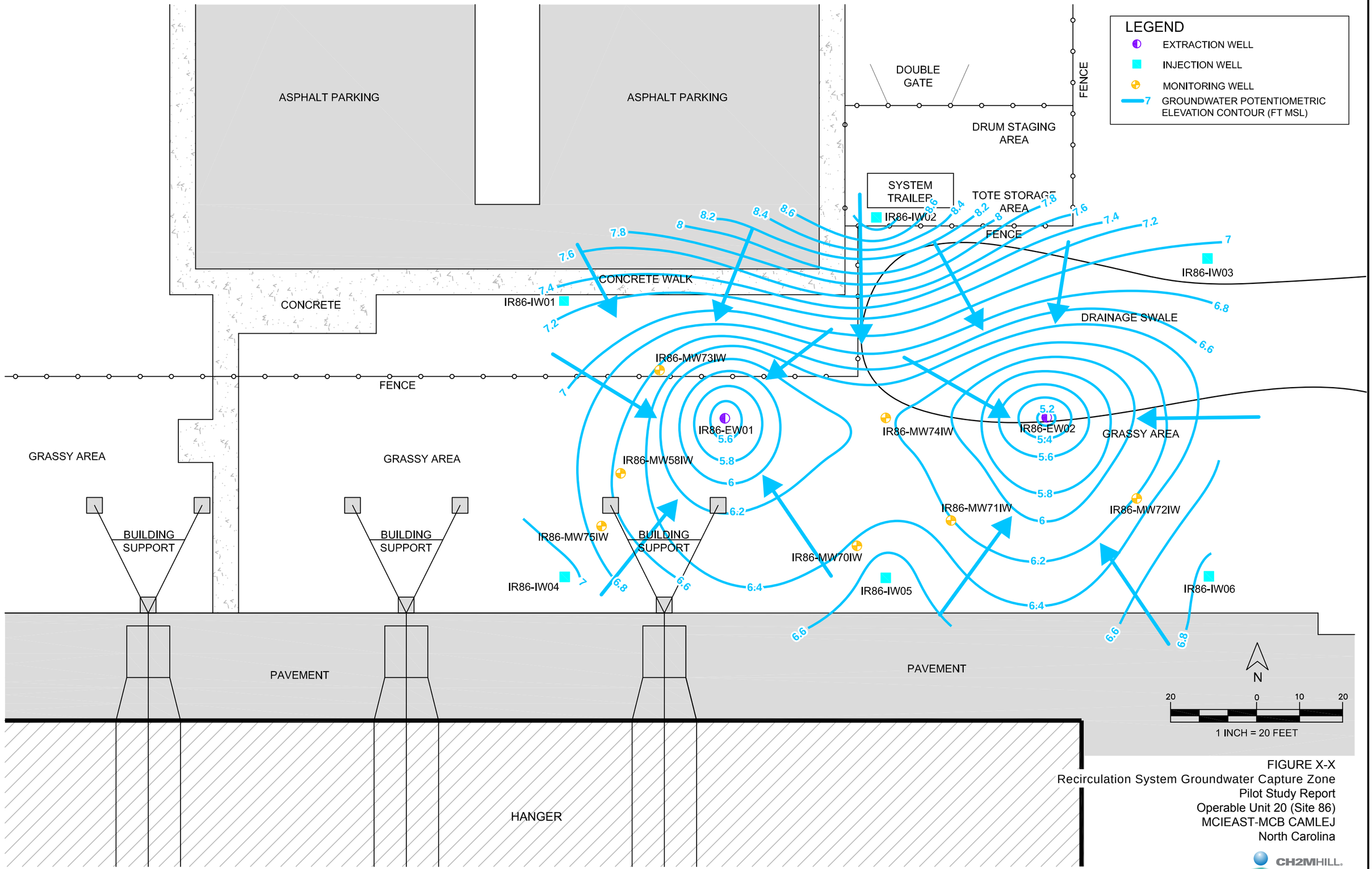

FIGURE X-X
Recirculation System Groundwater Capture Zone
Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

CH2MHILL

ES022112162539MKE

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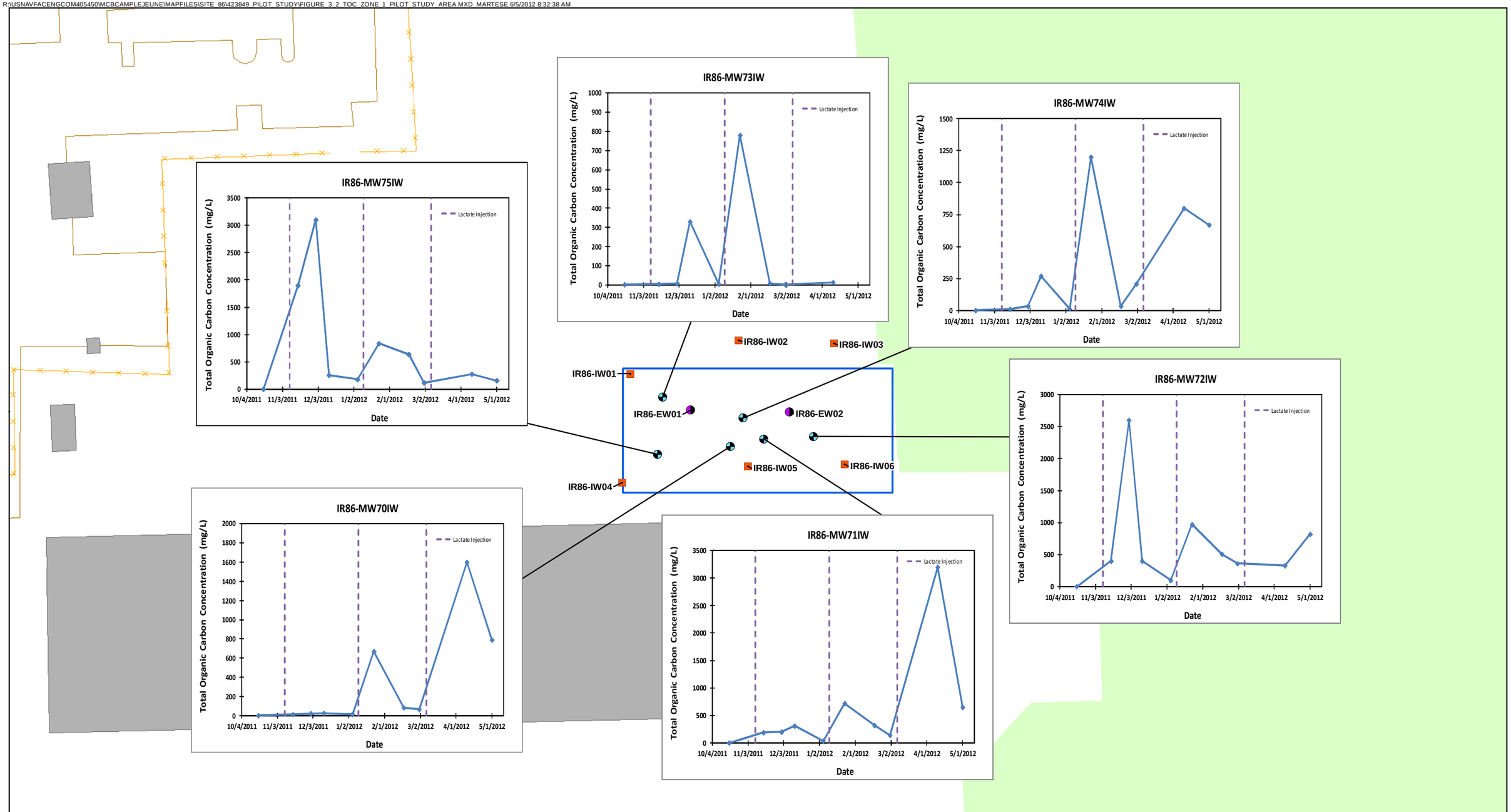

Legend

- Monitoring Wells
- Extraction Well
- Injection Well
- Fence Line
- Drainage Ditch
- Vehicle Driveway Area
- Vehicle Parking Area
- Buildings
- Northeast Grass Area
- Zone 1 Pilot Study Area

N

0 35 70 140 Feet

1 inch = 70 feet

Figure 3-2
Temporal Changes in Total Organic Carbon Concentrations - Zone 1 Pilot Study
Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

CH2MHILL

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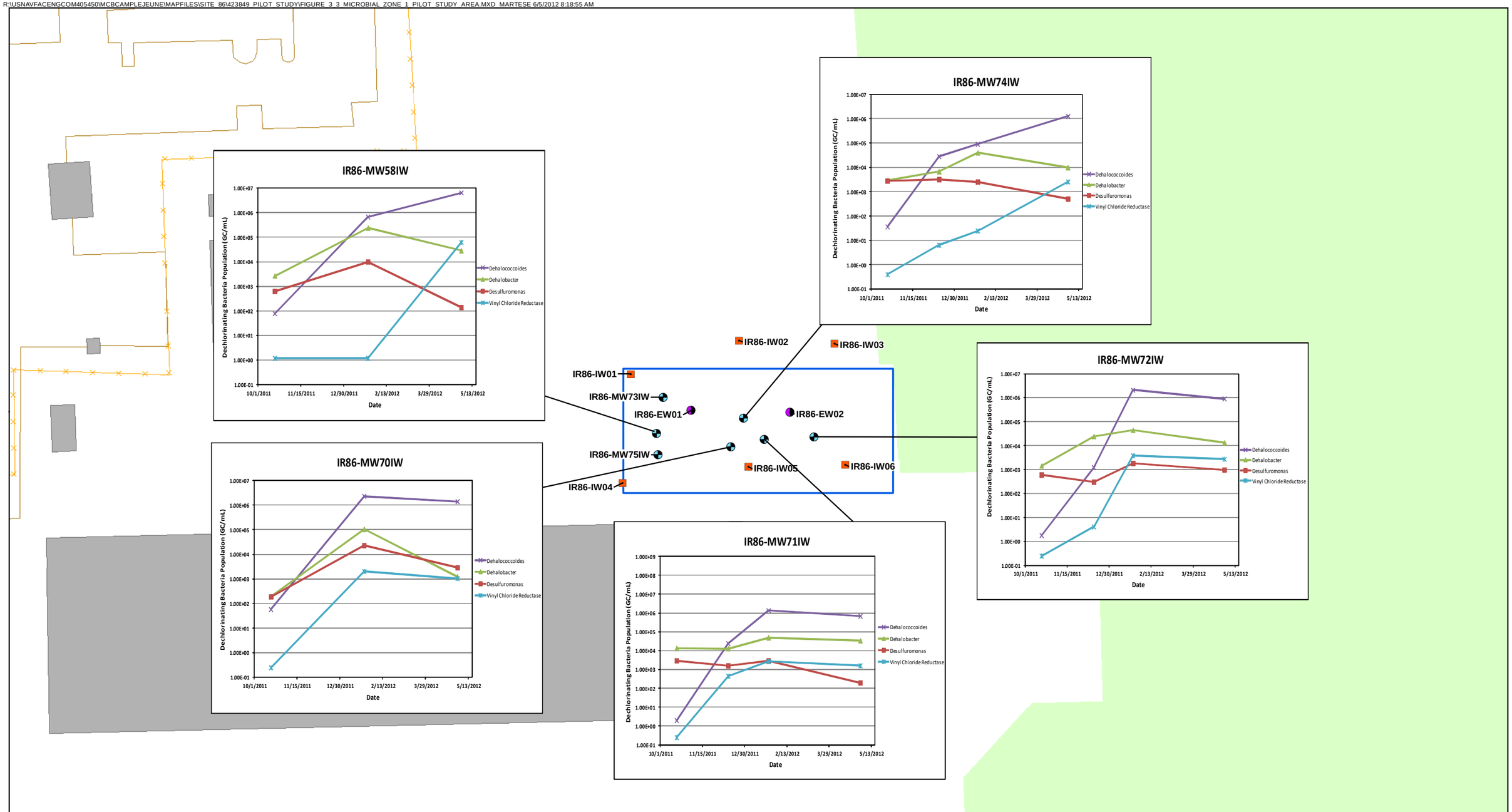

Legend

- Monitoring Wells
- Extraction Well
- Injection Well
- Fence Line
- Drainage Ditch
- Vehicle Driveway Area
- Vehicle Parking Area
- Buildings
- Northeast Grass Area
- Zone 1 Pilot Study Area

N

0 35 70 140 Feet

1 inch = 70 feet

Figure 3-3
Temporal Changes in Dechlorinating Bacteria Concentrations - Zone 1 Pilot Study
Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

CH2MHILL

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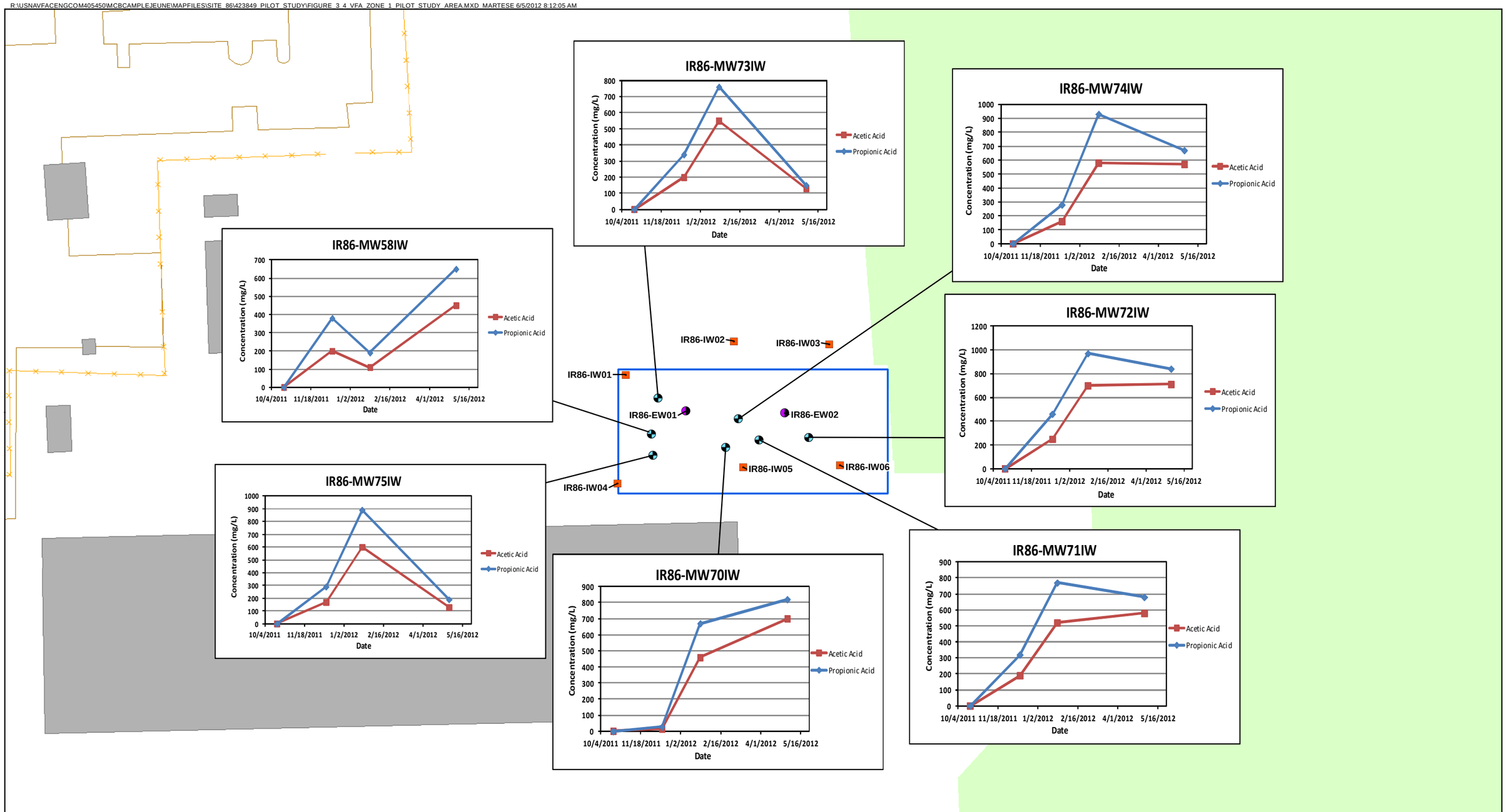

Legend

- Monitoring Wells
- Extraction Well
- Injection Well
- Fence Line
- Drainage Ditch
- Vehicle Driveway Area
- Vehicle Parking Area
- Buildings
- Northeast Grass Area
- Zone 1 Pilot Study Area

N

0 35 70 140 Feet

1 inch = 70 feet

Figure 3-4
Temporal Changes in Volatile Fatty Acid Concentrations - Zone 1 Pilot Study
Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

CH2MHILL

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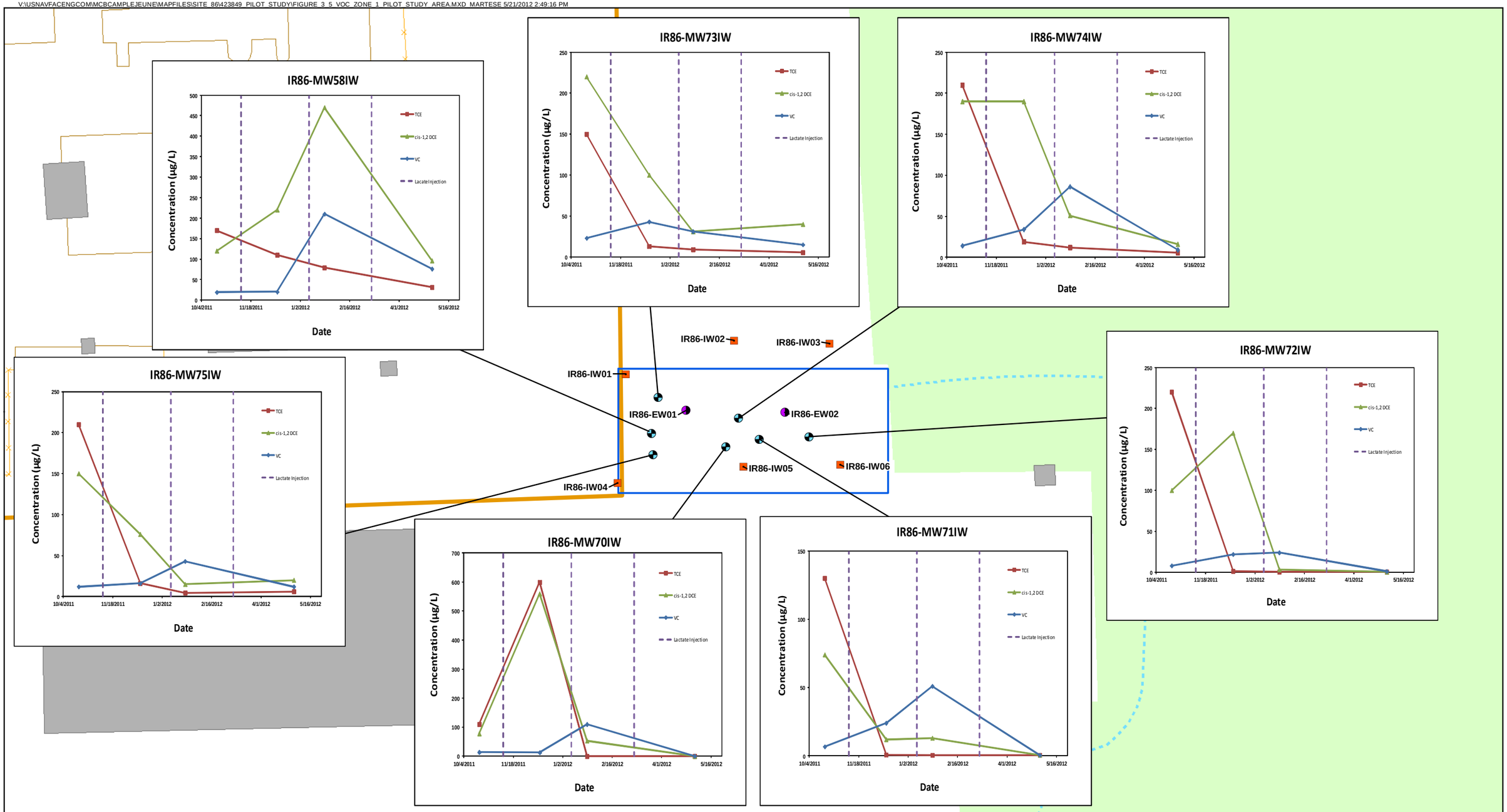

Legend

- Monitoring Wells
- Extraction Well
- Injection Well
- Fence Line
- Drainage Ditch
- Vehicle Driveway Area
- Vehicle Parking Area
- Buildings
- Northeast Grass Area
- Zone 1 Pilot Study Area
- August 2006 Site 86 Boundary

N

0 35 70 140 Feet

1 inch = 70 feet

Figure 3-5
Temporal Changes in Volatile Organic Compound Concentrations - Zone 1 Pilot Study
Pilot Study Report
Operable Unit No. 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

CH2MHILL

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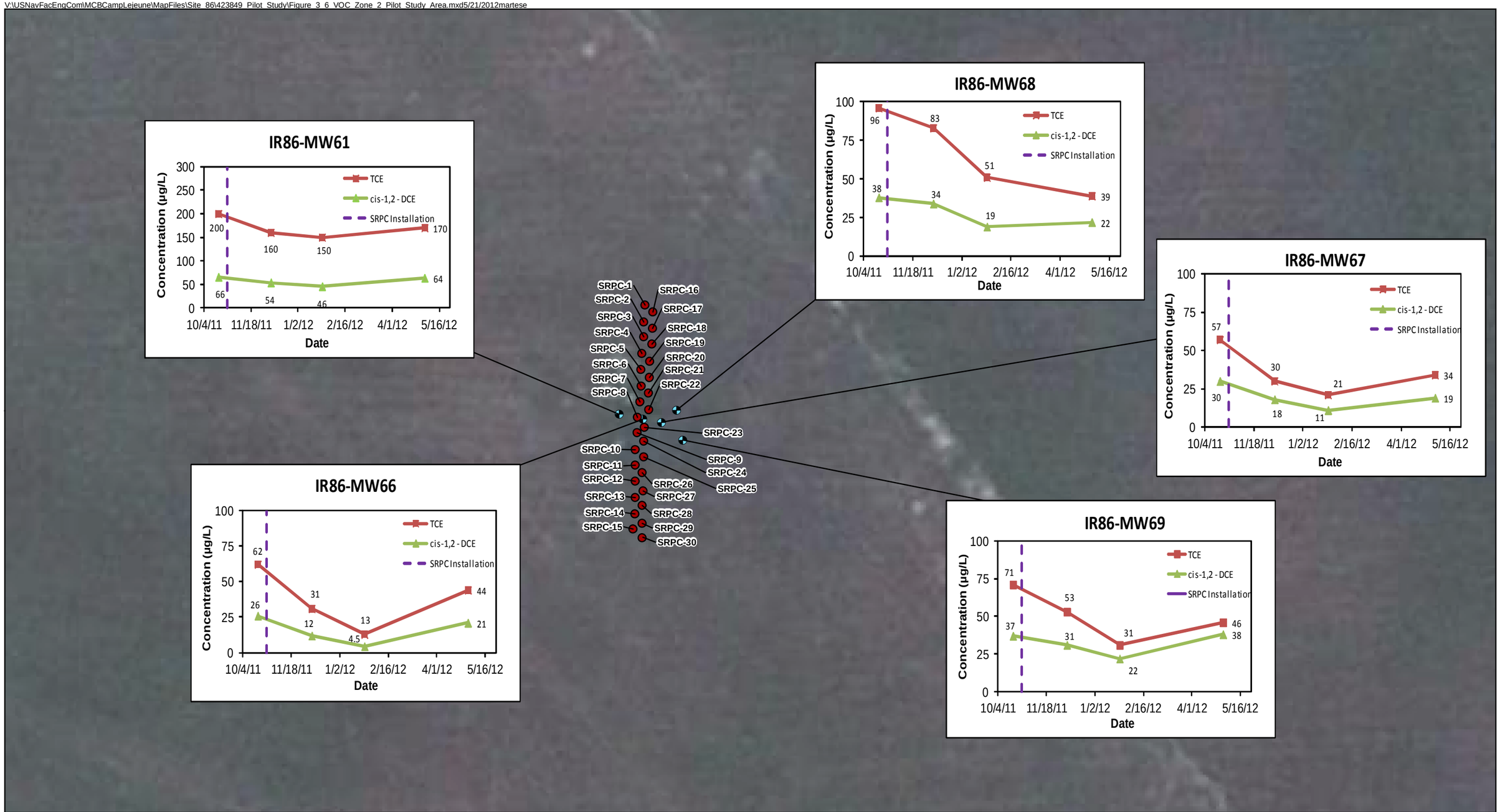

Legend

- Slow Release Permanganate Candle
- Monitoring Well

N

0 35 70 Feet

1 inch = 35 feet

Figure 3-6
Temporal Changes in Volatile Organic Compound Concentrations - Zone 2
Pilot Study Report
Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

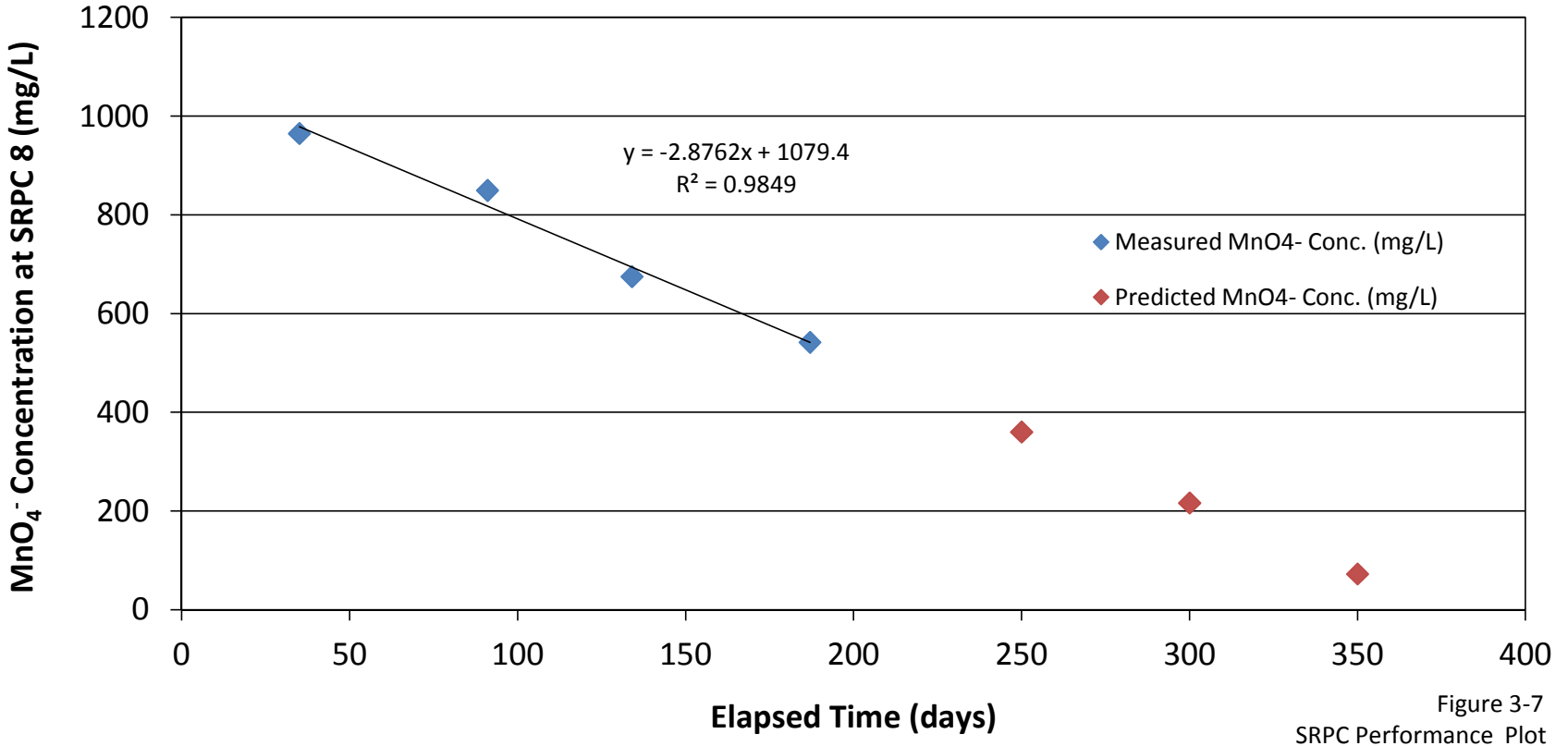

Figure 3-7
SRPC Performance Plot
Pilot Study Report
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MCIEAST-MCB CAMLEJ
North Carolina

SECTION 4

Pilot Study Evaluation and Conclusions

The following sections provide an evaluation and a conclusion for each of the pilot studies. The Zone 1 and Zone 2 pilot studies have been evaluated based on the primary objectives of each respective pilot study, which are:

- To evaluate the injection/extraction approach as a method for distributing the ERD substrate in areas where access is limited
- To evaluate the overall effectiveness of ERD in terms of reducing contaminant mass in Zone 1
- To evaluate the overall effectiveness of SRPC technology as a passive remediation remedy in Zone 2
- To obtain sufficient performance data and results to refine remedial alternatives for preparation of a Feasibility Study
- To reduce sufficient VOC mass within Zones 1 and 2 to evaluate monitored natural attenuation as a viable remedial option in the Feasibility Study.

4.1 Pilot Study Evaluation

4.1.1 Zone 1 ERD and Bioaugmentation Pilot Study

Based on the potentiometric surface map generated from data collected after one week of recirculation (**Figure 3-1**), an extraction rate of 7.5 gpm from each extraction well and an injection rate of 2.78 gpm into each injection wells was sufficient to capture upper Castle Hayne groundwater within the pilot study area. Based on the geometry of the capture zone (**Figure 3-1)**, each extraction well hydraulically contained (captured) upper Castle Hayne groundwater at least a 60 ft radius. Additionally, based on the groundwater elevation measurements (**Table 3-1**), more-aggressive extraction rates and injection rates could have been achieved without risk of surfacing at the injection wells, or pumping the extraction wells dry.

Based on a comparison of post-lactate injection TOC concentrations to baseline concentrations and the observed recirculation system's influence on the upper Castle Hayne aquifer's potentiometric surface, it appears that the recirculation system effectively distributed the lactate throughout the Zone 1 pilot study site. TOC concentrations in groundwater increased approximately 700 times compared to baseline concentrations in certain areas of the pilot study site, with an average increase of approximately 300 times that of baseline after the first lactate injection event. TOC was detected in groundwater sampled from extraction wells IR86-EW01 and IR86-EW02 at concentrations > 20 mg/L within 1 week of recirculation, indicating that 10,000 pounds was a sufficient dose to treat the total volume within the pilot study area, estimated to be 330,000 ft^3 (24,750 $ft^3$of soil and 82,500 $ft^3$of groundwater). TOC concentrations in groundwater sampled after the second and third lactate injection events had similar results, indicating that lactate was effectively distributed within the pilot study site, providing a sustained ERD substrate and the carbon source required to grow a dechlorinating microbial consortium effectively.

Dechlorinating bacteria was introduced to the upper Castle Hayne aquifer approximately 2 weeks after the first lactate injection event. Over the course of the study, *Dehalococciodes* populations in groundwater increased approximately five orders of magnitude (**Figure 3-3**). Additionally, *Vinyl Chloride Reductase,* the *Dehalococciodes* gene capable of converting VC to ethane, increased four orders of magnitude. The relatively uniform distribution of *Dehalococciode* detected in groundwater collected from the pilot study wells indicated that the volume of TSI DC introduced (200 liters) was sufficient to treat the volume of the pilot study area.

During the pilot study, total VFA concentrations increased from a mean baseline value of 0.97 mg/L to more than 500 mg/L after 1 month, and sustained at a mean concentration of approximately 1,000 mg/L after 3 months and 6 months (**Figure 3-4**). This indicates that lactate was effectively and evenly distributed in the pilot study area, and the rapid appearance of elevated concentrations of acetate and propionate indicates that the lactate was readily fermentable.

TCE concentrations decreased within the pilot study site by 93 percent over the 6-month pilot study. VC concentrations temporarily increased due to the dechlorination of TCE and cis-1,2-DCE but decreased after the 6-month groundwater sampling and will likely continue to decrease as long as *Dehalococciodes* populations, specifically the *Vinyl Chloride Reductase* gene, remain at levels sufficient for the reductive dechlorination of VC.

4.1.2 Zone 2 Slow-Release Permanganate Candle Pilot Study

Based on the results of the Zone 2 pilot study, SRPCs, specifically those used as PRBs, appear to be an effective passive remediation remedy. Data obtained from SRPC 8 indicates that an adequate concentration of MnO_4^- required to degrade chlorinated VOCs was released from the SRPCs. Research by Yan and Schwartz (1999) indicated that relatively low concentrations of MnO_4^- could effectively oxidize TCE, even in the presence of relatively high TOC concentrations. Yan and Schwartz (1999) showed that a MnO_4^- concentration of 120 mg/L could completely oxidize 1,000 µg/L of TCE. Baseline TCE concentrations in Zone 2 groundwater were between 57 and 200 µg/L, significantly lower than the 1,000 µg/L TCE concentration used by Yan and Schwartz.

MnO_4^- concentrations released from the SRPC 8 ranged between 965 and 542 mg/L throughout the 6-month pilot study. MnO_4^- concentrations are predicted to exceed the 120 mg/L concentration discussed by Yan and Schwartz through mid-September 2012, nearly 1 full year from their deployment date.

MnO_4^- was not detected in downgradient monitoring wells IR86-MW66 through IR86-MW69 and is likely attributed to one or more of the following: consumption by PNOD as it flowed downgradient, bifurcation throughout higher conductive lenses within the aquifer, dilution due to borehole mixing during groundwater sampling.

Overall concentrations of VOCs, specifically TCE and cis-1,2-DCE (VC was not detected throughout the pilot study), in groundwater were reduced across the pilot study site. VOC concentrations detected during the 6-month groundwater sampling event increased slightly compared to the 3-month groundwater sampling results but remained below baseline concentrations. Based on the all the data collected throughout the pilot study, SRPCs can effectively remove VOC mass from affected groundwater. Further investigations concerning SRPC placement arrays, candle dimensions, and candle installation angles will further refine the overall effectiveness of SRPCs for remediation applications.

4.2 Conclusion

4.2.1 Zone 1 ERD and Bioaugmentation Pilot Study

The following conclusions can be made based on the data generated throughout the Zone 1 pilot study.

- The capture zone of the recirculation system and injection/extraction well placement was sufficient to treat the entire pilot study area. Each extraction well hydraulically contained (captured) upper Castle Hayne groundwater out to a minimum of 60 ft.
- Approximately 30,000 pounds of sodium lactate was injected into the pilot study over three injection events. Based on TOC concentrations detected in the pilot study groundwater, 10,000 pounds of sodium lactate was sufficiently distributed throughout the pilot study treatment volume of approximately 330,000 ft^3 (24,750 $ft^3$of soil and 82,500 $ft^3$of groundwater), yielding a lactate to treatment area ratio of 0.03 lbs of lactate per cubic foot of treatment area.
- Approximately 200 liters (33.3 liters introduced into the six injection wells) of TSI DC was sufficiently distributed throughout the pilot study treatment volume, yielding a TSI DC to treatment area ratio of 6 $x10^{-4}$ liters of TSI DC per cubic foot of treatment area.
- During the pilot study, *Dehalococciodes* populations; including *Vinyl Chloride Reductase*, grew by several orders of magnitude.
- VFA concentrations increased significantly indicating that the lactate was readily fermentable and that a thriving bacterial consortium was maintained.

- TCE concentrations decreased by at least 93 percent. Cis-1,2-DCE concentrations in groundwater sampled from six of seven monitoring wells were reduced to below the NCGWQS of 70 µg/L.
- VC concentrations increased due to the reductive dechlorination of TCE and cis-1,2-DCE, but decreased significantly during the last three months of the pilot study and will continue to decrease as long as *Vinyl Chloride Reductase* populations remain at elevated levels.

4.2.2 Zone 2 Slow-Release Permanganate Candle Pilot Study

The following conclusions can be made based on the data generated throughout the Zone 2 pilot study:

- Decreases in VOC concentrations were identified in groundwater sampled throughout the pilot study. TCE concentrations in groundwater decreased between 47 and 79 percent with respect to baseline after 3 months. Concentrations of TCE and cis-1,2-DCE in groundwater sampled during the 6-month groundwater sampling event were detected 29 to 63 percent below baseline concentrations.
- Based on MnO_4^- concentration trends obtained from groundwater sampled from the SRPC 8 boring, the life span of the SRPCs used during the pilot study, under Site 86 specific conditions, appears to be approximately 1 year.

SECTION 5

References

Baker Environmental, Inc. (Baker). 1996. *Final Remedial Investigation Report, Operable Unit No. 6 (Site 86), Marine Corps Base Camp Lejeune, North Carolina*. August.

Bouwer, H. and R.C. Rice, 1976. A Slug Test Method for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells, *Water Resources Research*, vol. 12, no. 3, pp. 423-428.

CH2M HILL. 2011a. *Final Expanded Supplemental Remedial Investigation Site 86-Operable Unit No, 20, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina*. September.

CH2M HILL. 2011b. *Pilot Study Implementation Plan, Site 86-Operable Unit No, 20, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina*. September.

Christenson, M. D., 2011. Using Slow-Release Permanganate to Remove TCE from a Low Permeable Aquifer at a Former Landfill. Master's Thesis, University of Nebraska. August.

Haselow, J. S., Siegrest, R. L., Crimi, M., and Jarosch, T., 2003. Estimating the Total Oxidant Demand for In Situ Chemical Oxidation Design. *Remediation*. 13 (4), 5-16.

Kang, N., Hua, I., Rao, P. S., 2004. Production and Characterization of Encapsulated Potassium Permanganate for Sustained Release as an In Situ Oxidant. *Ind. & Eng. Chem. Res.* 43, 5187-5193.

Lee, E. S., Schwartz, F. W., 2007a. Characteristics and Applications of Controlled-Release KMnO4 for Groundwater Remediation. *Chemosphere* 66, 2058-2066.

Lee, E. S., Schwartz, F. W., 2007b. Characterization and Optimization of Long-term Controlled-Release System for Groundwater Remediation: a Generalized Modeling Approach. *Chemosphere* 69, 247-253.

Lee, E. S., Liu, G. M., Schwartz, F. W., Kim, Y. J., Ibaraki, M., 2008a. Model Based Evaluation of Controlled-Release Systems in the Remediation of Dissolved Plumes in Groundwater. *Chemosphere* 72, 165-173. 51

Lee, E. S., Woo, N. C., Schwartz, F. W., Lee, B. S., Lee, K. C., Woo, M. H., Kim, J. H., Kim, H. K., 2008b. Characterization of Controlled-Release KMnO4 (CRP) Barrier System for Groundwater Remediation: a Pilot-Scale Flow-Tank Study. *Chemosphere* 71, 902-910.

Lee, B. S., Kim, J. H., Lee, K. C., Bin Kim, Y., Schwartz, F. W., Lee, E. S., Woo, N. C., Lee, M. K., 2009. Efficacy of Controlled-Release KMnO4 (CRP) for Controlling Dissolved TCE Plume in Groundwater: a Large Flow-Tank Study. *Chemosphere* 74, 745-750.

Neuman, S.P., 1974. Effect of Partial Penetration on Flow in Unconfined Aquifers Considering Delayed Gravity Response. *Water Resources Research*, vol. 10, no. 2, pp. 303-312.

Ross, C., Murdoch, L. C., Freedman, D. L., Siegrist, R. L., 2005. Characteristics of Potassium Permanganate Encapsulated in Polymer. *Journal of Environmental Engineering*, 131, 1203-1211.

USEPA. 2006. In Situ Chemical Oxidation. *Engineering Issue*. July 28.

Yan, Y.E., and Schwartz, F.W. 1999. Oxidative Degradation and Kinetics of Chlorinated Ethylenes by Potassium Permanganate. *Journal of Contaminant Hydrology*. Volume 37. pages 343-365.

Appendix A
Soil Boring Logs and Well Completion Diagrams

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-EW01 SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 17.74 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276524.24, 3844466.44 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 9/28/2011 END: 9/28/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		**SILTY SAND (SM)** dark brown, dry, medium dense, medium grained, trace gravel, trace rootlets.	
5	S1	5.0 – 10.0	36	0		**CLAY (CH)** tan, moist, stiff, highly plastic. **SANDY SILT (ML)** dark gray, medium stiff. No Recovery.	
10	S2	10.0 – 15.0	60	0		**CLAY (CH)** light brown, moist, stiff, highly plastic. **SANDY CLAY (CL)** light brown, stiff, highly to moderately plastic. -color change to mottled with dark gray, medium stiff, moderately plastic, increasing silt content. -wet, soft.	
15	S3	15.0 – 20.0	42	0		**SAND (SP)** olive-tan, wet, loose, fine to medium grained. No Recovery.	
20	S4	20.0 – 25.0	42	0		**SAND (SP)** olive-tan, wet, very loose, fine to medium grained. No Recovery.	
25	S5	25.0 – 30.0	48	NM		**SAND (SP)** olive-tan, wet, loose to medium dense, fine to medium grained. No Recovery.	
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-EW01 SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 17.74 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276524.24, 3844466.44 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 9/28/2011 END: 9/28/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	48	0		**SAND (SP)** olive-tan, wet, loose, fine to medium grained.	
35						No Recovery.	
	S7	35.0 – 40.0	42	0		**SILTY SAND (SM)** olive-tan, wet, medium dense, fine to medium grained, cohesive.	
40						No Recovery.	
	S8	40.0 – 45.0	42	0		**SANDY LIMESTONE (LIMESTONE)** light gray, fine to coarse grained, gravel sized shell fragments, moderately cemented sand with shells.	
45						No Recovery.	
	S9	45.0 – 50.0	48	0		**SANDY LIMESTONE (LIMESTONE)** light gray, fine to coarse grained, gravel sized shell fragments, moderately cemented sand with shells. **SILTY SAND (SM)** light brown, wet, medium dense, fine to coarse grained, few gravel sized shell fragments.	
50						No Recovery.	
	S10	50.0 – 55.0	48	0		**SILTY SAND (SM)** light brown, wet, medium dense, fine to coarse grained, few to little gravel sized shell fragments and cemented sand nodules.	
55							
60						End of Boring Log at 56 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-EW02 SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 14.39 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276545.70, 3844466.34 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 9/28/2011 END: 9/28/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		**SILTY SAND (SM)** tan, moist. **SILT (ML)** black. **SILTY SAND (SM)** tan, moist. **CLAY (CL)** brown, moist, medium stiff.	
5	S1	5.0 – 10.0	24	0		**SILTY CLAY (CL)** wet, stiff, medium plasticity, <10% sand. No Recovery.	
10	S2	10.0 – 15.0	60	0		**SILTY CLAY (CL)** brown, moist, medium stiff to soft, medium plasticity.	
15	S3	15.0 – 20.0	36	0		**SAND (SW)** moist, loose, fine to coarse grained. **SAND (SP)** brown. **SAND (SW)** olive tan, wet, loose to medium dense, very fine to medium grained.	
20	S4	20.0 – 25.0	36	0			
25	S5	25.0 – 30.0	60	0		**SILTY SAND (SM)** dark olive, wet, medium dense, very fine to medium grained.	
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-EW02 SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 14.39 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276545.70, 3844466.34 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 9/28/2011 END: 9/28/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	60	0		**SILTY SAND (SM)** dark olive, wet, medium dense, very fine to medium grained.	
35	S7	35.0 – 40.0	60	NM		**SANDY LIMESTONE (LIMESTONE)** light gray to white, dense, very fine to coarse grained, trace silt, partially cemented sand with shells.	
40	S8	40.0 – 45.0	60	NM		**SILTY SAND (SM)** light brown, wet, medium dense, few gravel sized shell fragments.	
45	S9	45.0 – 50.0	60	NM		-partially cemented sand with shells. -few gravel sized shell fragments and cemented sand pieces.	
50	S10	50.0 – 55.0	60	NM		-partially cemented sand with shells.	
55						**SAND (SW)** light brown, wet, fine to coarse grained, trace silt, trace gravel sized shell fragments.	
60						End of Boring Log at 55 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-IW01 SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 18.54 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276510.58, 3844474.37 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 10/13/2011 END: 10/13/2011 LOGGER : B.Propst/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		**SILTY SAND (SM)** tan-brown, dry, medium dense, fine grained.	
5	S1	5.0 – 10.0	60	4.7		**SANDY SILT (OL)** dark grey and tan, wet, medium dense, fine grained, organic material.	
10	S2	10.0 – 15.0	60	0		**SANDY CLAY (CL)** light tan, soft, fine grained.	
15	S3	15.0 – 20.0	60	0		**CLAY (OH)** gray, medium stiff.	
						SANDY CLAY (CL) gray/tan, soft, fine grained.	
20	S4	20.0 – 25.0	60	0		**SAND (SP)** gray, wet, loose, fine grained. -tan, saturated. -gray with trace green.	
25	S5	25.0 – 30.0	60	0			
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-IW01 SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 18.54 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276510.58, 3844474.37 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 10/13/2011 END: 10/13/2011 LOGGER : B.Propst/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	60	0		**SILTY SAND (SM)** gray, wet, medium dense, fine grained.	
35	S7	35.0 – 40.0	60	7.6		-tan, saturated, soft/loose. -medium dense, trace shell and partially cemented sand pieces.	
40	S8	40.0 – 45.0	60	3.8		**CLAYEY SAND (SC)** white, saturated, dense, abundant shell and partially cemented sand pieces.	
45	S9	45.0 – 50.0	60	1.2		**SILTY SAND (SM)** tan, medium dense, abundant shell and partially cemented sand pieces decreasing with depth.	
50	S10	50.0 – 55.0	60	0		-grayish brown, fine grained.	
55							
60						End of Boring Log at 56 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-IW02 SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 17.66 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276532.97, 3844481.85 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 10/13/2011 END: 10/13/2011 LOGGER : B.Propst/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	0		**SILTY SAND (SM)** tan, dry, medium dense.	
5	S1	5.0 – 10.0	60	0		**SILT (OL)** dark gray, soft, fine grained, organic material. **SANDY CLAY (CL)** brown, medium stiff, medium plasticity, fine grained.	
10	S2	10.0 – 15.0	60	0		**SILTY CLAYEY SAND (SC)** yellow-orange with gray, wet, soft. **CLAY (OH)** gray, moist, soft, trace sand increasing with depth.	
15	S3	15.0 – 20.0	60	0			
20	S4	20.0 – 25.0	60	0		**SAND (SP)** tan, wet to saturated, medium to fine grained.	
25	S5	25.0 – 30.0	60	0		-tan with trace green, saturated, medium dense, fine grained.	
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-IW02 SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 17.66 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276532.97, 3844481.85 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 10/13/2011 END: 10/13/2011 LOGGER : B.Propst/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
		30.0					
	S6		60	0		**SILTY SAND (SM)** gray, saturated, medium dense, fine grained.	
35		35.0					
		35.0					
	S7		60	21.3		-olive green.	
40		40.0					
		40.0					
	S8		60	5.6		-dark green band approx. 1" thick.	
45		45.0				**SILTY SAND (SM)** white, saturated, dense, abundant partially cemented sand and shell fragments. -tan.	
		45.0					
	S9		60	0			
50		50.0					
		50.0					
	S10		60	0			
55		55.0				**SILTY SAND (SM)** grayish brown, moist, medium dense, fine grained, little partially cemented sand and shells.	
						End of Boring Log at 56 ft bgs	
60						Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-IW03 SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 15.63 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276556.44, 3844479.66 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 10/4/2011 END: 10/4/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	0		**SILTY SAND (SM)** brown with orange and black mottling, dry, dense, coarse, trace rootlets.	
						SAND (SW) tan, moist, medium grained to coarse, trace gravel.	
						SAND (SP) tan, moist, loose, medium grained to coarse.	
5	S1	5.0 – 10.0	42	0.5		**SILTY SAND (SM)** black, dry, medium dense, fine to medium grained, mottled with coarse gray sand, organic rich.	
						No Recovery.	
						SANDY SILT (ML) black with brown and orange mottling, moist, very fine to medium grained.	
10						**SANDY CLAY (CL)** light gray, moist, medium stiff to stiff, medium plasticity.	
	S2	10.0 – 15.0	42	0		No Recovery.	
						SANDY CLAY (CL) light gray, soft, medium plasticity. -medium tan with orange mottling, medium stiff to stiff, plastic.	
15	S3	15.0 – 20.0	60	0		**SAND (SP)** tan with olive, moist, loose, very fine to medium grained.	
20	S4	20.0 – 25.0	60	0			
25	S5	25.0 – 30.0	32	0		-wet.	
						No Recovery.	
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-IW03 SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 15.63 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276556.44, 3844479.66 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 10/4/2011 END: 10/4/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	60	0		**SAND (SP)** dark olive, wet, loose, very fine to medium grained.	
35	S7	35.0 – 40.0	60	0		**SAND (SW)** white, wet, medium dense, moderately to strongly cemented, some cobble sized strongly cemented sand pieces with shells.	
40	S8	40.0 – 45.0	60	0		**SILTY SAND (SM)** tan, loose, fine grained, some cobble sized strongly cemented sand pieces with shells.	
45	S9	45.0 – 50.0	60	0		-increasing silt content with depth.	
50	S10	50.0 – 55.0	60	0		-decreasing silt content with depth.	
55							
60						End of Boring Log at 56 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-IW04 SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 17.41 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276512.81, 3844455.69 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 9/27/2011 END: 9/27/2011 LOGGER : J.Albano/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		**SILT (ML)** black, slightly moist, top soil. **SILTY SAND (SM)** dark tan, slightly moist, loose, very fine grained sand.	
5	S1	5.0 – 10.0	60	NM			
10	S2	10.0 – 15.0	60	NM			
15	S3	15.0 – 20.0	60	0		**SAND (SP)** gray with olive hue, wet, loose, fine to very fine grained sand.	
20	S4	20.0 – 25.0	60	0			
25	S5	25.0 – 30.0	60	0			
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-IW04 SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 17.41 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276512.81, 3844455.69 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 9/27/2011 END: 9/27/2011 LOGGER : J.Albano/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	60	NM		**SILTY SAND (SM)** dark gray, wet, loose, sticky.	
35	S7	35.0 – 40.0	60	NM			
40	S8	40.0 – 45.0	60	NM		**SAND (SP)** light gray, wet, poorly indurated, partially cemented sand. **SANDY LIMESTONE (LIMESTONE)** light tan, fine grained sand, partially cemented fossiliferous sand and shells.	
45	S9	45.0 – 50.0	60	NM		**SAND (SP)** light gray, wet, poorly indurated, partially cemented sand. **SILTY SAND (SM)** light tan, loose to medium dense, trace shell fragments.	
50	S10	50.0 – 55.0	60	NM			
55							
60						End of Boring Log at 56 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-IW05 SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 16.88 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276534.48, 3844458.04 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 9/28/2011 END: 9/28/2011 LOGGER : J.Albano/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		**SILT (ML)** black, slightly moist, top soil. **SILTY SAND (SM)** dark brown, dry, medium dense with concrete/asphalt debris. **SANDY CLAY (CL)** brown-red mottled, dry, medium stiff, medium plasticity.	
5	S1	5.0 – 10.0	60	0		**SILT (ML)** black, wet, soft.	
10	S2	10.0 – 15.0	60	0		**CLAY (CL)** tan/orange mottled, very moist, medium stiff.	
15	S3	15.0 – 20.0	60	0		**SAND (SP)** tan, wet, loose, medium to very fine grained sand.	
20	S4	20.0 – 25.0	60	0		-color change to gray with olive hue.	
25	S5	25.0 – 30.0	60	0			
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-IW05 SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 16.88 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276534.48, 3844458.04 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 9/28/2011 END: 9/28/2011 LOGGER : J.Albano/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	60	0		**SAND (SP)** tan, wet, loose, medium to very fine grained sand.	
35	S7	35.0 – 40.0	60	NM		**SANDY LIMESTONE (LIMESTONE)** light tan, wet, loose, fine to very fine grained sand, poorly indurated, partially cemented fossiliferous sand and shells.	
40	S8	40.0 – 45.0	60	NM			
45	S9	45.0 – 50.0	60	NM		**SILTY SAND (SM)** light tan, slightly moist, medium dense, very fine to fine grained sand. -tan, wet, poorly indurated, partially cemented fossiliferous silty sand.	
50	S10	50.0 – 55.0	60	NM			
55							
60						End of Boring Log at 56 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-IW06 SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 16.41 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276558.04, 3844457.04 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 9/30/2011 END: 9/30/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
		0.0				-top soil.	
						-concrete.	
	HA-1		60	NM		**SANDY CLAY (CL)** brown with red mottling, moist, medium stiff, medium plasticity.	
5		5.0				**SANDY SILT (ML)** dark brownish black, dry, medium stiff.	
		5.0				**SILTY SAND (SM)** dark brownish black, wet, stiff, fine grained sand, trace rootlets.	
	S1		32	4.6			
						No Recovery.	
10		10.0					
		10.0				**SILTY SAND (SM)** dark brownish black, wet, stiff, fine grained sand, trace rootlets.	
	S2		60	NM		**SILTY CLAY (CL)** brown, moist, soft to medium stiff, medium plasticity.	
15		15.0					
		15.0				**SAND (SW)** olive tan, wet, loose to medium dense, fine to medium grained.	
	S3		60	NM			
20		20.0					
		20.0					
	S4		60	NM			
25		25.0					
		25.0				-color change to dark olive.	
	S5		60	NM			
30		30.0					

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-IW06 SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 16.41 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276558.04, 3844457.04 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: -- START: 9/30/2011 END: 9/30/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	60	0		**SILTY SAND (SM)** dark olive, wet, medium dense, very fine to medium grained.	
35	S7	35.0 – 40.0	60	0		**PARTIALLY CEMENTED SILTY SAND (SM)** white, wet, medium dense, very fine to coarse grained, abundant gravel sized shells, fossiliferous silty sand.	
40	S8	40.0 – 45.0	60	0		**SILTY SAND (SM)** light gray to tan, wet, medium dense, little gravel sized shell fragments, weak to no cementation.	
45	S9	45.0 – 50.0	60	0		-color change to tan.	
50	S10	50.0 – 55.0	60	0		-color change to dark tan, trace gravel sized shell fragments. -trace gravel sized cemented sand nodules, no shell fragments.	
55							
60						End of Boring Log at 56 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW66 SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 12.89 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276732.60, 3844456.30 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 7.78 ft BTOC (10/17/2011) START: 10/3/2011 END: 10/3/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	0		**SILTY SAND (SM)** black, moist, medium dense, fine grained, top soil with rootlets. **SILTY SAND (SM)** tan with orange mottling, moist, loose, cohesive, trace clay. **SAND (SP)** tan with orange mottling, moist, loose, very fine to fine grained.	
5	S1	5.0 – 10.0	60	0		**CLAY (CL)** tan, moist, medium stiff, medium plasticity. -soft.	
10	S2	10.0 – 15.0	60	0		-color change to light gray, wet, soft to very soft.	
15	S3	15.0 – 20.0	48	13.3		**SAND (SW)** gray, wet, medium dense, very fine to medium grained. **SAND (SP)** olive tan, wet, loose, fine to medium grained. No Recovery.	
20	S4	20.0 – 25.0	60	0.4		**SAND (SW)** dark gray, wet, medium dense, fine to coarse grained, subrounded to rounded. **SILTY SAND (SM)** dark gray, wet, medium dense, fine to coarse grained, subrounded to rounded.	
25	S5	25.0 – 30.0	60	0.3		**SILTY SAND (SM)** dark olive, moist, dense, very fine to fine grained, trace to little gravel sized shell remnants, cohesive. -color change to light olive gray.	
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW66 SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 12.89 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276732.60, 3844456.30 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 7.78 ft BTOC (10/17/2011) START: 10/3/2011 END: 10/3/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 34.0	48	NM			
35						End of Boring Log at 34 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	
40							
45							
50							
55							
60							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW67 SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 12.88 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276734.69, 3844455.92 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 7.91 ft BTOC (10/17/2011) START: 10/3/2011 END: 10/3/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		**SILTY SAND (SM)** black, moist, medium dense, top soil with rootlets.	
						SILTY SAND (SM) tan with orange mottling, moist, loose, cohesive, trace clay.	
5	S1	5.0 – 10.0	24	0.1		No Recovery.	
						SANDY CLAY (CL) tan, wet, medium stiff to soft, medium plasticity.	
10	S2	10.0 – 15.0	60	0.4		**CLAY (CL)** brown mottled with light gray, wet, soft, medium plasticity.	
15						**SAND (SW)** gray, wet, loose, fine to coarse grained, subrounded.	
	S3	15.0 – 20.0	60	0.3		**SAND (SP)** olive tan, wet, loose, fine to medium grained.	
20	S4	20.0 – 25.0	60	0.4		**SILTY SAND (SM)** dark gray, wet, loose to medium dense, fine to coarse grained, subrounded to rounded.	
25	S5	25.0 – 30.0	60	0.4		**SILTY SAND (SM)** dark olive, dense, very fine grained, gravel sized shell fragments. -color change to light olive gray.	
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW67 SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 12.88 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276734.69, 3844455.92 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 7.91 ft BTOC (10/17/2011) START: 10/3/2011 END: 10/3/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 34.0	48	NM		**SANDY LIMESTONE (LIMESTONE)** light gray to white, moderately cemented sand with shells. -increase in silt content.	
35						End of Boring Log at 34 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	
40							
45							
50							
55							
60							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW68 SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 12.96 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276736.40, 3844457.33 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 7.98 ft BTOC (10/17/2011) START: 10/3/2011 END: 10/3/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		**SILTY SAND (SM)** black, moist, medium dense, top soil with rootlets.	
						SILTY SAND (SM) tan with orange mottling, moist, loose, cohesive, trace clay.	
5	S1	5.0 – 10.0	60	0		**SANDY CLAY (CL)** tan, moist, medium stiff, medium plasticity.	
10	S2	10.0 – 15.0	60	0		**CLAY (CL)** brown, moist, very soft, medium plasticity.	
						SAND (SW) gray and light gray mottled, moist, loose, fine to coarse grained.	
15	S3	15.0 – 20.0	60	0		**SAND (SP)** olive tan, wet, medium dense, fine to medium grained.	
20	S4	20.0 – 25.0	60	0		**SILTY SAND (SM)** dark gray, wet, loose, fine to coarse grained, subrounded to rounded.	
25	S5	25.0 – 30.0	60	0		**SILTY SAND (SM)** brown, moist, dense, very fine to fine grained, gravel sized shell remnants and fragments.	
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW68 SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 12.96 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276736.40, 3844457.33 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 7.98 ft BTOC (10/17/2011) START: 10/3/2011 END: 10/3/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 34.0	60	0		**SANDY LIMESTONE (LIMESTONE)** moderately cemented sand with shells. -increase in silt content.	
35						End of Boring Log at 34 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	
40							
45							
50							
55							
60							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW69 SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 12.74 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276737.11, 3844453.95 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 7.56 ft BTOC (10/17/2011) START: 10/4/2011 END: 10/4/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		**SILTY SAND (SM)** moist, medium dense, top soil with rootlets. **SILTY SAND (SM)** tan with orange mottling, moist, medium dense, cohesive, trace clay.	
5	S1	5.0 – 10.0	60	0		**CLAY (CL)** tan with orange mottling, moist, stiff to medium stiff, medium plasticity.	
10	S2	10.0 – 15.0	60	0		**SILTY CLAY (CL)** dark brown, moist, soft to very soft, medium plasticity. **SAND (SP)** light gray, moist, loose, medium grained.	
15	S3	15.0 – 20.0	60	0		**SILTY SAND (SM)** olive tan, wet, medium dense, very fine to medium grained.	
20	S4	20.0 – 25.0	60	0		-color change to dark greenish gray, loose to medium dense, fine to coarse grained.	
25	S5	25.0 – 30.0	60	0		**SILTY SAND (SM)** dark olive, moist, dense, very fine to fine grained, little gravel sized shell fragments.	
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW69 SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 12.74 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276737.11, 3844453.95 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 7.56 ft BTOC (10/17/2011) START: 10/4/2011 END: 10/4/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 34.0	60	0		**SANDY LIMESTONE (LIMESTONE)** wet, dense, weakly cemented sand. -increase in silt content.	
35						End of Boring Log at 34 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	
40							
45							
50							
55							
60							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW70IW SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 16.92 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276532.01, 3844460.02 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 9.83 ft BTOC (10/17/2011) START: 10/11/2011 END: 10/11/2011 LOGGER : B.Propst/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		**SILTY SAND (SM)** tan, dry, loose, fine grained.	
						SANDY CLAY (CL) tan/brown, dry, medium dense, fine grained.	
5	S1	5.0 – 10.0	60	NM		**SILTY SAND (SM)** dark gray, dry, medium dense, fine grained, trace clay.	
						SANDY SILT (OL) dark brown, soft, loose, fine grained, trace clay. Trace root material, organic.	
10	S2	10.0 – 15.0	60	NM			
						CLAY (CH) light brown, hard grading to soft, fine grained.	
15	S3	15.0 – 20.0	60	NM		**CLAY (CL)** light brown, soft, fine grained.	
						SILTY SAND (SM) light brown, loose, fine grained.	
20	S4	20.0 – 25.0	60	NM		**SAND (SP)** tan with slight green hue, saturated, loose, fine grained.	
25	S5	25.0 – 30.0	60	NM			
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW70IW SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 16.92 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276532.01, 3844460.02 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 9.83 ft BTOC (10/17/2011) START: 10/11/2011 END: 10/11/2011 LOGGER : B.Propst/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	60	NM		**SILTY SAND (SM)** olive-gray, wet, medium dense to dense, fine grained.	
35	S7	35.0 – 40.0	60	NM		-trace clay. **SANDY CLAY (CL)** light tan, medium dense, partially cemented and fossilliferrous sand pieces.	
40	S8	40.0 – 45.0	60	NM		**SANDY LIMESTONE (LIMESTONE)** saturated, medium dense, partially cemented and fossilliferrous sand with bivalve fragments.	
45	S9	45.0 – 50.0	60	NM		**SANDY CLAY (CL)** light tan, medium dense, partially cemented and fossilliferrous sand pieces. **SILTY SAND (SM)** tan, medium dense, fine grained, trace partially cemented sand pieces, some shell fragments.	
50							
55						End of Boring Log at 51 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	
60							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW71IW SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 16.70 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276539.55, 3844461.75 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 9.52 ft BTOC (10/17/2011) START: 10/2/2011 END: 10/2/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		**SILTY SAND (SM)** light gray, dry, dense, fine to medium grained. -color change to dark brown, roots and rootlets. **SANDY CLAY (CL)** tan with red mottling, dry, stiff, medium plasticity.	
5	S1	5.0 – 10.0	36	0.2		**CLAYEY SAND (SC)** dark brown with orange mottling, dry, soft, fine to medium grained. No Recovery. **SANDY SILT (ML)** very dark brown, wet, soft, very fine grained sand. **SANDY CLAY (CL)** dark brown mottled with gray, moist, stiff, medium plasticity.	
10	S2	10.0 – 15.0	42	0.2		No Recovery. **SILTY SAND (SM)** dark brown, moist, very soft, very fine to fine sand, low plasticity, trace clay. **CLAY (CL)** tan with orange motting, wet, medium stiff to stiff, medium plasticity. -soft.	
15	S3	15.0 – 20.0	48	0.3		No Recovery. **SAND (SP)** tan with dark gray mottling, wet, loose, coarse, some clay present. **SAND (SW)** olive tan, wet, loose, very fine to medium grained, no clay.	
20	S4	20.0 – 25.0	48	0			
25	S5	25.0 – 30.0	48	0			
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW71IW SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 16.70 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276539.55, 3844461.75 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 9.52 ft BTOC (10/17/2011) START: 10/2/2011 END: 10/2/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	60	0		**SILTY SAND (SM)** dark olive, wet, medium dense, fine grained, cohesive.	
35	S7	35.0 – 40.0	60	0		-little gravel sized shell fragments, increase in clay content. **SILTY SAND (SM)** white to light gray, wet to moist, weakly to moderately cemented sand with abundand shells.	
40	S8	40.0 – 45.0	60	0		**SANDY LIMESTONE (LIMESTONE)** white to light gray, wet, dense, moderately to strongly cemented fossiliferrous sand.	
45	S9	45.0 – 50.0	60	0		**SILTY SAND (SM)** tan, wet, medium dense, abundant gravel sized shell fragments, some cobble sized strongly cemented sand pieces.	
50							
55						End of Boring Log at 51 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	
60							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW72IW SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 16.48 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276550.72, 3844462.32 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 9.54 ft BTOC (10/17/2011) START: 10/1/2011 END: 10/1/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		-concrete and fill. **CLAY (CL)** brown with red mottling, dry, stiff, medium plasticity.	
5	S1	5.0 – 10.0	60	1.1		**SANDY SILT (ML)** dark brown to black, dry, medium stiff. **SILTY SAND (SM)** dark brown, wet, medium stiff, fine grained. -wood debris.	
10	S2	10.0 – 15.0	36	0		-very soft. **CLAY (CL)** light gray, moist, stiff, medium plasticity. No Recovery.	
15	S3	15.0 – 20.0	48	0.5		**SILTY CLAY (CL)** light gray, soft, medium plasticity. **SAND (SP)** gray, moist, loose, very coarse grained, trace gravel. No Recovery.	
20	S4	20.0 – 25.0	60	0.2		**SAND (SW)** olive tan, wet, medium dense, very fine to medium grained.	
25	S5	25.0 – 30.0	60	0.3			
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW72IW SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 16.48 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276550.72, 3844462.32 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 9.54 ft BTOC (10/17/2011) START: 10/1/2011 END: 10/1/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	54	0.1		**SILTY SAND (SM)** dark green, wet, stiff, very fine to fine grained, low plasticity.	
35	S7	35.0 – 40.0	60	0.1		**SILTY SANDY LIMESTONE (LIMESTONE)** light gray to white, medium dense, moderately cemented silty sand with gravel sized shell fragments.	
40	S8	40.0 – 45.0	60	0			
45	S9	45.0 – 50.0	60	0.1		**SILTY SAND (SM)** tan, medium dense, little gravel sized shell fragments, little to few moderately cemented sand nodules.	
50							
55						End of Boring Log at 51 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	
60							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW73IW SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 18.44 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276516.79, 3844471.21 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 11.14 ft BTOC (10/17/2011) START: 10/12/2011 END: 10/12/2011 LOGGER : B.Propst/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		**SILTY SAND (SM)** tan, dry, medium dense to loose, fine grained, fill.	
5	S1	5.0 – 10.0	24	0		No Recovery.	
10	S2	10.0 – 15.0	60	0		**SILTY SAND (SM)** light brown and gray, wet, loose, fine grained.	
						SANDY CLAY (CL) gray, soft, fine grained.	
15						**CLAY (OL)** yellow-orange and gray, hard, fine grained.	
	S3	15.0 – 20.0	60	0		**SANDY CLAY (CL)** gray, medium stiff. -very soft.	
20	S4	20.0 – 25.0	60	0		**SAND (SP)** gray and olive green, wet, loose to medium dense, fine grained.	
25	S5	25.0 – 30.0	60	0			
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW73IW SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 18.44 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276516.79, 3844471.21 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 11.14 ft BTOC (10/17/2011) START: 10/12/2011 END: 10/12/2011 LOGGER : B.Propst/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	60	0		**SAND (SP)** gray and olive green, wet, loose to medium dense, fine grained.	
35	S7	35.0 – 40.0	60	0		**CLAYEY SILTY SAND (SM)** gray and olive green, saturated, medium dense, fine grained.	
40	S8	40.0 – 45.0	60	0		**CLAYEY SAND (SC)** tan, partially cemented sand and shell fragments. **SANDY LIMESTONE (LIMSETONE)** tan, medium dense to dense, partially cemented sand with abundant shell fragments.	
45	S9	45.0 – 50.0	60	0		**SANDY SILT (ML)** tan, saturated, medium dense, partially cemented sand and shell fragments decreasing with depth. **SILTY SAND (SM)** tan, dense, some cemented sand pieces and shell fragments.	
50						End of Boring Log at 51 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	
55							
60							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW74IW SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 16.62 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276534.84, 3844466.45 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 9.6 ft BTOC (10/17/2011) START: 10/2/2011 END: 10/2/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		**SANDY SILT (ML)** black with orange mottling, dry, stiff, trace rootlets. **SAND (SP)** light gray, dry, medium dense, coarse grained, organic. **SILTY SAND (SM)** black, dry, abundant rootlets, rich organic material.	
5	S1	5.0 – 10.0	36	0.1		No Recovery. **SILTY SAND (SM)** brown, wet, loose, medium to coarse grained, little rootlets. **CLAYEY SANDY SILT (ML)** dark brown to black mottled with gray, moist, hard, 15% sand. -wet, soft.	
10	S2	10.0 – 15.0	60	0.3		**SILTY CLAY (CL)** light gray, wet, soft to medium stiff, medium plasticity.	
15	S3	15.0 – 20.0	60	0.2		**SAND (SW)** olive tan, wet, loose to medium dense, fine to medium grained.	
20	S4	20.0 – 25.0	42	0.1		No Recovery.	
25	S5	25.0 – 30.0	36	0.4		**SAND (SW)** olive tan, wet, loose to medium dense, fine to medium grained. No Recovery.	
30							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW74IW SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 16.62 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276534.84, 3844466.45 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 9.6 ft BTOC (10/17/2011) START: 10/2/2011 END: 10/2/2011 LOGGER : A.Guilfoyle/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	54	0.4		**SAND (SW)** olive tan, wet, loose to medium dense, fine to medium grained.	
35						No Recovery.	
	S7	35.0 – 40.0	60	0.1		**SAND (SW)** olive tan, wet, loose to medium dense, fine to medium grained. **SILTY SAND (SM)** dark olive, wet, medium dense, cohesive, fine grained.	
40							
	S8	40.0 – 45.0	36	0.4		**SANDY LIMESTONE (LIMESTONE)** white, wet, fine to coarse, moderately cemented fossiliferrous sand with abundant gravel sized shell fragments.	
						No Recovery.	
45							
	S9	45.0 – 50.0	60	0.4		**SILTY SAND (SM)** tan, wet, fine to coarse, moderately cemented fossiliferrous sand with abundant gravel sized shell fragments.	
50							
						End of Boring Log at 51 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	
55							
60							

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW75IW SHEET 1 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 17.35 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276515.61, 3844458.22 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 10.07 ft BTOC (10/17/2011) START: 10/11/2011 END: 10/11/2011 LOGGER : B.Propst/CLT

DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	HA-1	0.0 – 5.0	60	NM		No Recovery.	
5	S1	5.0 – 10.0	12	NM		**SILT (OL)** dark gray, wet, loose, soft, fine grained, trace sand. No Recovery.	
10	S2	10.0 – 15.0	24	NM		**SILT (OL)** dark gray, wet, loose, soft, fine grained, trace sand. No Recovery.	
15	S3	15.0 – 20.0	60	NM		**CLAY (OH)** orange, hard grading to soft, fine grained. **SILTY SAND (SM)** gray, dry, dense, fine grained.	
20	S4	20.0 – 25.0	60	NM		**SAND (SP)** light gray with trace olive-green, wet, medium dense, fine grained.	
25	S5	25.0 – 30.0	60	NM		-saturated.	
30						No Recovery.	

PROJECT NUMBER:	BORING NUMBER:
423849.PT.MW	IR86-MW75IW SHEET 2 OF 2

Soil Boring Log

CLIENT: NAVFAC PROJECT : Site 86 2011 Pilot Study LOCATION : MCAS New River, Site 86

ELEVATION : 17.35 ft above sea level DRILLING CONTRACTOR : Groundwater Protection, Orlando, FL

EAST, NORTH (UTM Z18 NAD83, meters) : 276515.61, 3844458.22 DRILLING METHOD AND EQUIPMENT : Rotosonic Geoprobe 8140DT

WATER LEVEL: 10.07 ft BTOC (10/17/2011) START: 10/11/2011 END: 10/11/2011 LOGGER : B.Propst/CLT

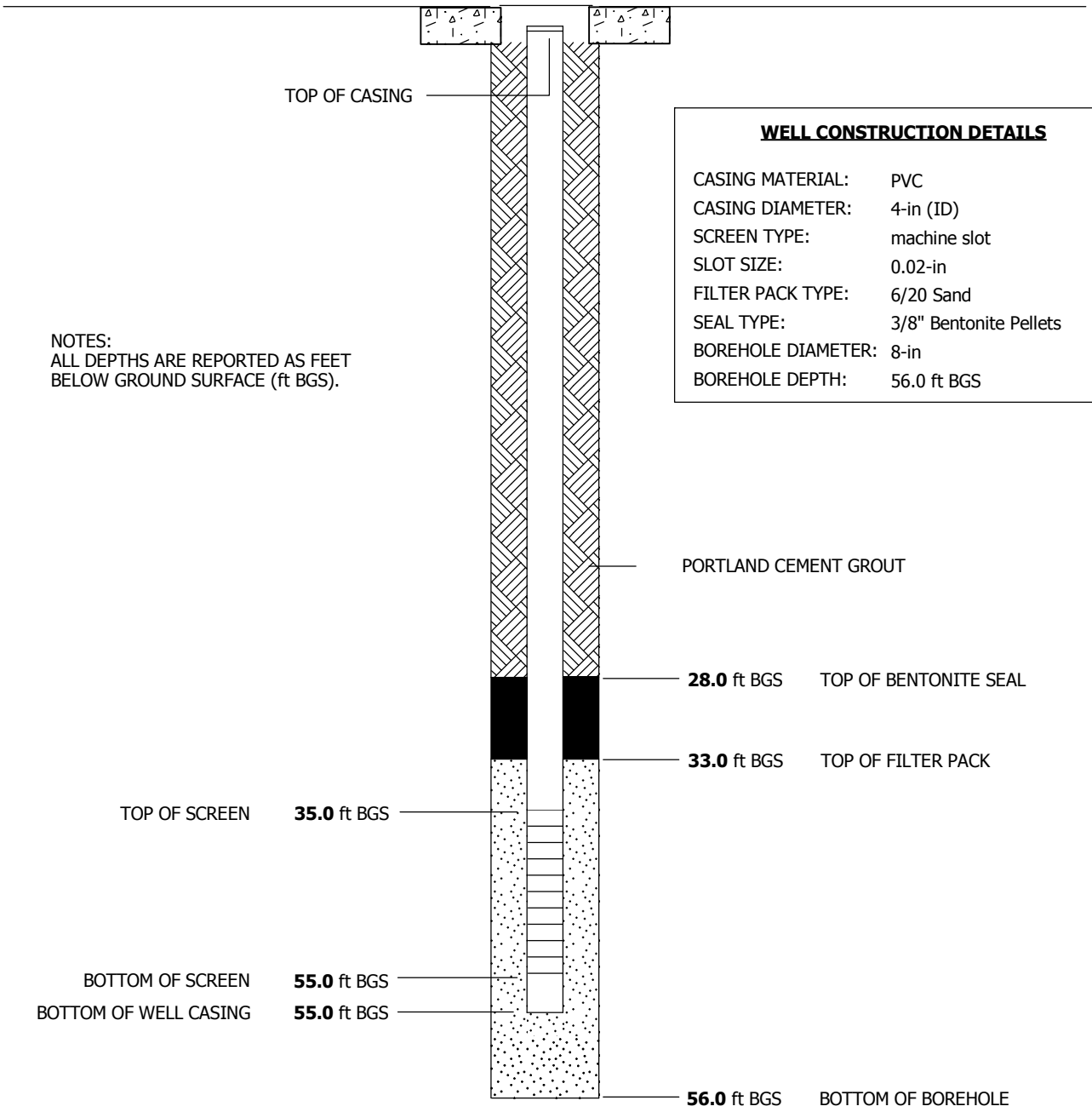
DEPTH BELOW GROUND SURFACE (ft)	SAMPLE TYPE	INTERVAL (ft)	RECOVERY (inches)	PID SCREENING (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION
	S6	30.0 – 35.0	0	NM		No Recovery.	
35	S7	35.0 – 40.0	60	NM		**SILTY SAND (SM)** olive-gray, wet, soft to medium dense, fine grained.	
40						**SILTY CLAYEY SAND (SM)** tan, wet, medium dense, fine grained, trace shells and partially cemented sand pieces.	
	S8	40.0 – 45.0	60	NM		**SANDY LIMESTONE (LIMESTONE)** gray, medium dense, partially cemented sand eith abundant shell fragments.	
45	S9	45.0 – 50.0	60	NM		**SILTY SAND (SM)** tan, saturated, medium dense, partially cemented sand with shell fragments. -loose/soft, fine grained, some shell fragments.	
50							
55						End of Boring Log at 51 ft bgs Abbreviations: bgs - below ground surface BTOC- below top of casing ft - feet HA - Hand Auger in - inch NM - Not Measured NS - Not Sampled PID - photo ionization detector S - Sonic Run	
60							

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-EW01

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 17.54 ft	**NORTHING (UTM Z18 NAD83):** 3844466.44 meters	**EASTING (UTM Z18 NAD83):** 276524.24 meters	**STATIC WATER LEVEL:** Not Available
GROUND ELEVATION (NAVD 88): 17.74 ft	**START:** 09/28/2011	**FINISH:** 09/28/2011	**LOGGED BY:** A.Guilfoyle/CLT

FLUSH MOUNT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	4-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.02-in
FILTER PACK TYPE:	6/20 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	8-in
BOREHOLE DEPTH:	56.0 ft BGS

NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

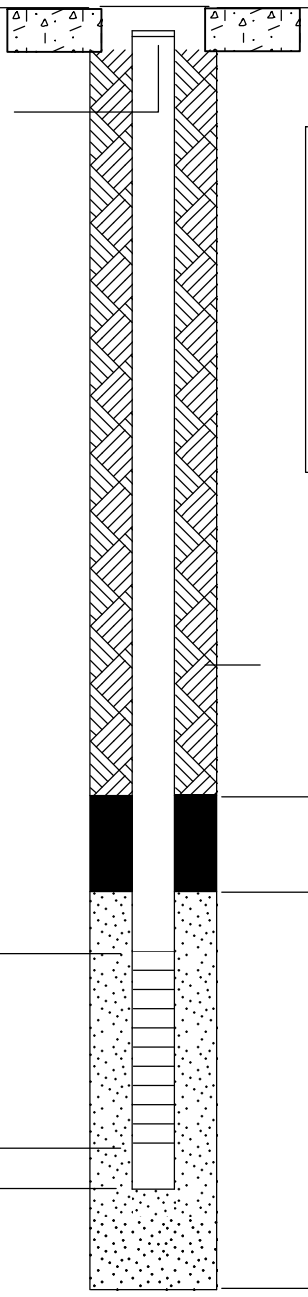
WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-EW02

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 14.68 ft	**NORTHING (UTM Z18 NAD83):** 3844466.34 meters	**EASTING (UTM Z18 NAD83):** 276545.70 meters	**STATIC WATER LEVEL:** Not Available
GROUND ELEVATION (NAVD 88): 14.39 ft	**START:** 09/28/2011	**FINISH:** 09/28/2011	**LOGGED BY:** A.Guilfoyle/CLT

FLUSH MOUNT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	4-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.02-in
FILTER PACK TYPE:	6/20 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	8-in
BOREHOLE DEPTH:	55.0 ft BGS

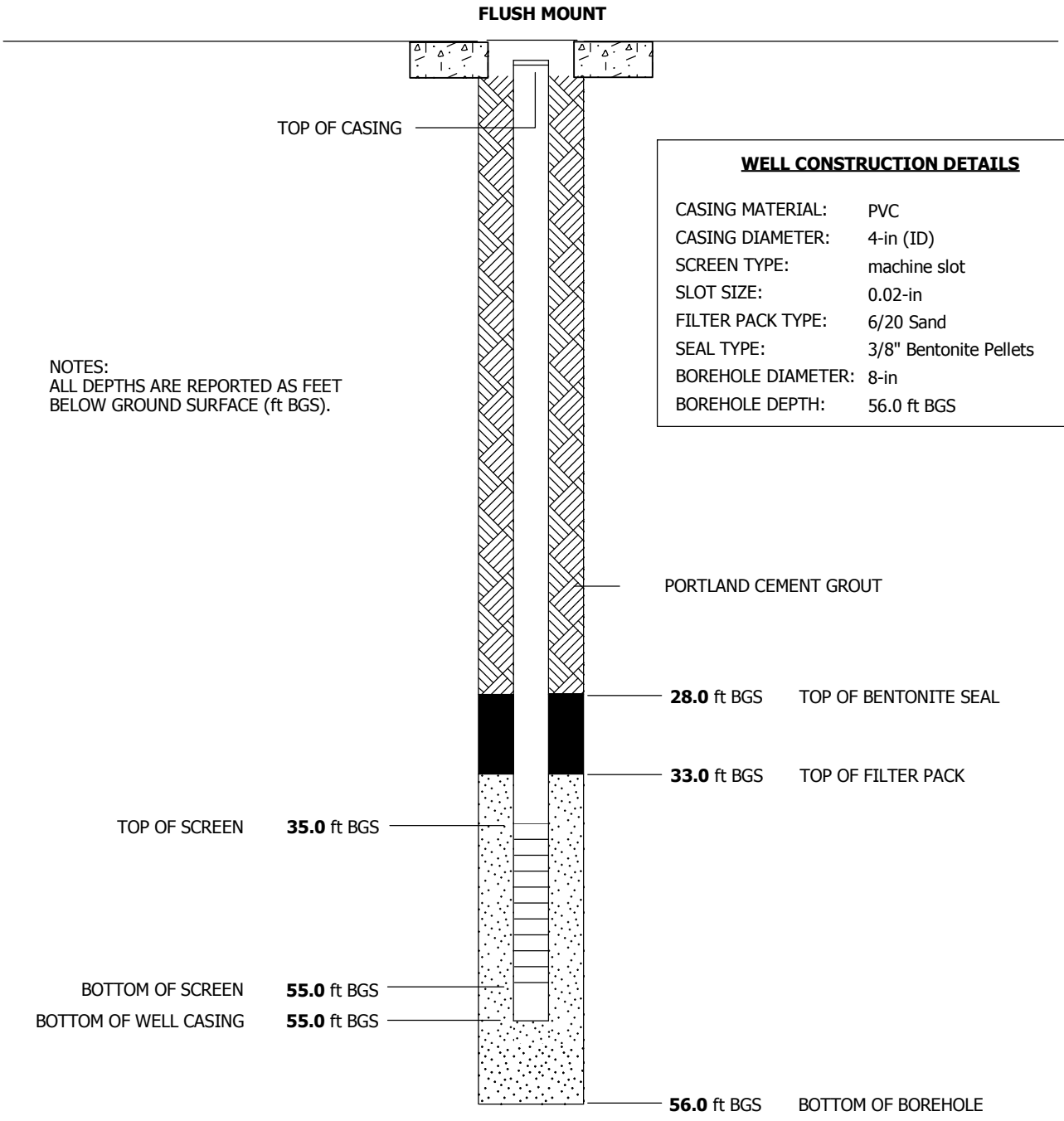
NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-IW01

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 18.34 ft	**NORTHING (UTM Z18 NAD83):** 3844474.37 meters	**EASTING (UTM Z18 NAD83):** 276510.58 meters	**STATIC WATER LEVEL:** Not Available
GROUND ELEVATION (NAVD 88): 18.54 ft	**START:** 10/13/2011	**FINISH:** 10/13/2011	**LOGGED BY:** B.Propst/CLT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	4-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.02-in
FILTER PACK TYPE:	6/20 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	8-in
BOREHOLE DEPTH:	56.0 ft BGS

NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

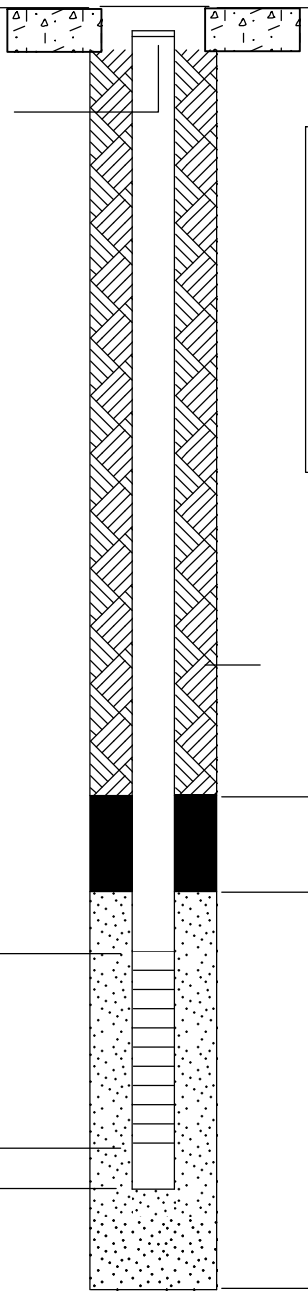
WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-IW02

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 17.72 ft	**NORTHING (UTM Z18 NAD83):** 3844481.85 meters	**EASTING (UTM Z18 NAD83):** 276532.97 meters	**STATIC WATER LEVEL:** Not Available
GROUND ELEVATION (NAVD 88): 17.66 ft	**START:** 10/13/2011	**FINISH:** 10/13/2011	**LOGGED BY:** B.Propst/CLT

FLUSH MOUNT



TOP OF CASING

WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	4-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.02-in
FILTER PACK TYPE:	6/20 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	8-in
BOREHOLE DEPTH:	56.0 ft BGS

NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

PORTLAND CEMENT GROUT

28.0 ft BGS TOP OF BENTONITE SEAL

33.0 ft BGS TOP OF FILTER PACK

TOP OF SCREEN **35.0** ft BGS

BOTTOM OF SCREEN **55.0** ft BGS

BOTTOM OF WELL CASING **55.0** ft BGS

56.0 ft BGS BOTTOM OF BOREHOLE

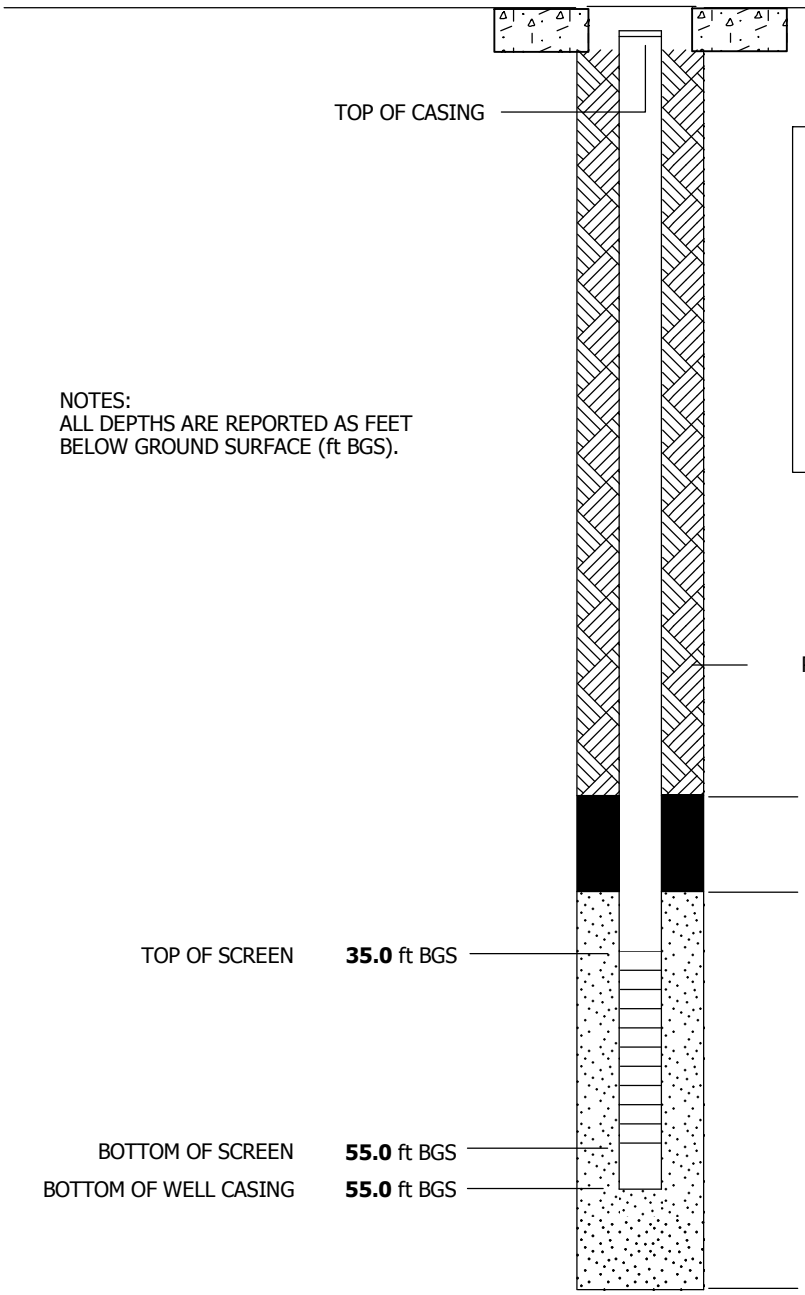
WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-IW03

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 15.54 ft	**NORTHING (UTM Z18 NAD83):** 3844479.66 meters	**EASTING (UTM Z18 NAD83):** 276556.44 meters	**STATIC WATER LEVEL:** Not Available
GROUND ELEVATION (NAVD 88): 15.63 ft	**START:** 10/04/2011	**FINISH:** 10/04/2011	**LOGGED BY:** A.Guilfoyle/CLT

FLUSH MOUNT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	4-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.02-in
FILTER PACK TYPE:	6/20 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	8-in
BOREHOLE DEPTH:	56.0 ft BGS

NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

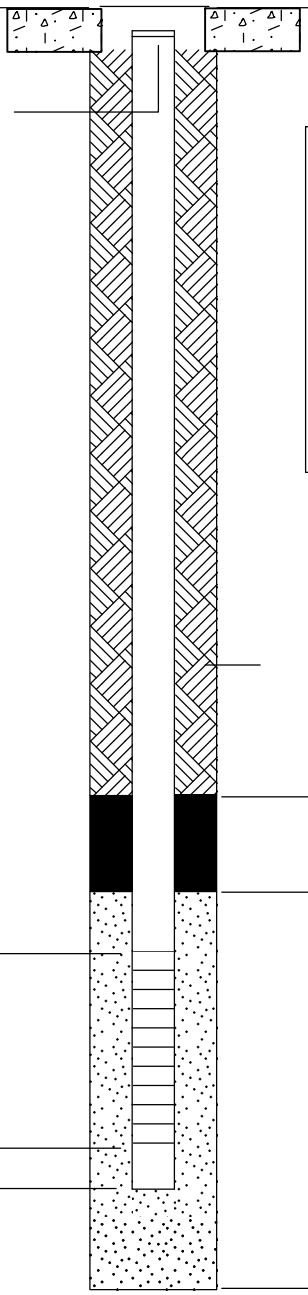
WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-IW04

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 16.94 ft	**NORTHING (UTM Z18 NAD83):** 3844455.69 meters	**EASTING (UTM Z18 NAD83):** 276512.81 meters	**STATIC WATER LEVEL:** Not Available
GROUND ELEVATION (NAVD 88): 17.41 ft	**START:** 09/27/2011	**FINISH:** 09/27/2011	**LOGGED BY:** J.Albano/CLT

FLUSH MOUNT



TOP OF CASING

WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	4-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.02-in
FILTER PACK TYPE:	6/20 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	8-in
BOREHOLE DEPTH:	56.0 ft BGS

NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

PORTLAND CEMENT GROUT

28.0 ft BGS TOP OF BENTONITE SEAL

33.0 ft BGS TOP OF FILTER PACK

TOP OF SCREEN **35.0** ft BGS

BOTTOM OF SCREEN **55.0** ft BGS

BOTTOM OF WELL CASING **55.0** ft BGS

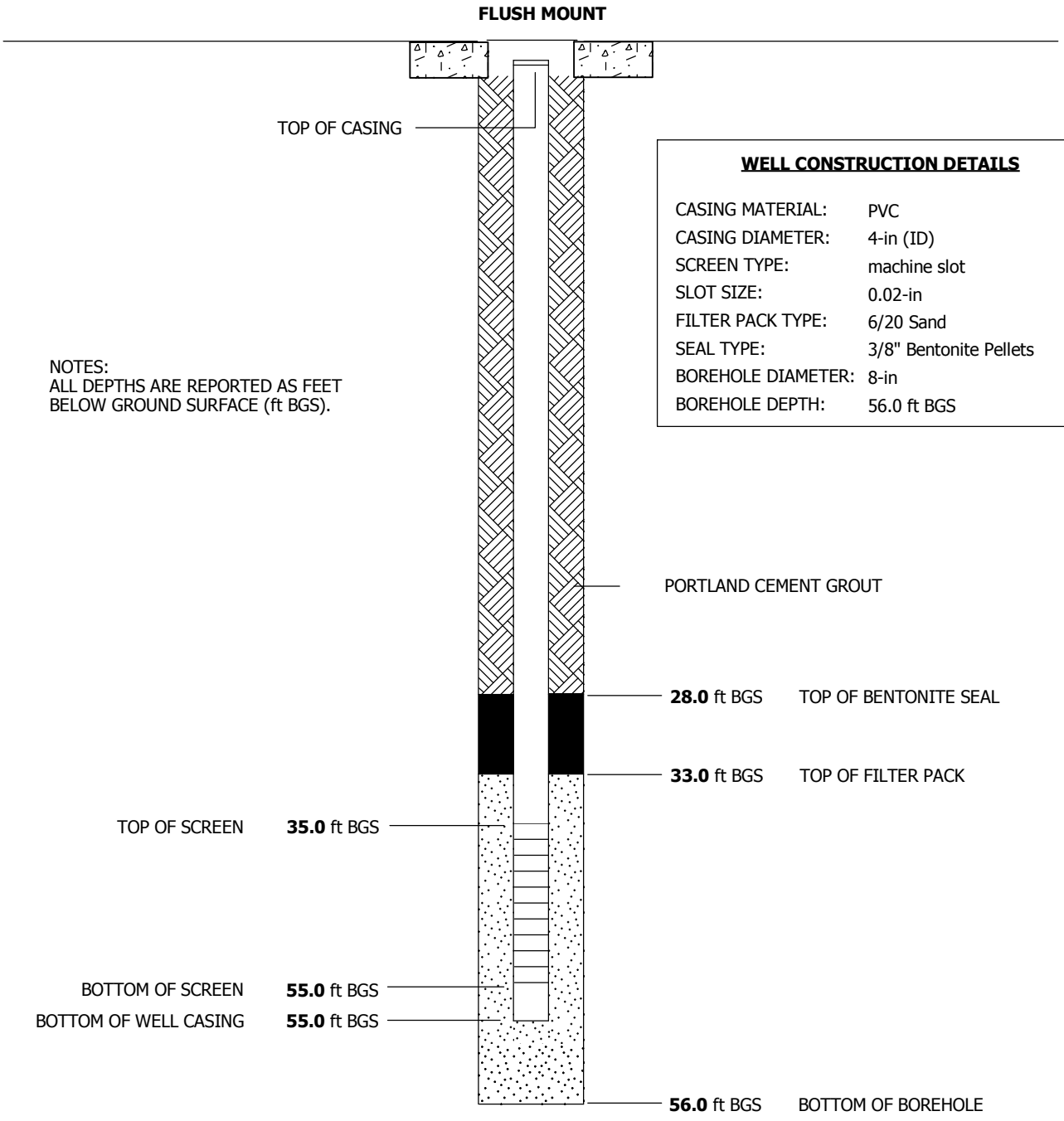
56.0 ft BGS BOTTOM OF BOREHOLE

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-IW05

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 16.47 ft	**NORTHING (UTM Z18 NAD83):** 3844458.04 meters	**EASTING (UTM Z18 NAD83):** 276534.48 meters	**STATIC WATER LEVEL:** Not Available
GROUND ELEVATION (NAVD 88): 16.88 ft	**START:** 09/28/2011	**FINISH:** 09/28/2011	**LOGGED BY:** J.Albano/CLT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	4-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.02-in
FILTER PACK TYPE:	6/20 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	8-in
BOREHOLE DEPTH:	56.0 ft BGS

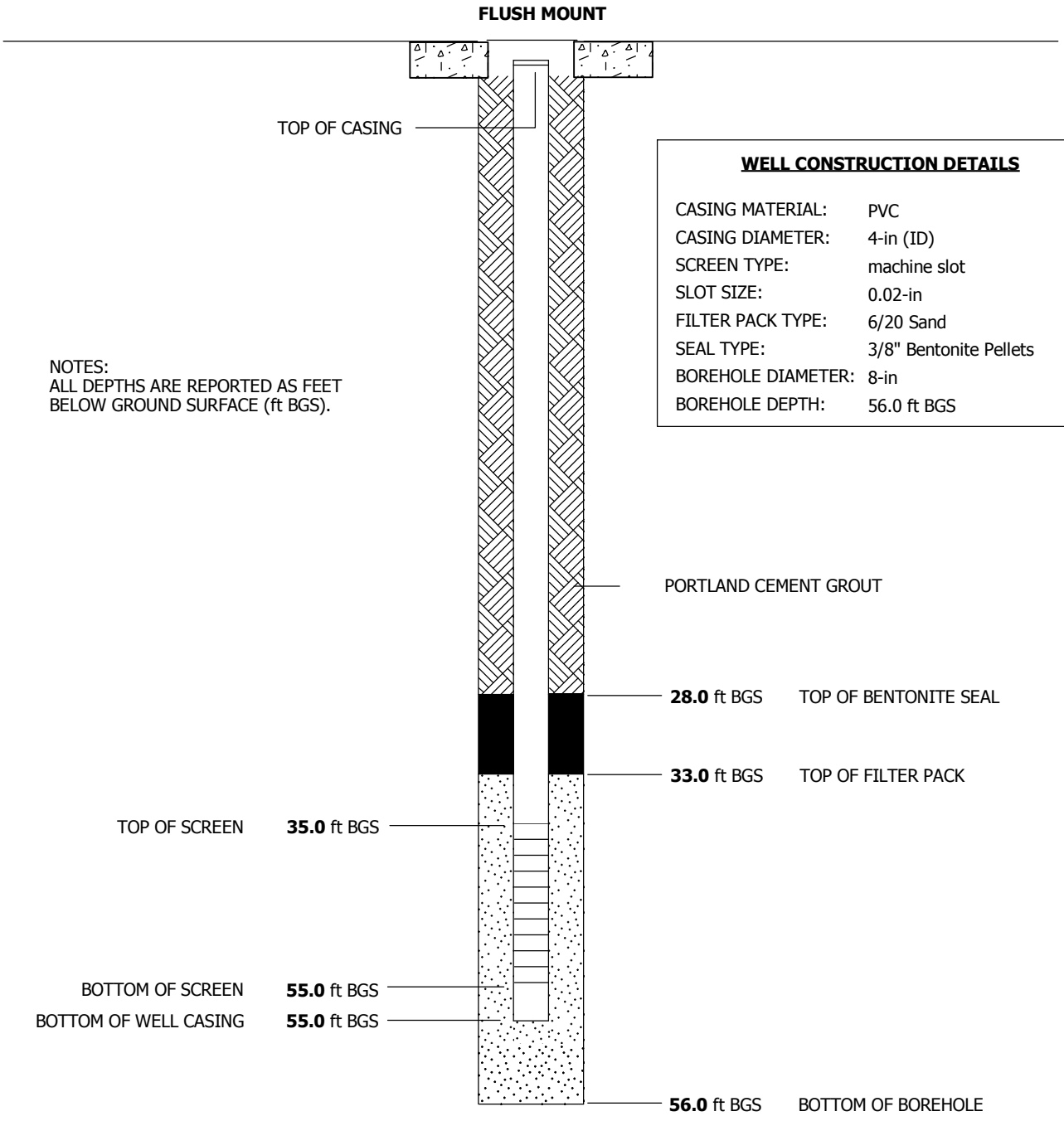
NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-IW06

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 16.12 ft	**NORTHING (UTM Z18 NAD83):** 3844457.04 meters	**EASTING (UTM Z18 NAD83):** 276558.04 meters	**STATIC WATER LEVEL:** Not Available
GROUND ELEVATION (NAVD 88): 16.41 ft	**START:** 09/30/2011	**FINISH:** 09/30/2011	**LOGGED BY:** A.Guilfoyle/CLT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	4-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.02-in
FILTER PACK TYPE:	6/20 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	8-in
BOREHOLE DEPTH:	56.0 ft BGS

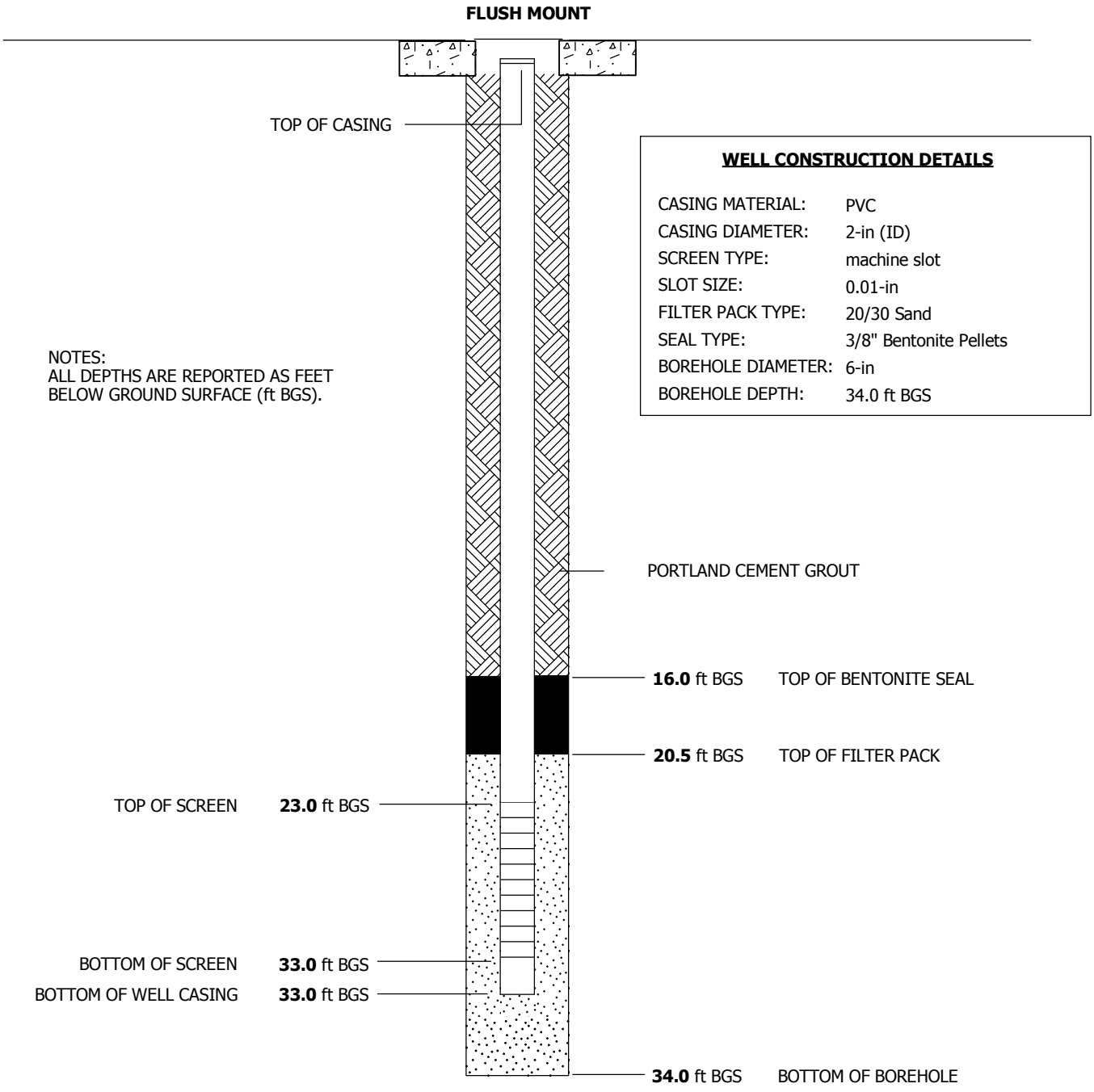
NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-MW66

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 12.63 ft	**NORTHING (UTM Z18 NAD83):** 3844456.30 meters	**EASTING (UTM Z18 NAD83):** 276732.60 meters	**STATIC WATER LEVEL:** 7.78 ft BTOC (10/17/2011)
GROUND ELEVATION (NAVD 88): 12.89 ft	**START:** 10/03/2011	**FINISH:** 10/03/2011	**LOGGED BY:** A.Guilfoyle/CLT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	2-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.01-in
FILTER PACK TYPE:	20/30 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	6-in
BOREHOLE DEPTH:	34.0 ft BGS

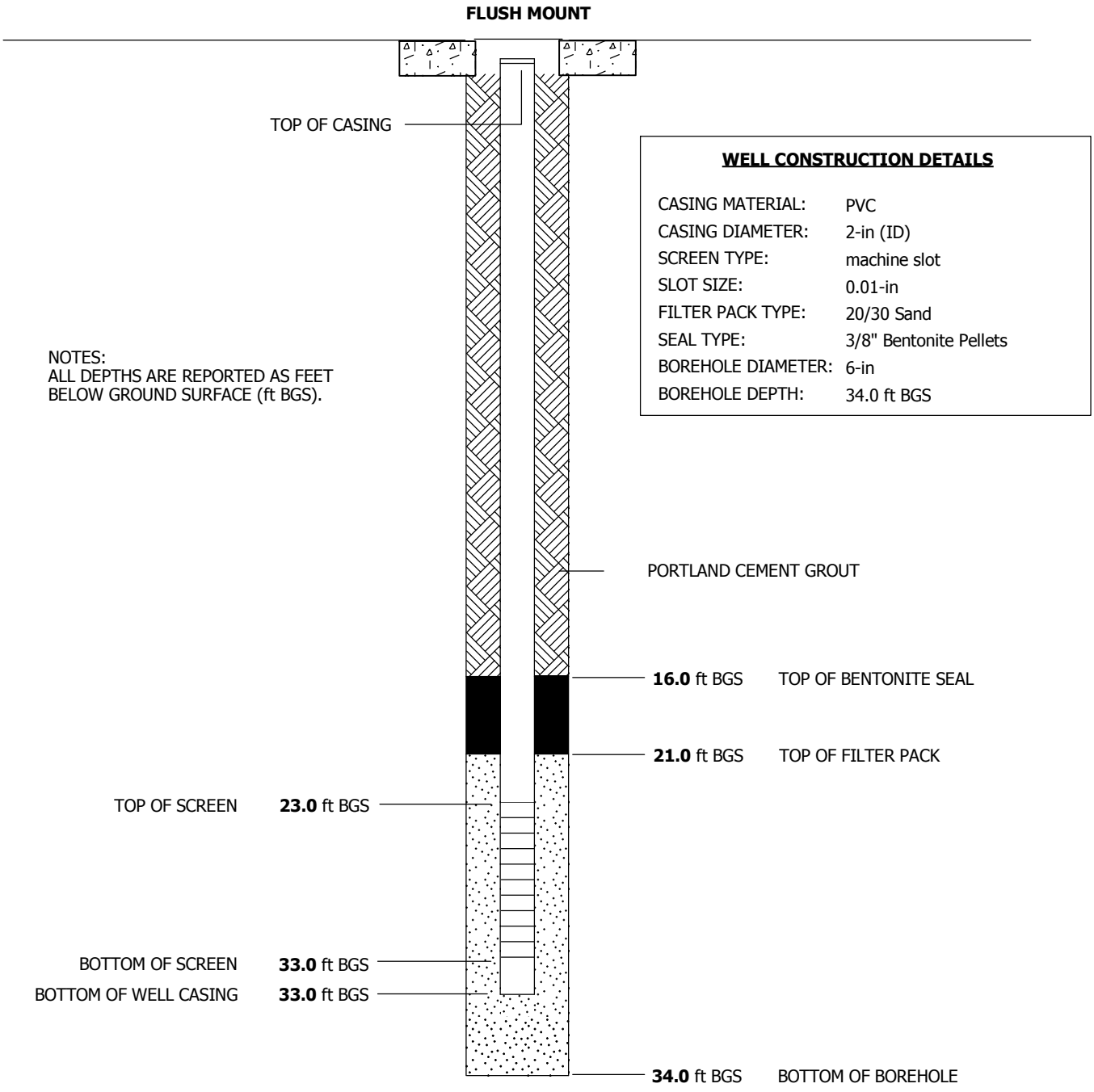
NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-MW67

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 12.75 ft	**NORTHING (UTM Z18 NAD83):** 3844455.92 meters	**EASTING (UTM Z18 NAD83):** 276734.69 meters	**STATIC WATER LEVEL:** 7.91 ft BTOC (10/17/2011)
GROUND ELEVATION (NAVD 88): 12.88 ft	**START:** 10/03/2011	**FINISH:** 10/03/2011	**LOGGED BY:** A.Guilfoyle/CLT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	2-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.01-in
FILTER PACK TYPE:	20/30 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	6-in
BOREHOLE DEPTH:	34.0 ft BGS

NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

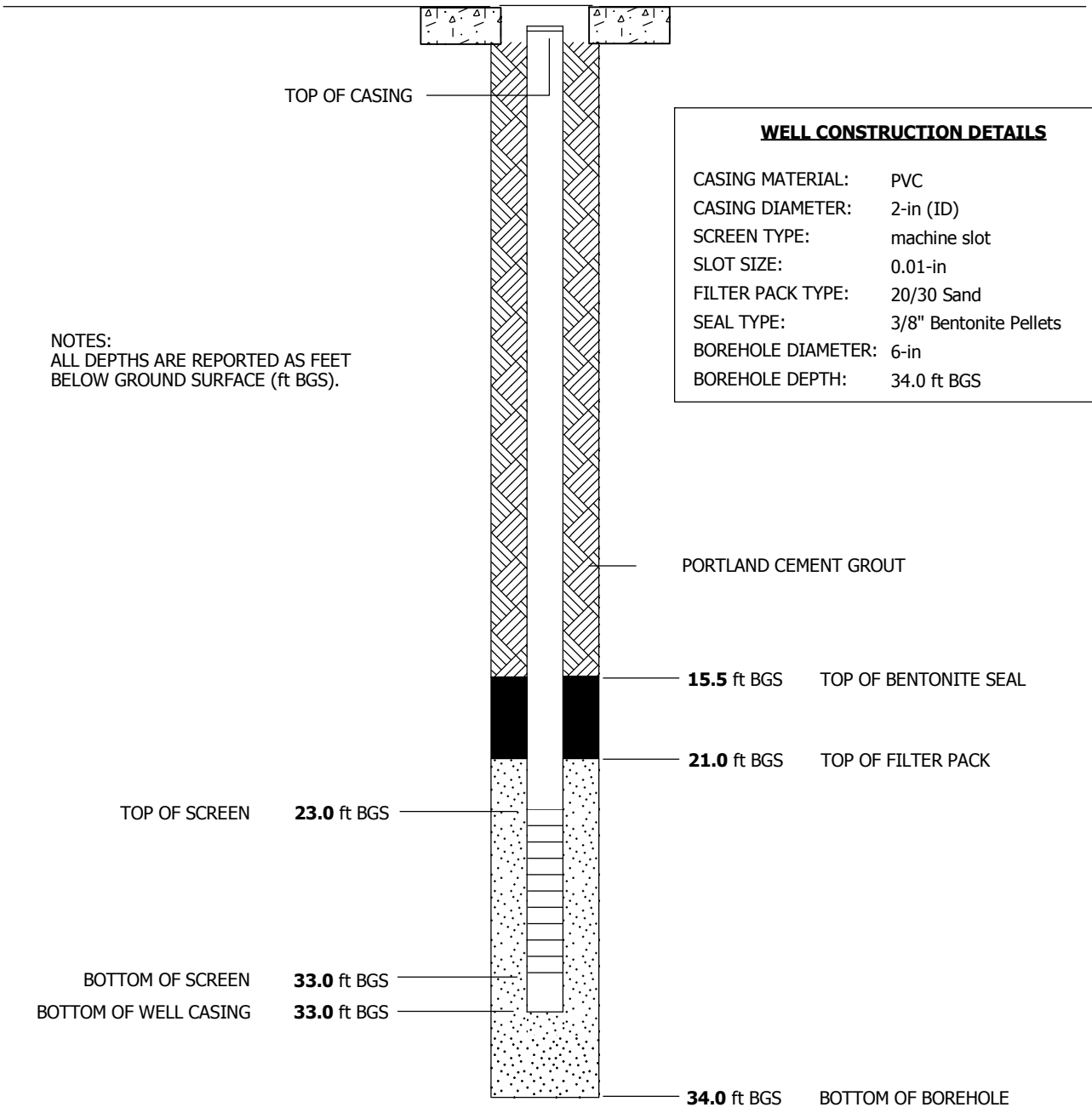
WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-MW68

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 12.83 ft	**NORTHING (UTM Z18 NAD83):** 3844457.33 meters	**EASTING (UTM Z18 NAD83):** 276736.40 meters	**STATIC WATER LEVEL:** 7.98 ft BTOC (10/17/2011)
GROUND ELEVATION (NAVD 88): 12.96 ft	**START:** 10/03/2011	**FINISH:** 10/03/2011	**LOGGED BY:** A.Guilfoyle/CLT

FLUSH MOUNT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	2-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.01-in
FILTER PACK TYPE:	20/30 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	6-in
BOREHOLE DEPTH:	34.0 ft BGS

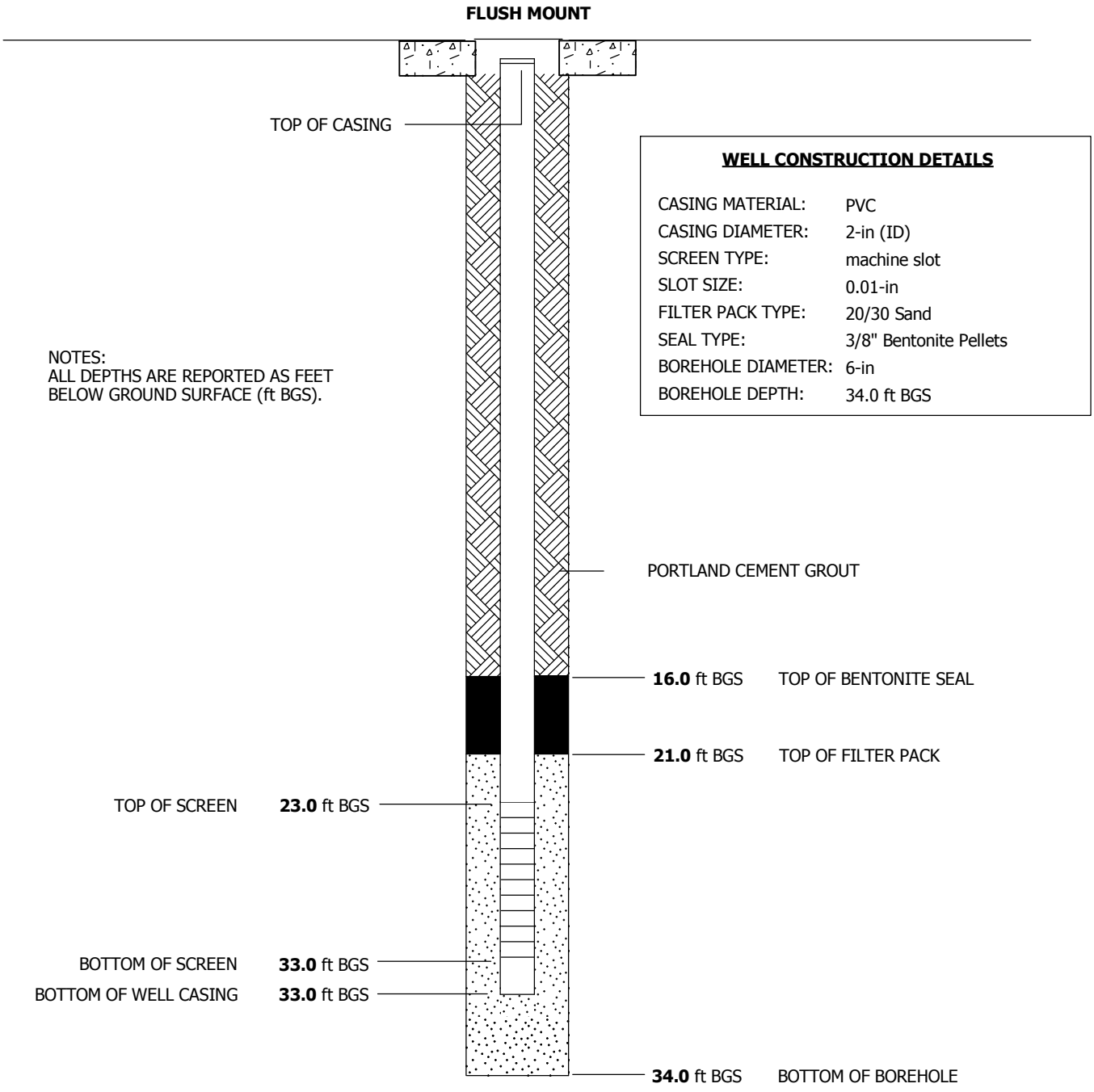
NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-MW69

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 12.42 ft	**NORTHING (UTM Z18 NAD83):** 3844453.95 meters	**EASTING (UTM Z18 NAD83):** 276737.11 meters	**STATIC WATER LEVEL:** 7.56 ft BTOC (10/17/2011)
GROUND ELEVATION (NAVD 88): 12.74 ft	**START:** 10/04/2011	**FINISH:** 10/04/2011	**LOGGED BY:** A.Guilfoyle/CLT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	2-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.01-in
FILTER PACK TYPE:	20/30 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	6-in
BOREHOLE DEPTH:	34.0 ft BGS

NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

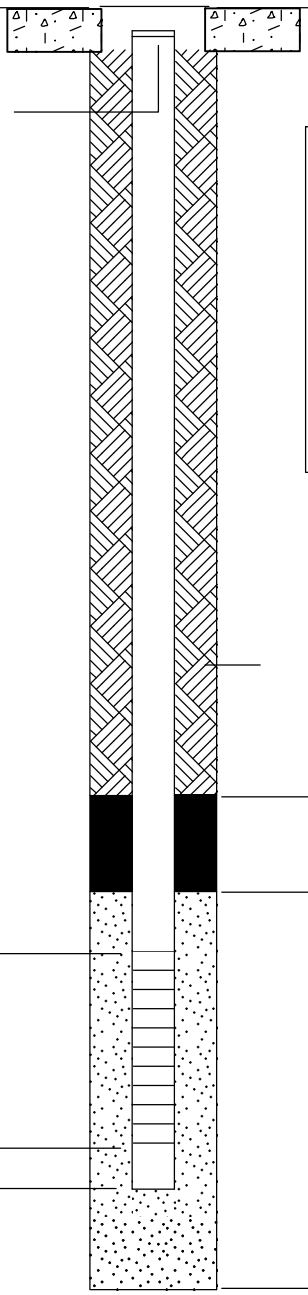
WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-MW70IW

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 16.78 ft	**NORTHING (UTM Z18 NAD83):** 3844460.02 meters	**EASTING (UTM Z18 NAD83):** 276532.01 meters	**STATIC WATER LEVEL:** 9.83 ft BTOC (10/17/2011)
GROUND ELEVATION (NAVD 88): 16.92 ft	**START:** 10/11/2011	**FINISH:** 10/11/2011	**LOGGED BY:** B.Propst/CLT

FLUSH MOUNT



TOP OF CASING

WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	2-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.01-in
FILTER PACK TYPE:	20/30 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	6-in
BOREHOLE DEPTH:	51.0 ft BGS

NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

PORTLAND CEMENT GROUT

33.0 ft BGS TOP OF BENTONITE SEAL

38.0 ft BGS TOP OF FILTER PACK

TOP OF SCREEN **40.0** ft BGS

BOTTOM OF SCREEN **50.0** ft BGS

BOTTOM OF WELL CASING **50.0** ft BGS

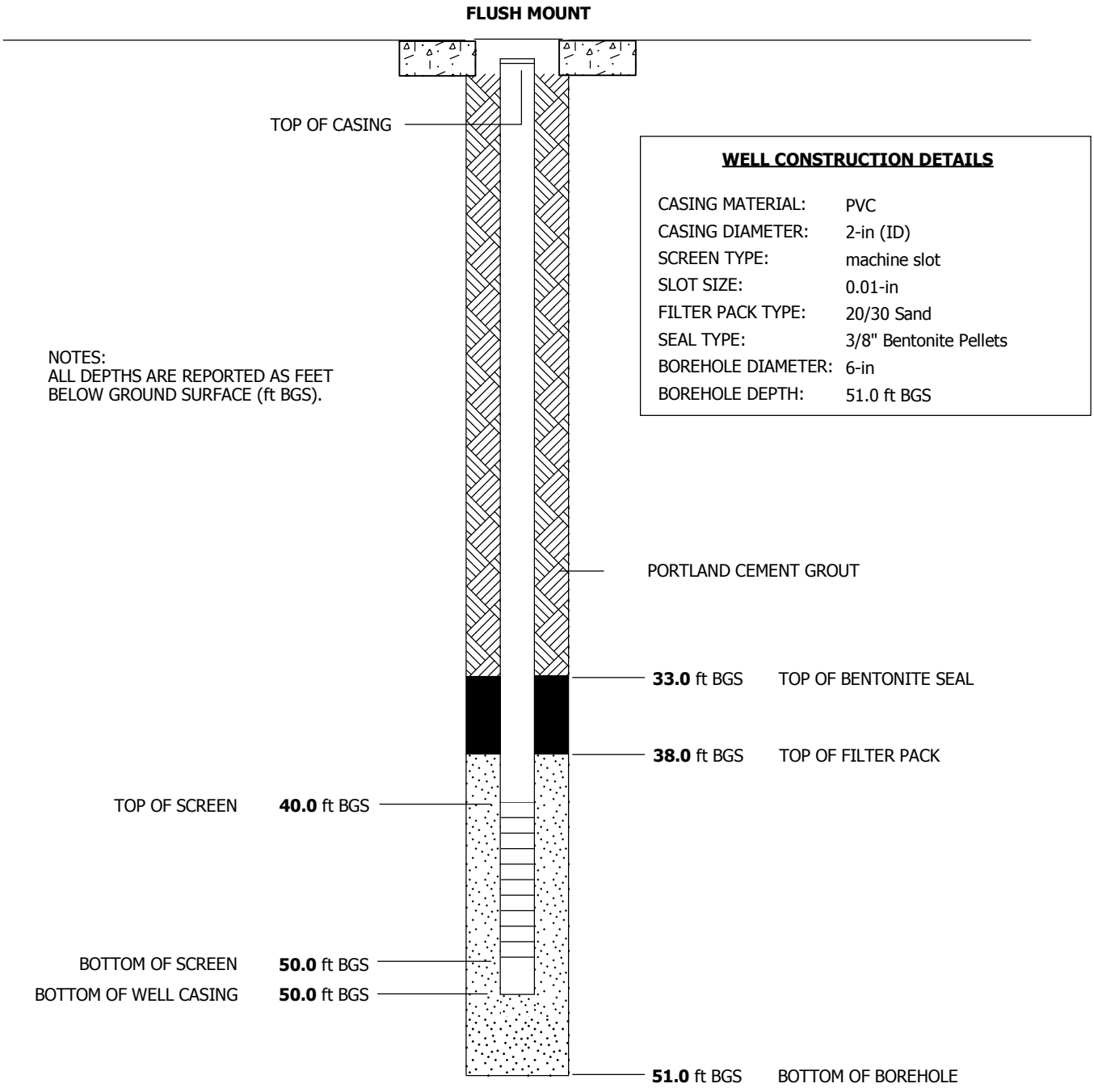
51.0 ft BGS BOTTOM OF BOREHOLE

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-MW71IW

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 16.36 ft	**NORTHING (UTM Z18 NAD83):** 3844461.75 meters	**EASTING (UTM Z18 NAD83):** 276539.55 meters	**STATIC WATER LEVEL:** 9.52 ft BTOC (10/17/2011)
GROUND ELEVATION (NAVD 88): 16.70 ft	**START:** 10/02/2011	**FINISH:** 10/02/2011	**LOGGED BY:** A.Guilfoyle/CLT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	2-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.01-in
FILTER PACK TYPE:	20/30 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	6-in
BOREHOLE DEPTH:	51.0 ft BGS

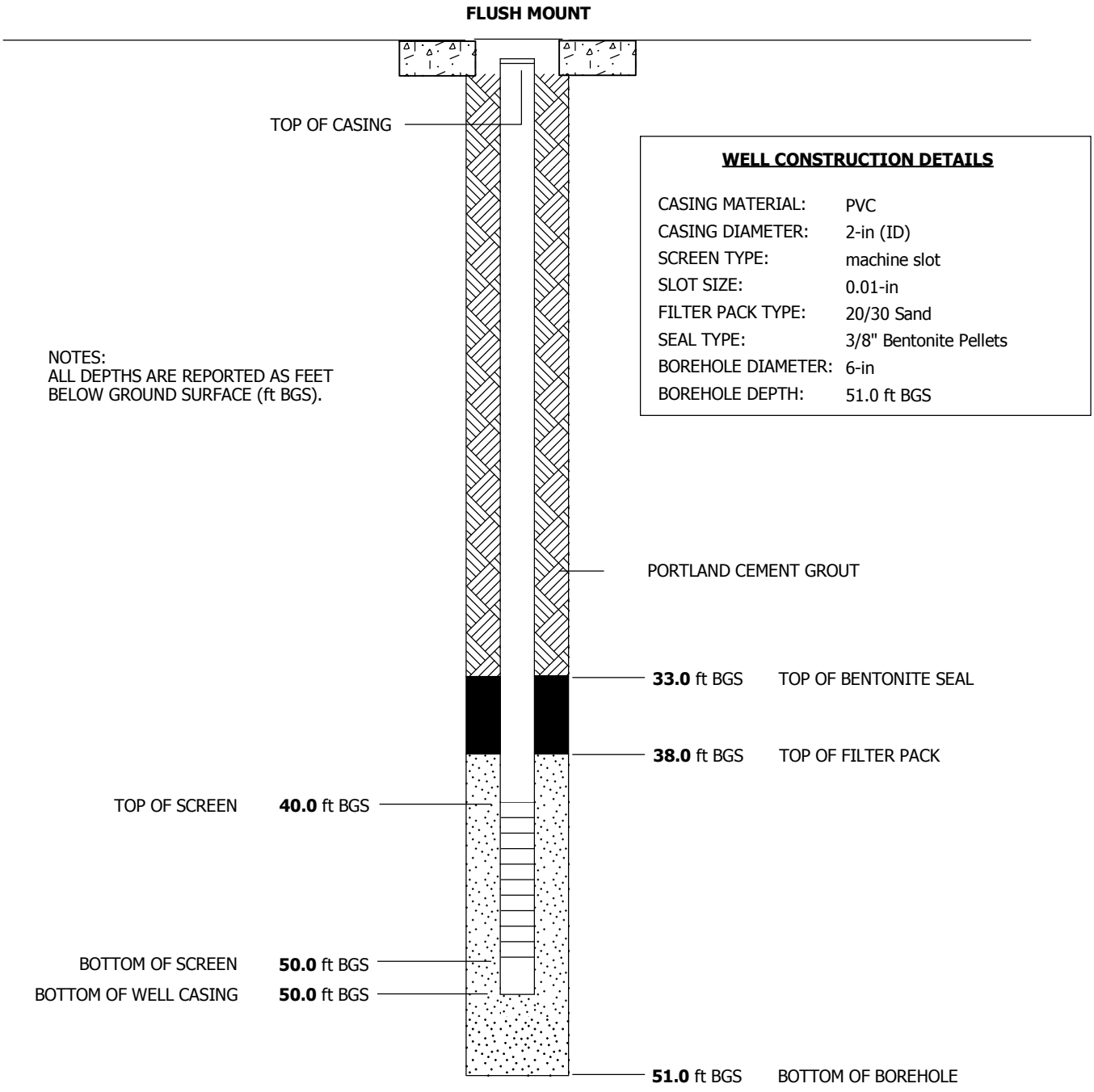
NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-MW72IW

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 16.24 ft	**NORTHING (UTM Z18 NAD83):** 3844462.32 meters	**EASTING (UTM Z18 NAD83):** 276550.72 meters	**STATIC WATER LEVEL:** 9.54 ft BTOC (10/17/2011)
GROUND ELEVATION (NAVD 88): 16.48 ft	**START:** 10/01/2011	**FINISH:** 10/01/2011	**LOGGED BY:** A.Guilfoyle/CLT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	2-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.01-in
FILTER PACK TYPE:	20/30 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	6-in
BOREHOLE DEPTH:	51.0 ft BGS

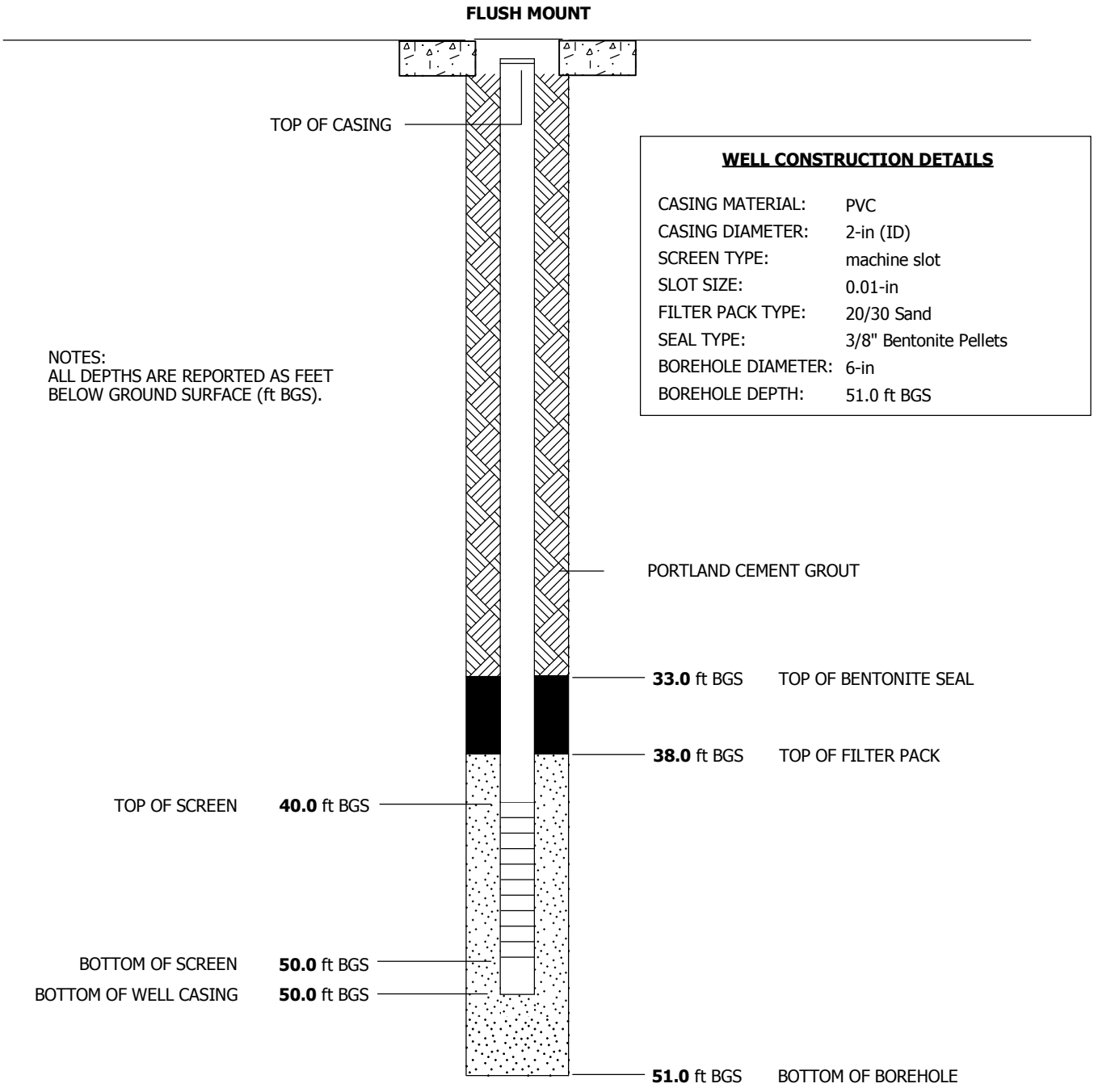
NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-MW73IW

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 18.14 ft	**NORTHING (UTM Z18 NAD83):** 3844471.21 meters	**EASTING (UTM Z18 NAD83):** 276516.79 meters	**STATIC WATER LEVEL:** 11.14 ft BTOC (10/17/2011)
GROUND ELEVATION (NAVD 88): 18.44 ft	**START:** 10/12/2011	**FINISH:** 10/12/2011	**LOGGED BY:** B.Propst/CLT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	2-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.01-in
FILTER PACK TYPE:	20/30 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	6-in
BOREHOLE DEPTH:	51.0 ft BGS

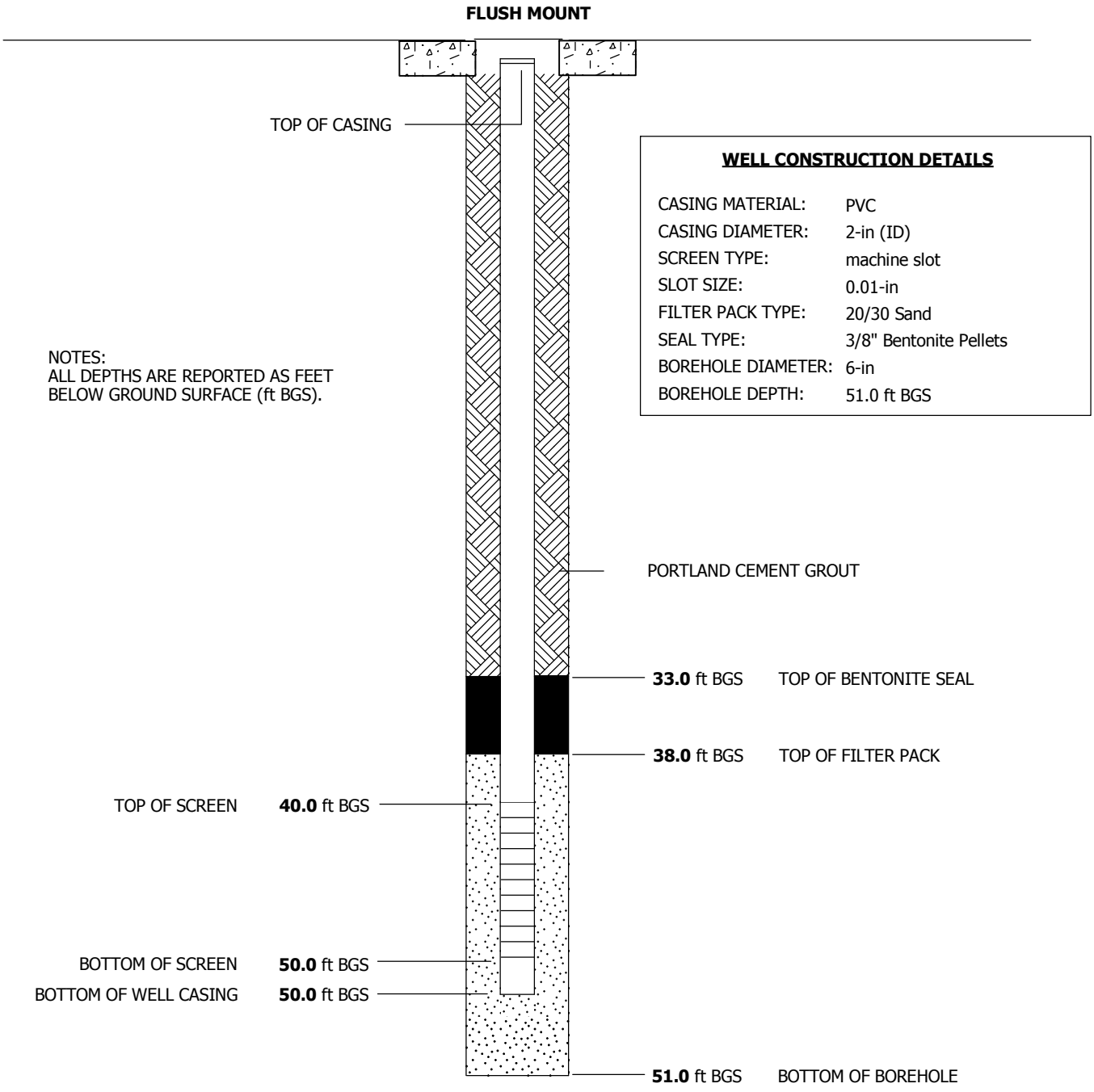
NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-MW74IW

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 16.44 ft	**NORTHING (UTM Z18 NAD83):** 3844466.45 meters	**EASTING (UTM Z18 NAD83):** 276534.84 meters	**STATIC WATER LEVEL:** 9.60 ft BTOC (10/17/2011)
GROUND ELEVATION (NAVD 88): 16.62 ft	**START:** 10/02/2011	**FINISH:** 10/02/2011	**LOGGED BY:** A.Guilfoyle/CLT



WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	2-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.01-in
FILTER PACK TYPE:	20/30 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	6-in
BOREHOLE DEPTH:	51.0 ft BGS

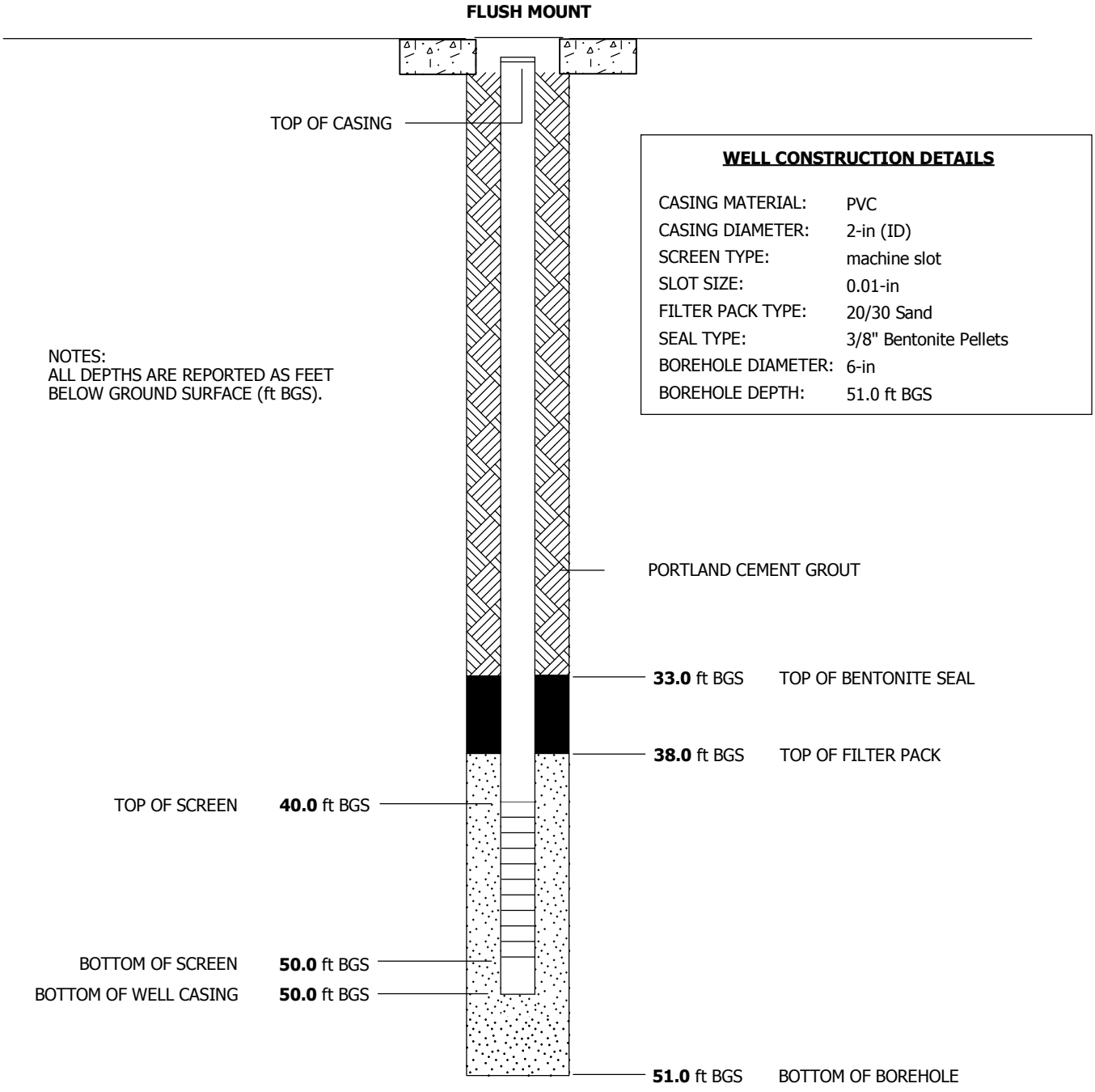
NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL	**PROJECT NUMBER:** 423849.PT.MW	**BORING NUMBER:** IR86-MW75IW

WELL COMPLETION DIAGRAM

PROJECT: Site 86 2011 Pilot Study		**LOCATION:** MCAS New River, Site 86	
DRILLING METHOD: Rotosonic Geoprobe 8140DT		**DRILLING CONTRACTOR:** Groundwater Protection, Orlando, FL	
TOP OF CASING ELEVATION (NAVD 88): 17.12 ft	**NORTHING (UTM Z18 NAD83):** 3844458.22 meters	**EASTING (UTM Z18 NAD83):** 276515.61 meters	**STATIC WATER LEVEL:** 10.07 ft BTOC (10/17/2011)
GROUND ELEVATION (NAVD 88): 17.35 ft	**START:** 10/11/2011	**FINISH:** 10/11/2011	**LOGGED BY:** B.Propst/CLT



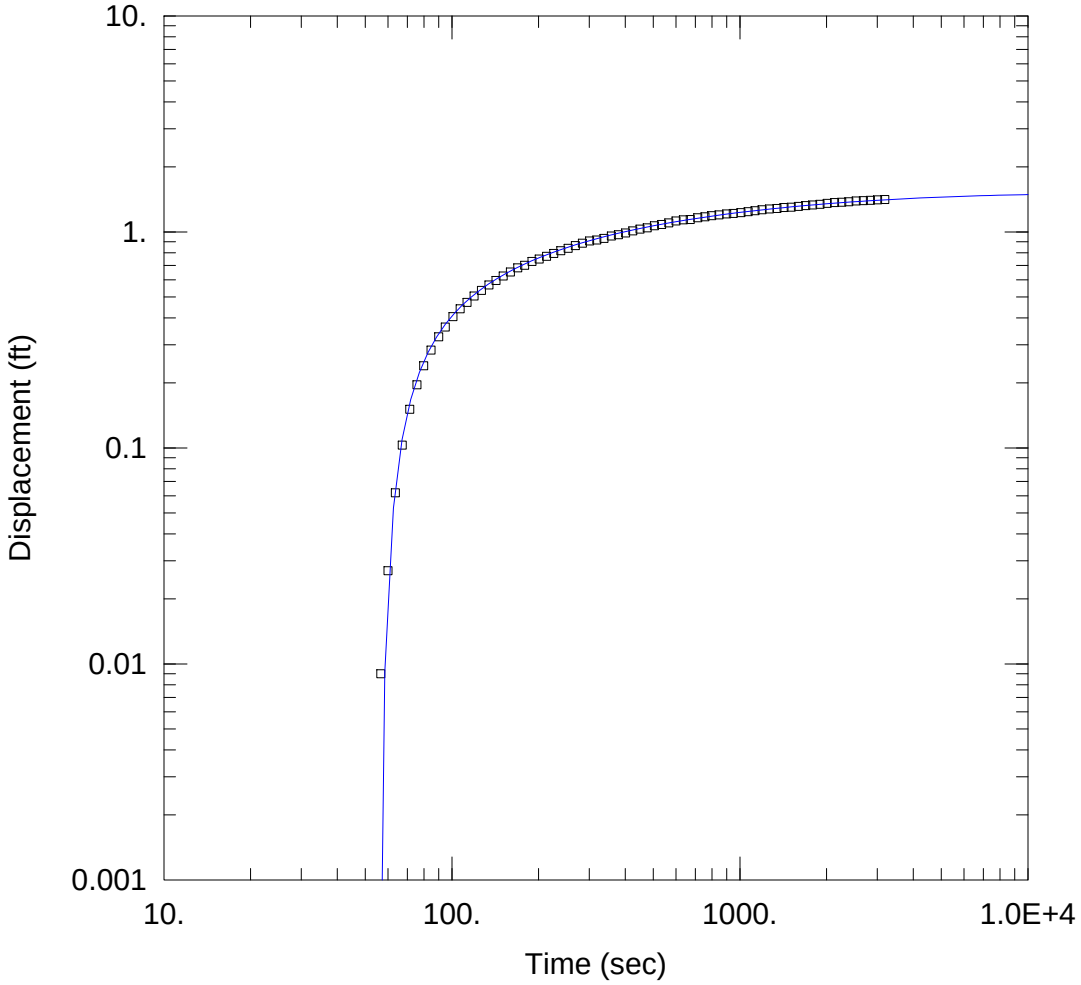
WELL CONSTRUCTION DETAILS

CASING MATERIAL:	PVC
CASING DIAMETER:	2-in (ID)
SCREEN TYPE:	machine slot
SLOT SIZE:	0.01-in
FILTER PACK TYPE:	20/30 Sand
SEAL TYPE:	3/8" Bentonite Pellets
BOREHOLE DIAMETER:	6-in
BOREHOLE DEPTH:	51.0 ft BGS

NOTES:
ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE (ft BGS).

WELL DIAGRAM IS NOT TO SCALE

Appendix B
AQTESOLV Pro 4.0 Outputs



WELL TEST ANALYSIS

Data Set: \...\iw03.aqt
Date: 10/31/11 Time: 14:33:27

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 150. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW02	0	0

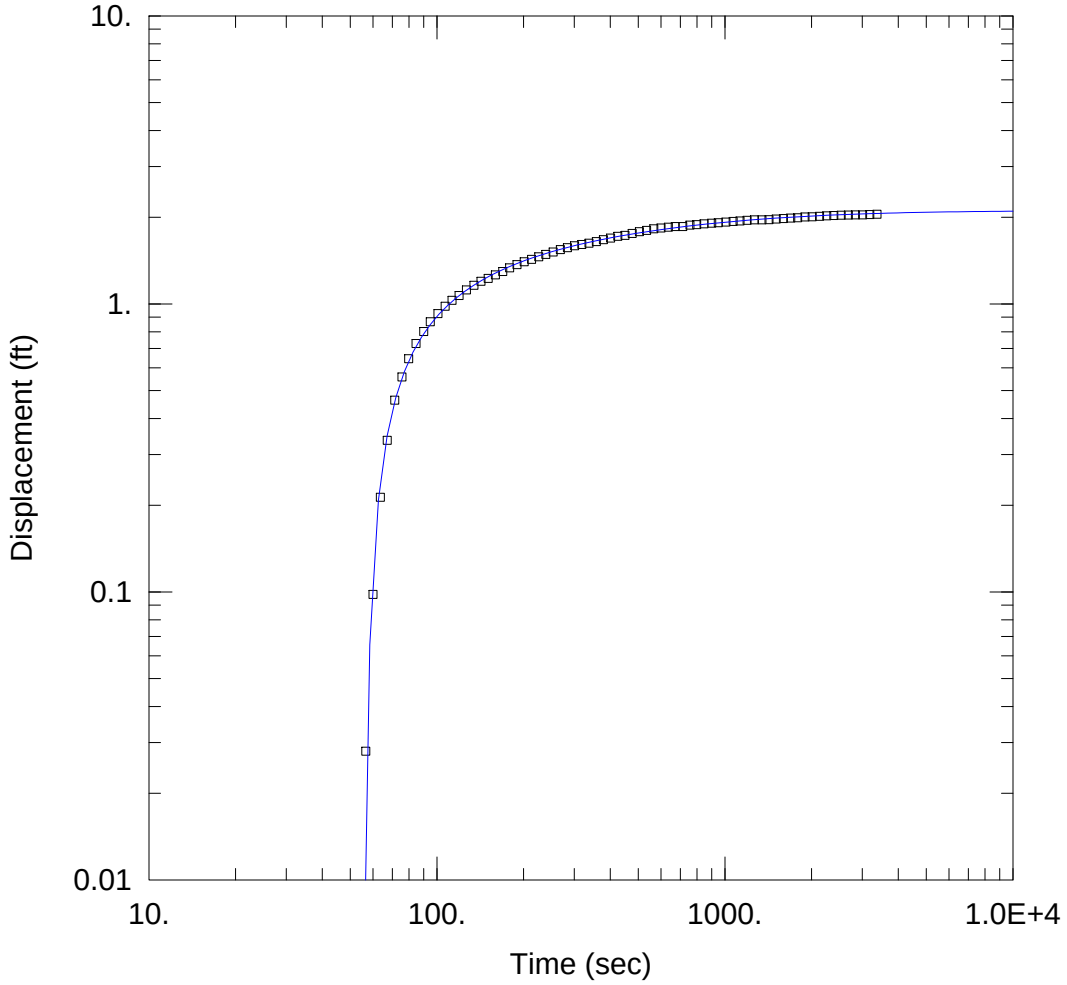
Observation Wells

Well Name	X (ft)	Y (ft)
▫ IW03	35	35

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 3030.2 ft^2/day
S = 0.0006676
Sy = 0.2967
ß = 0.0002818



WELL TEST ANALYSIS

Data Set: C:\Users\JAlbano\Documents\86\pilot study aquifer testing\Pump Test Data\mw71iw.aqt
Date: 10/31/11 Time: 14:34:56

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 150. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW02	0	0

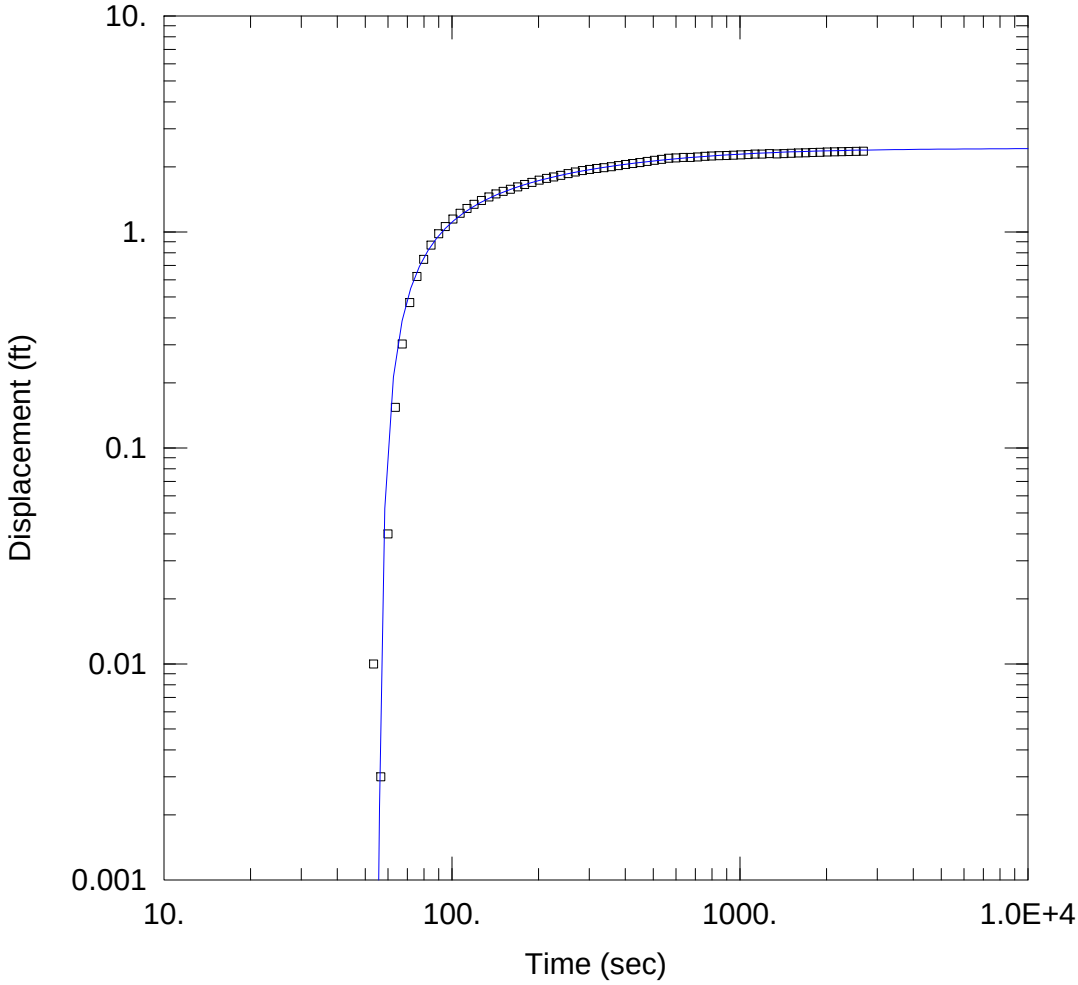
Observation Wells

Well Name	X (ft)	Y (ft)
▫ mw71iw	-20	25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 2095.3 ft^2/day
S = 0.0006288
Sy = 0.5
ß = 0.0004578



WELL TEST ANALYSIS

Data Set: C:\Users\JAlbano\Documents\86\pilot study aquifer testing\Pump Test Data\mw72iw.aqt
Date: 10/31/11 Time: 14:35:16

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 150. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW02	0	0

Observation Wells

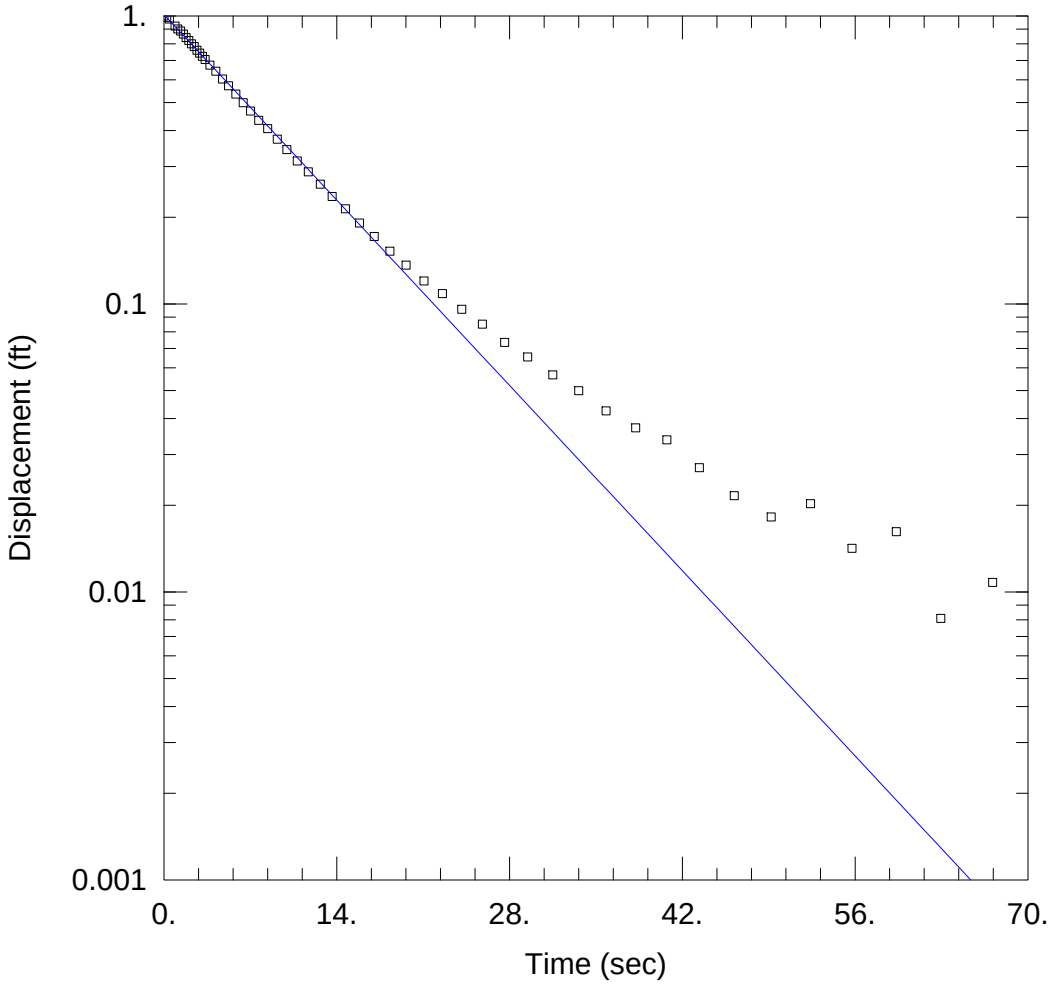
Well Name	X (ft)	Y (ft)
▫ mw72iw	25	-15

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 1320.6 ft^2/day
Sy = 0.5

S = 0.000631
ß = 0.001258



WELL TEST ANALYSIS

Data Set: \...\IW01-1.aqt
Date: 11/01/11 Time: 09:17:29

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-01
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

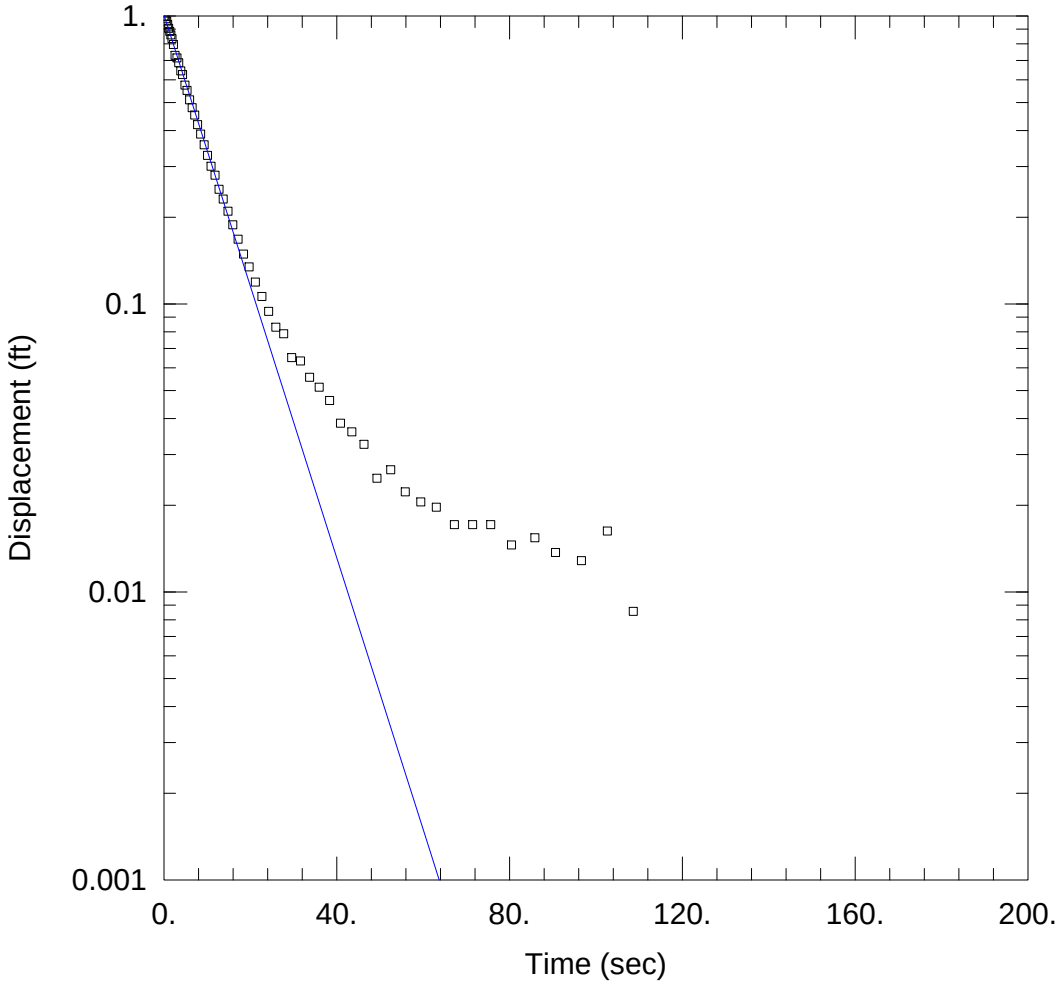
WELL DATA (IW-01)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 19.24 ft/day y0 = 1.01 ft



WELL TEST ANALYSIS

Data Set: \...\IW01-2.aqt
Date: 11/01/11 Time: 09:17:40

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-01
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

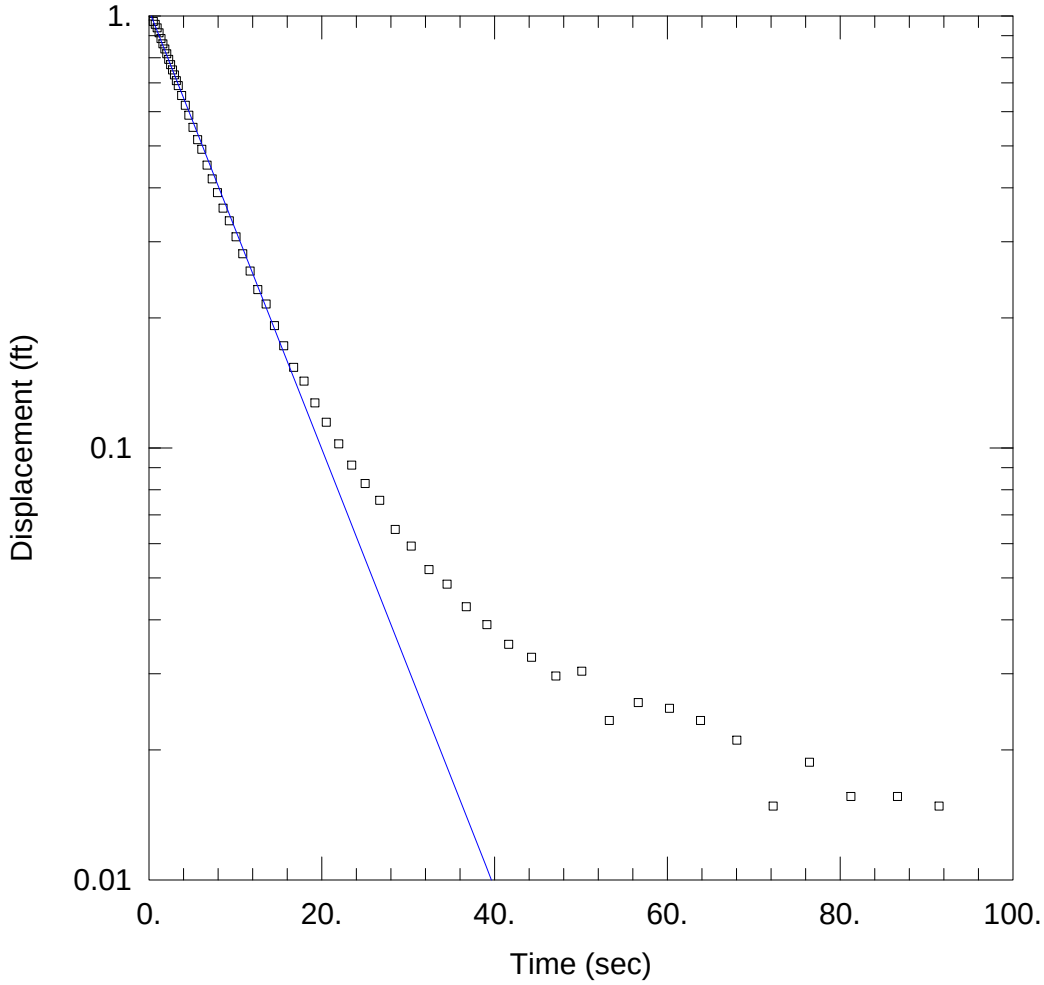
WELL DATA (IW-01)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 19.74 ft/day y0 = 1.01 ft



WELL TEST ANALYSIS

Data Set: \...\IW01-3.aqt
Date: 11/01/11 Time: 09:17:48

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-01
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

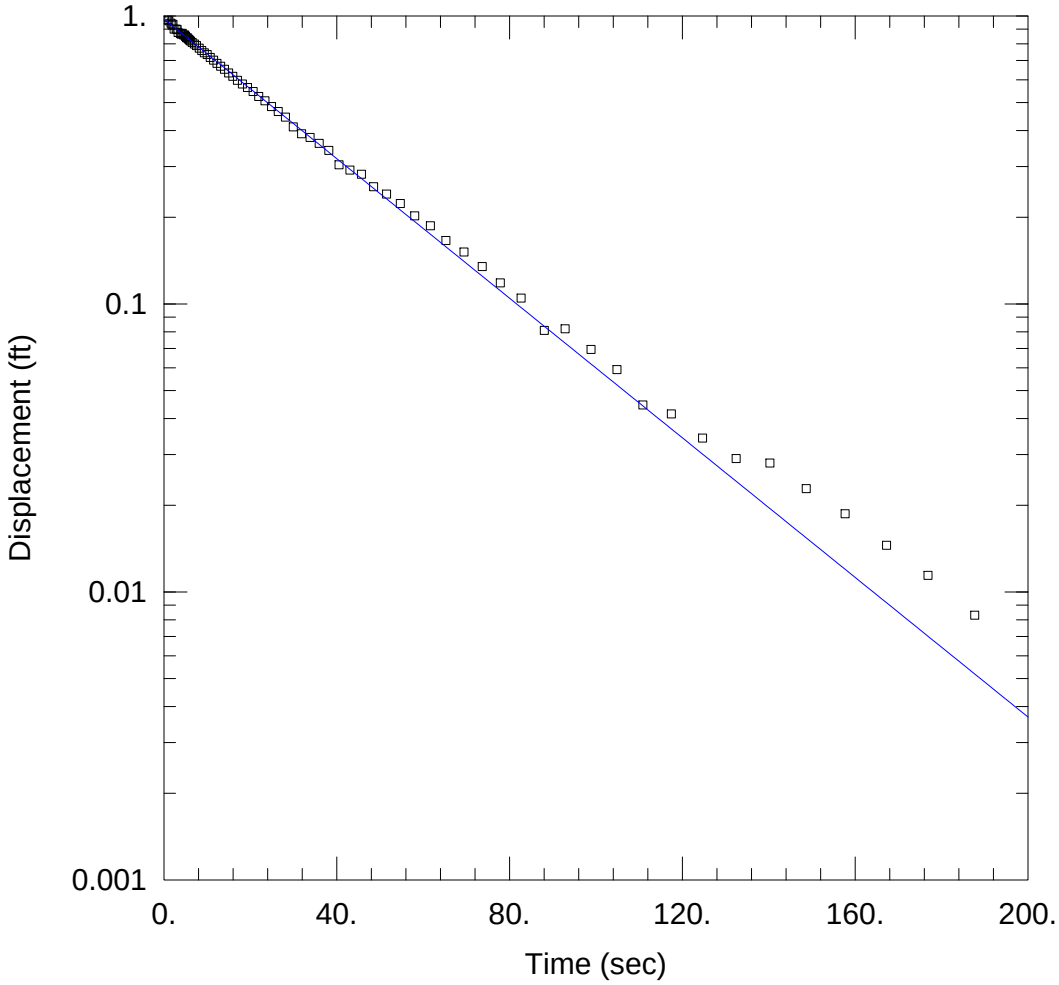
WELL DATA (IW-01)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 21.26 ft/day y0 = 1.031 ft



WELL TEST ANALYSIS

Data Set: \...\IW02-1.aqt
Date: 11/01/11 Time: 09:17:53

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-02
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

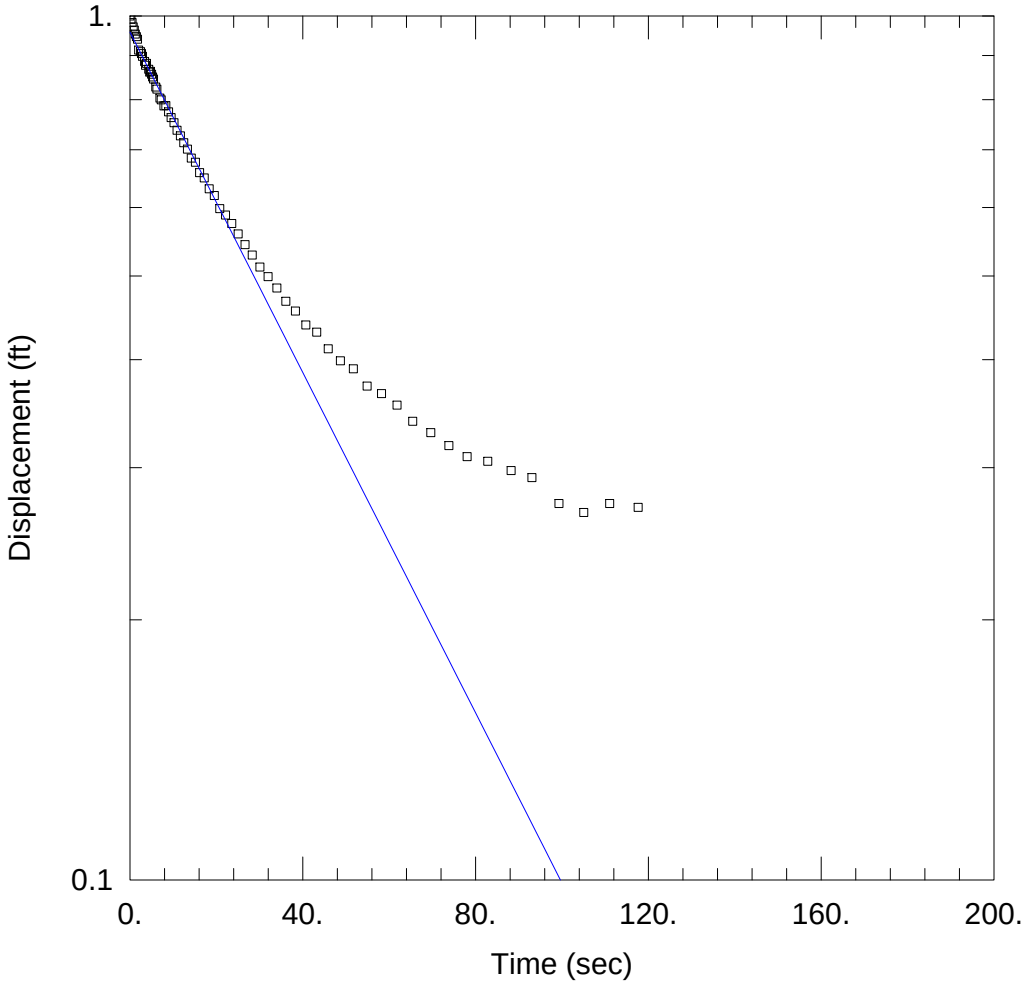
WELL DATA (IW-02)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 5.073 ft/day y0 = 0.9753 ft



WELL TEST ANALYSIS

Data Set: \...\IW02-2.aqt
Date: 11/01/11 Time: 09:18:00

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-02
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

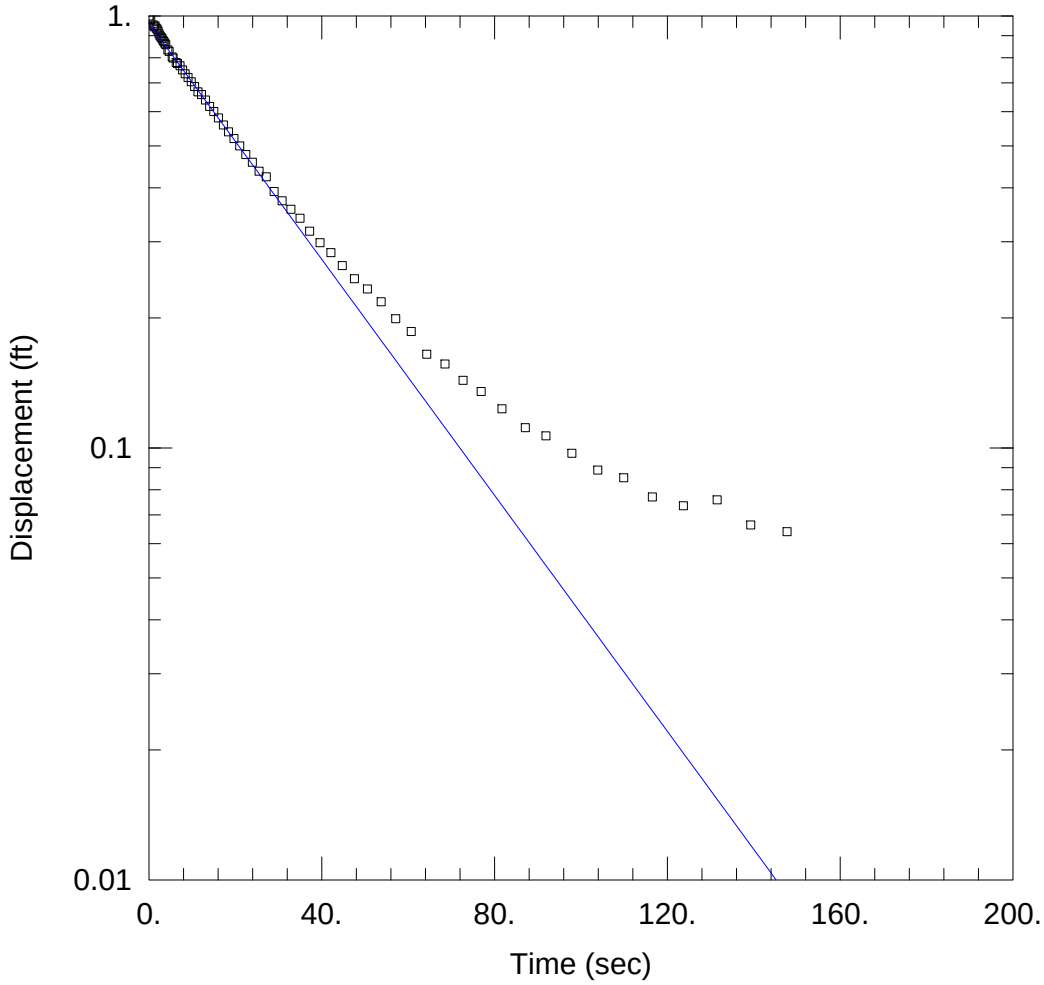
WELL DATA (IW-02)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 4.123 ft/day y0 = 0.9576 ft



WELL TEST ANALYSIS

Data Set: \...\IW02-3.aqt
Date: 11/01/11 Time: 09:18:05

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-02
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

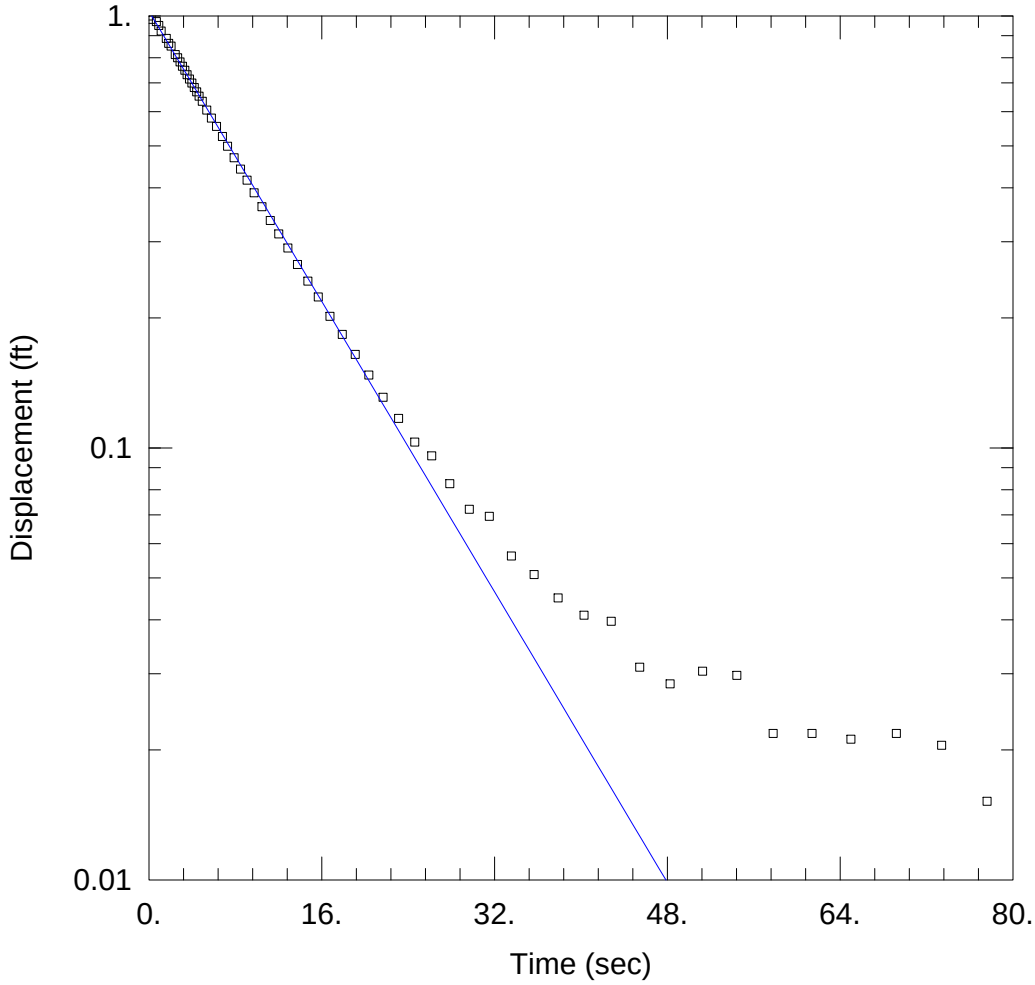
WELL DATA (IW-02)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 5.717 ft/day y0 = 0.9607 ft



WELL TEST ANALYSIS

Data Set: \...\IW04-1.aqt
Date: 11/01/11 Time: 09:18:10

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-04
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

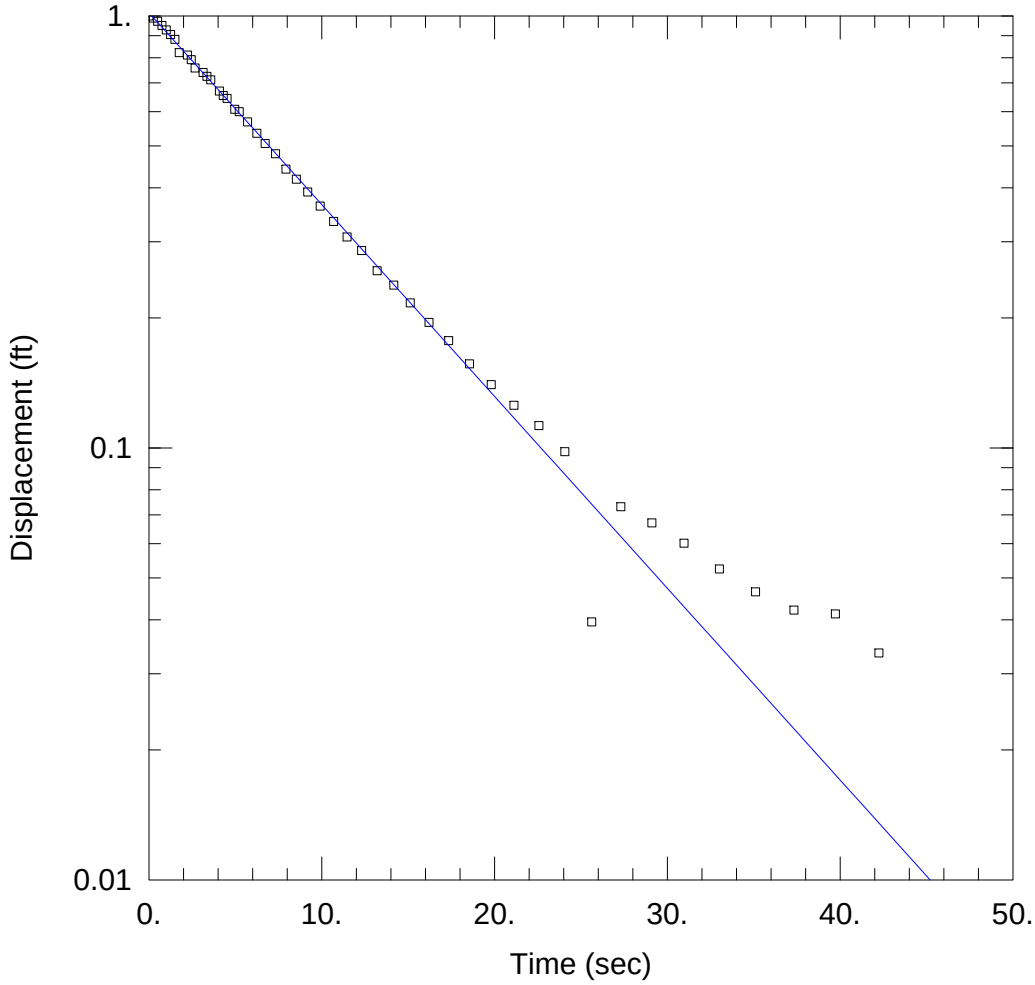
WELL DATA (IW-04)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 17.59 ft/day y0 = 1.026 ft



WELL TEST ANALYSIS

Data Set: \...\IW04-2.aqt
Date: 11/01/11 Time: 09:18:16

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-04
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

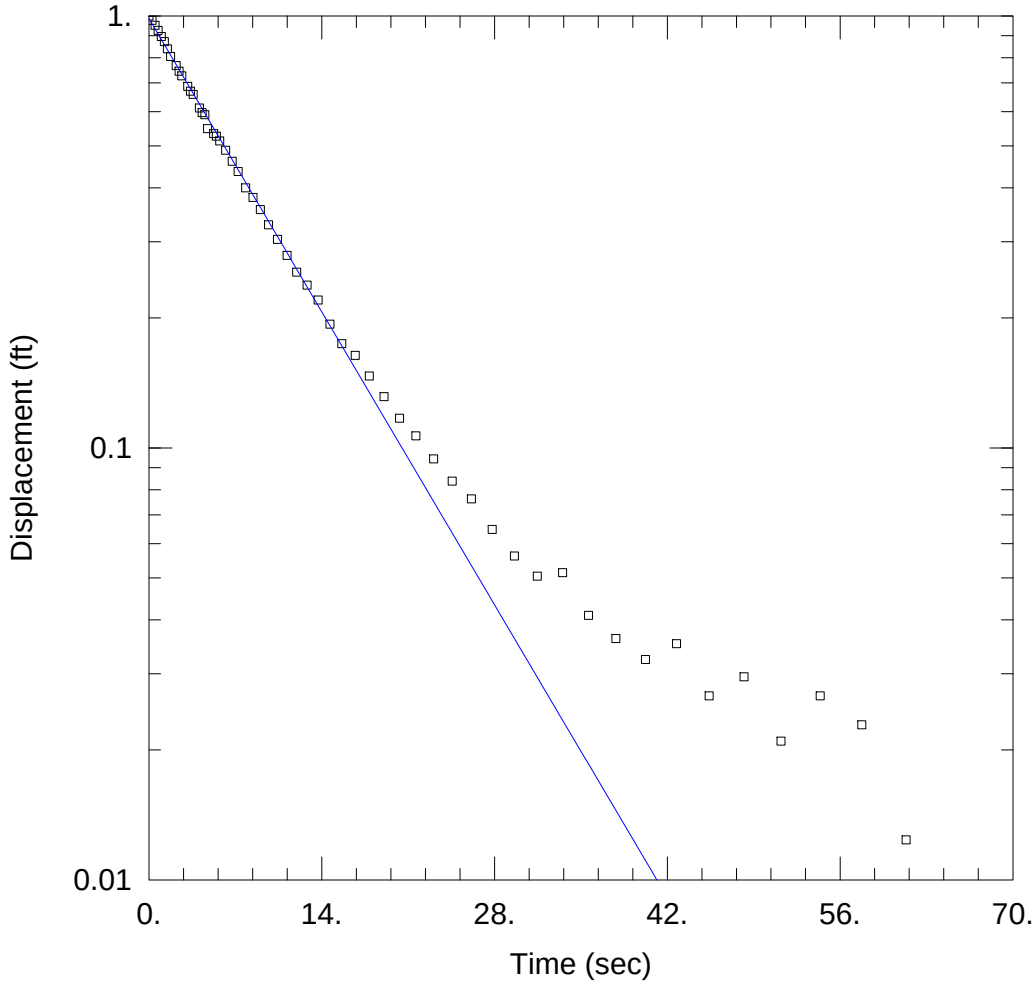
WELL DATA (IW-04)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 18.59 ft/day y0 = 1.017 ft



WELL TEST ANALYSIS

Data Set: \...\IW04-3.aqt
Date: 11/01/11 Time: 09:18:21

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-04
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

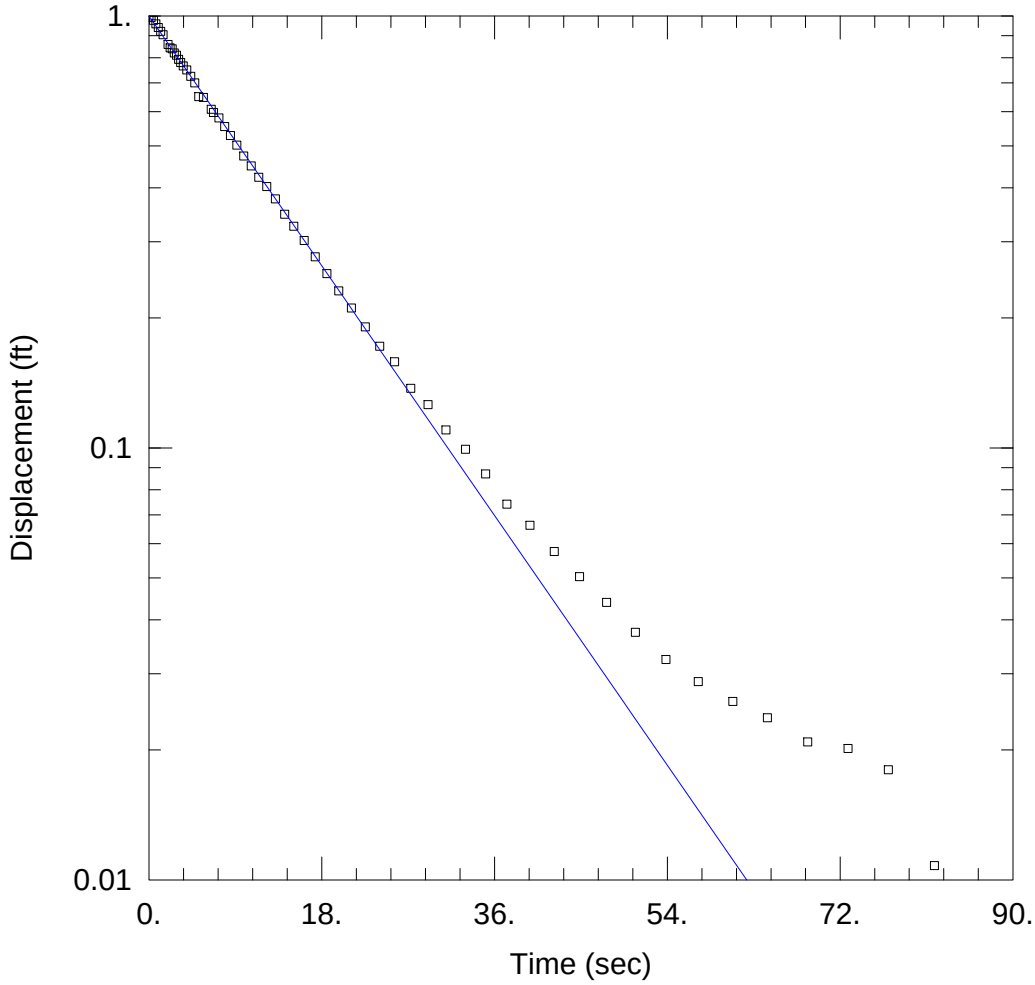
WELL DATA (IW-04)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 20.28 ft/day y0 = 0.9861 ft



WELL TEST ANALYSIS

Data Set: \...\IW05-1.aqt
Date: 11/01/11 Time: 09:18:25

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-05
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

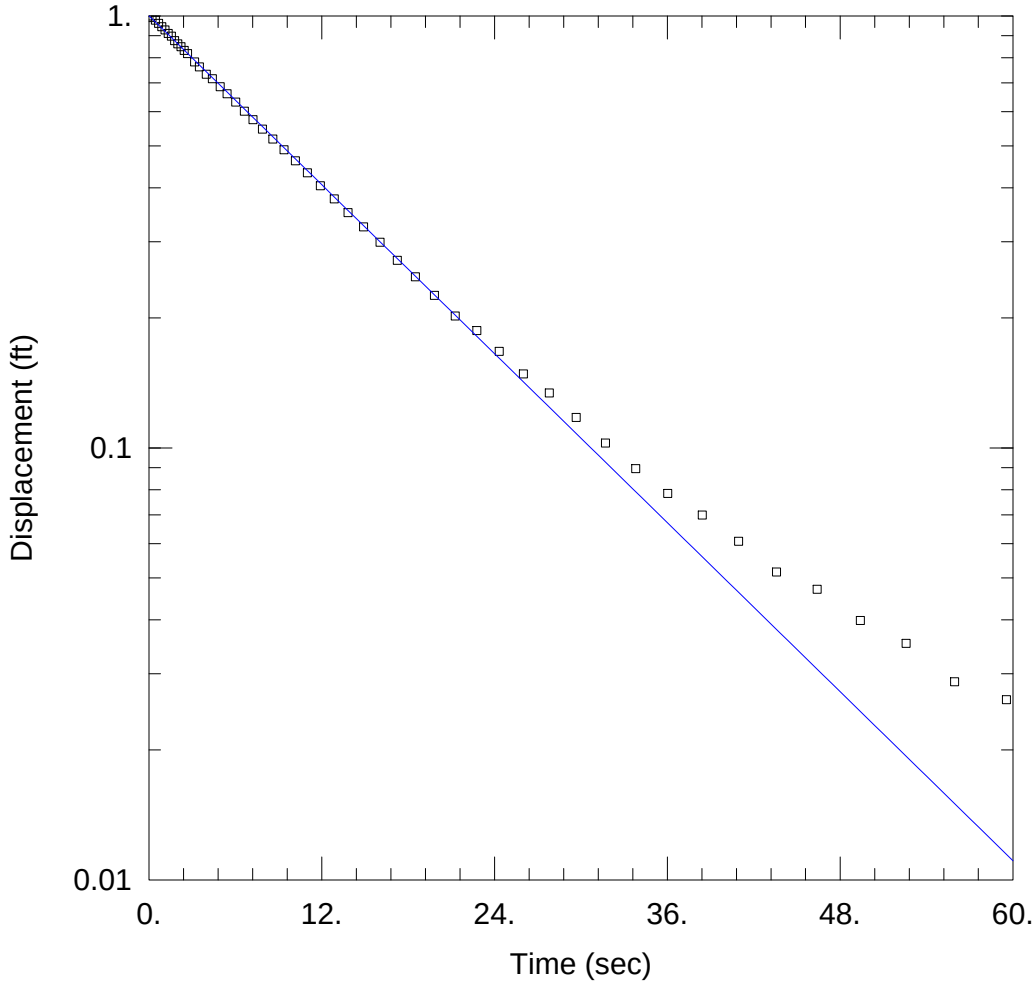
WELL DATA (IW-05)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 13.44 ft/day y0 = 0.9993 ft



WELL TEST ANALYSIS

Data Set: \...\IW05-2.aqt
Date: 11/01/11 Time: 09:18:30

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-05
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

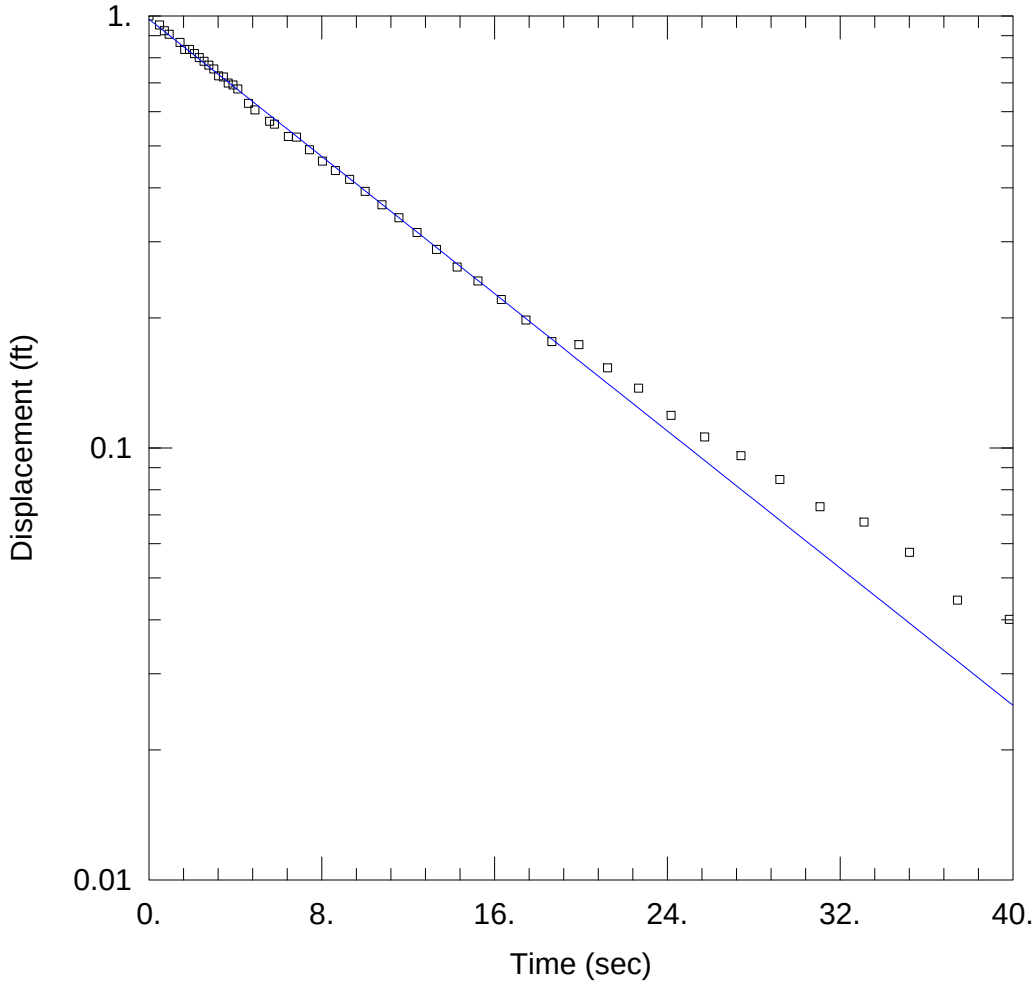
WELL DATA (IW-05)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 13.65 ft/day y0 = 1.001 ft



WELL TEST ANALYSIS

Data Set: \...\IW05-3.aqt
Date: 11/01/11 Time: 09:18:35

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-05
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

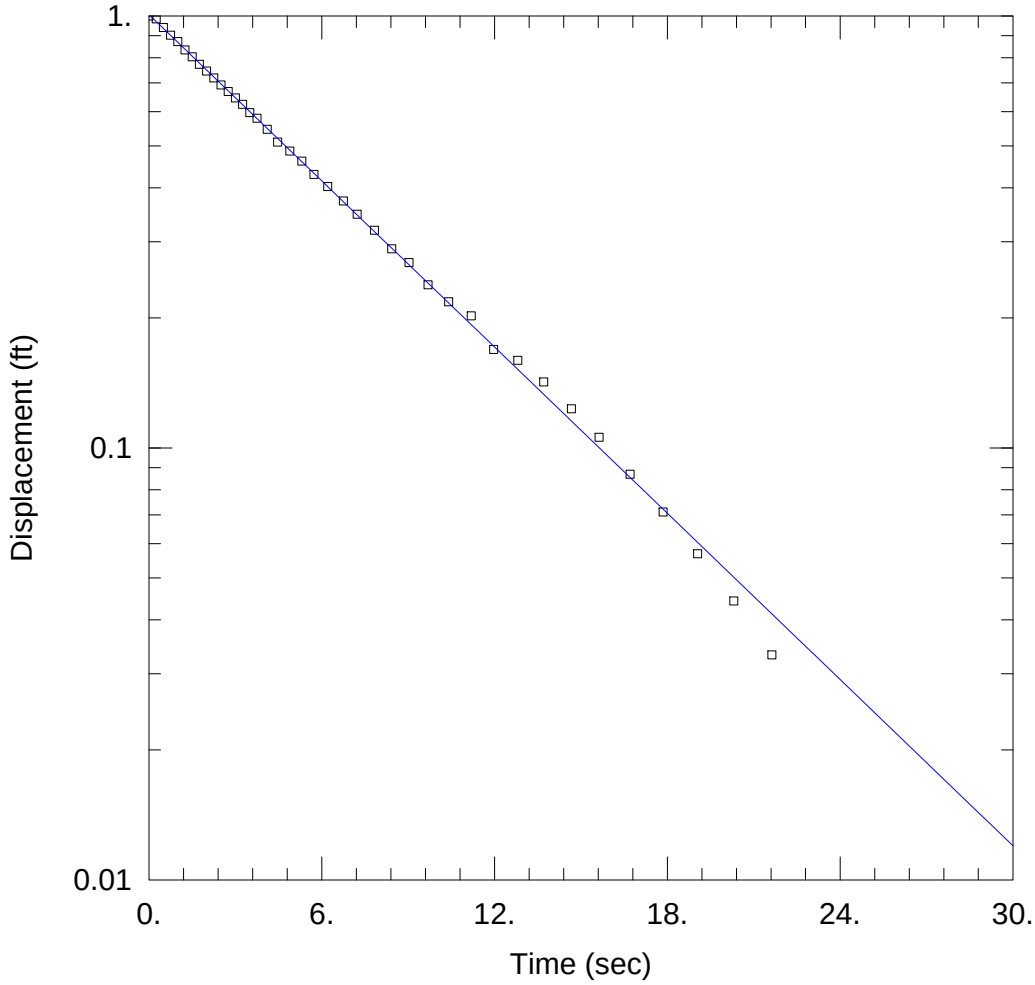
WELL DATA (IW-05)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 16.62 ft/day y0 = 0.9823 ft



WELL TEST ANALYSIS

Data Set: \...\IW06-1.aqt
Date: 11/01/11 Time: 09:18:39

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-06
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

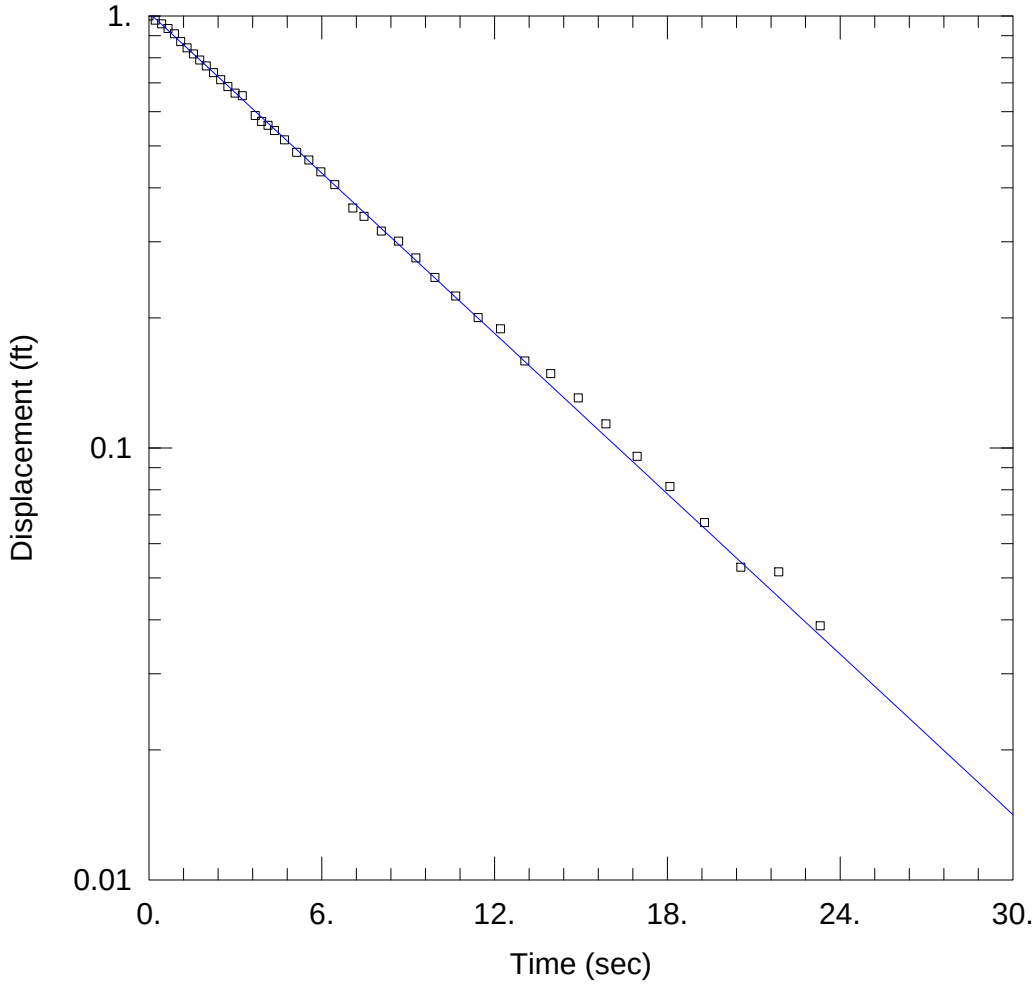
WELL DATA (IW-06)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 26.85 ft/day y0 = 1.007 ft



WELL TEST ANALYSIS

Data Set: \...\IW06-2.aqt
Date: 11/01/11 Time: 09:28:25

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-06
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

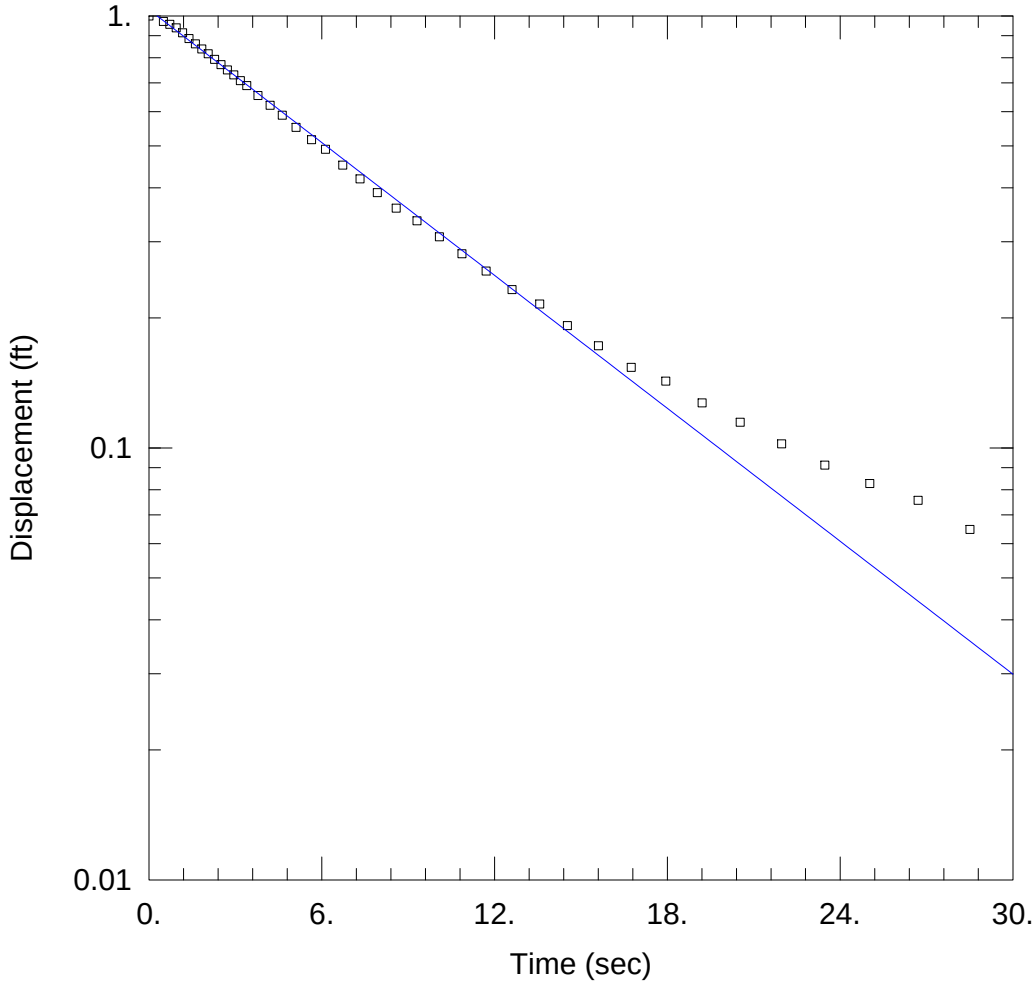
WELL DATA (IW-06)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 25.91 ft/day y0 = 1.017 ft



WELL TEST ANALYSIS

Data Set: \...\IW06-3.aqt
Date: 11/01/11 Time: 09:29:18

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: IW-06
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

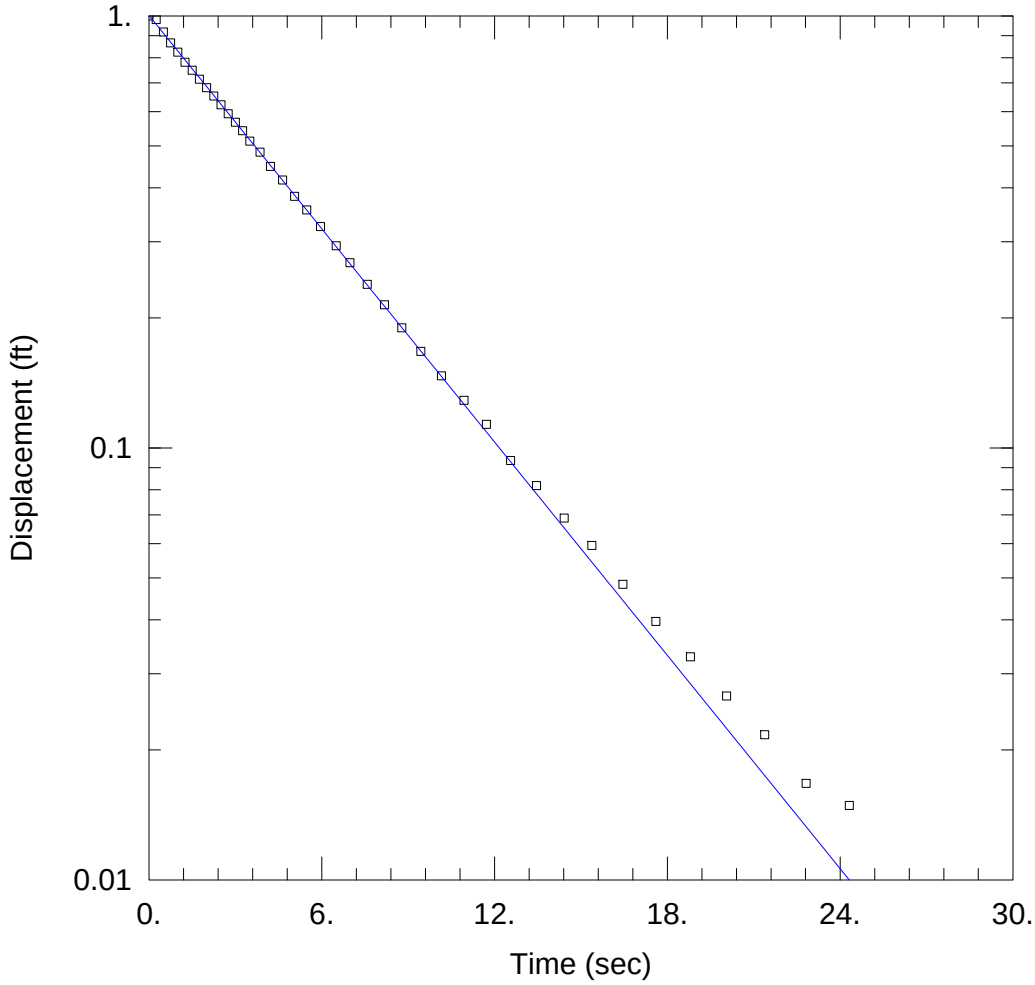
WELL DATA (IW-06)

Initial Displacement: 1. ft Static Water Column Height: 45. ft
Total Well Penetration Depth: 45. ft Screen Length: 20. ft
Casing Radius: 0.167 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 21.47 ft/day y0 = 1.034 ft



WELL TEST ANALYSIS

Data Set: \...\MW70IW-1.aqt
Date: 11/01/11 Time: 09:20:10

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW70IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

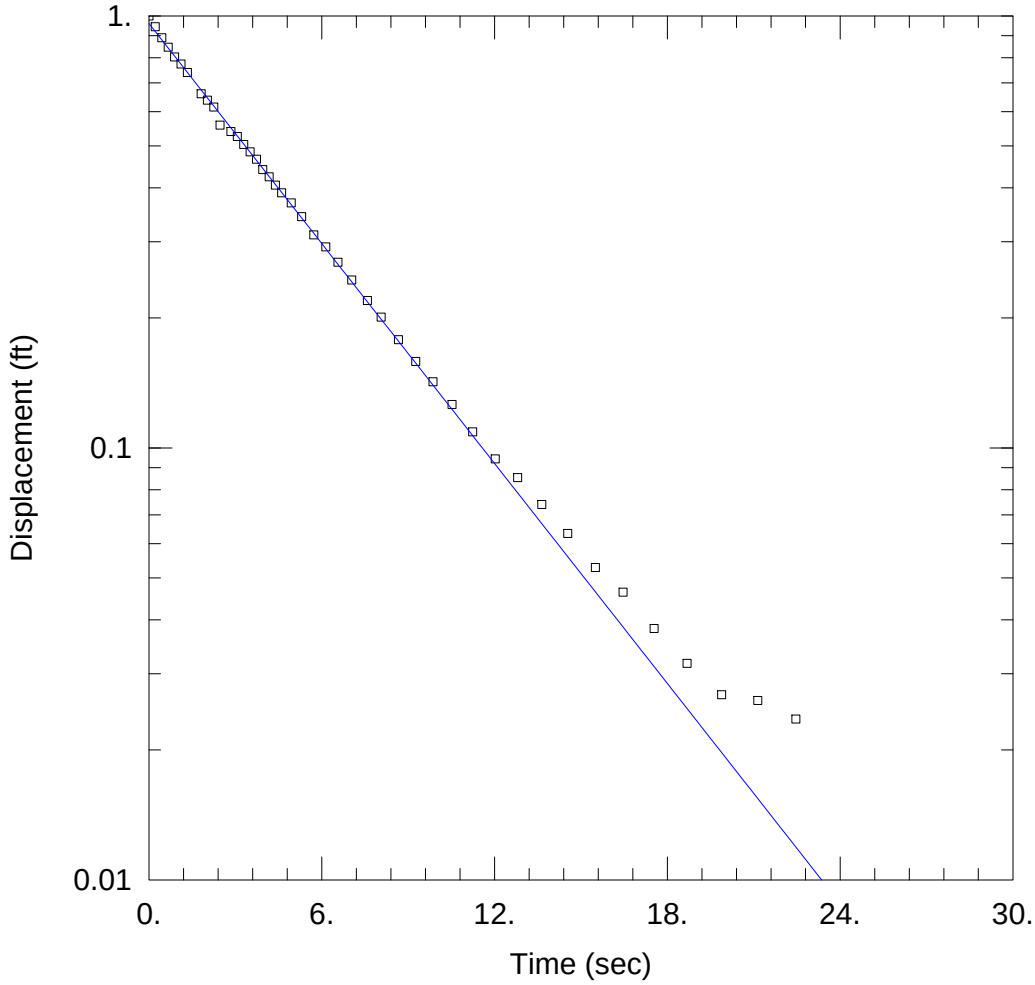
WELL DATA (MW70IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 18.13 ft/day y0 = 1.003 ft



WELL TEST ANALYSIS

Data Set: \...\MW70IW-2.aqt
Date: 11/01/11 Time: 09:20:15

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW70IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

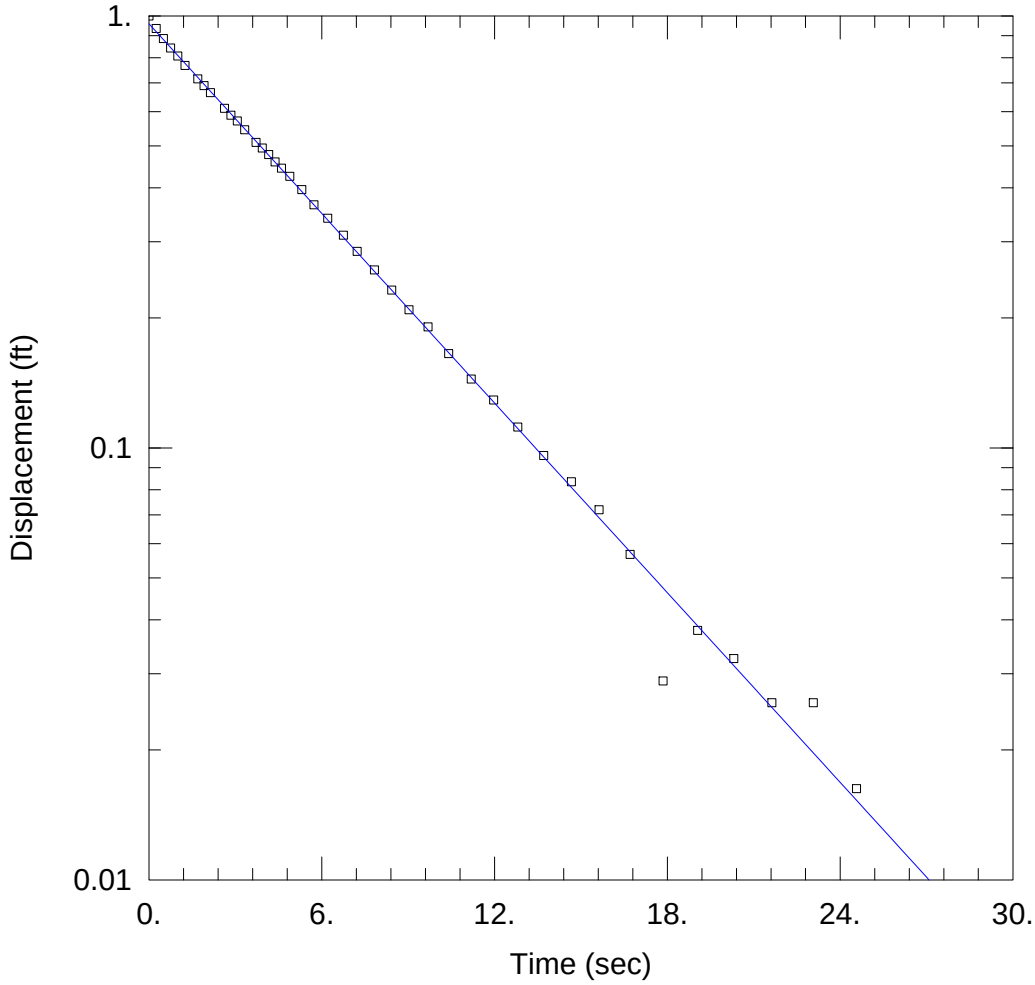
WELL DATA (MW70IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 18.69 ft/day y0 = 0.9602 ft



WELL TEST ANALYSIS

Data Set: \...\MW70IW-3.aqt
Date: 11/01/11 Time: 09:20:20

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW70IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

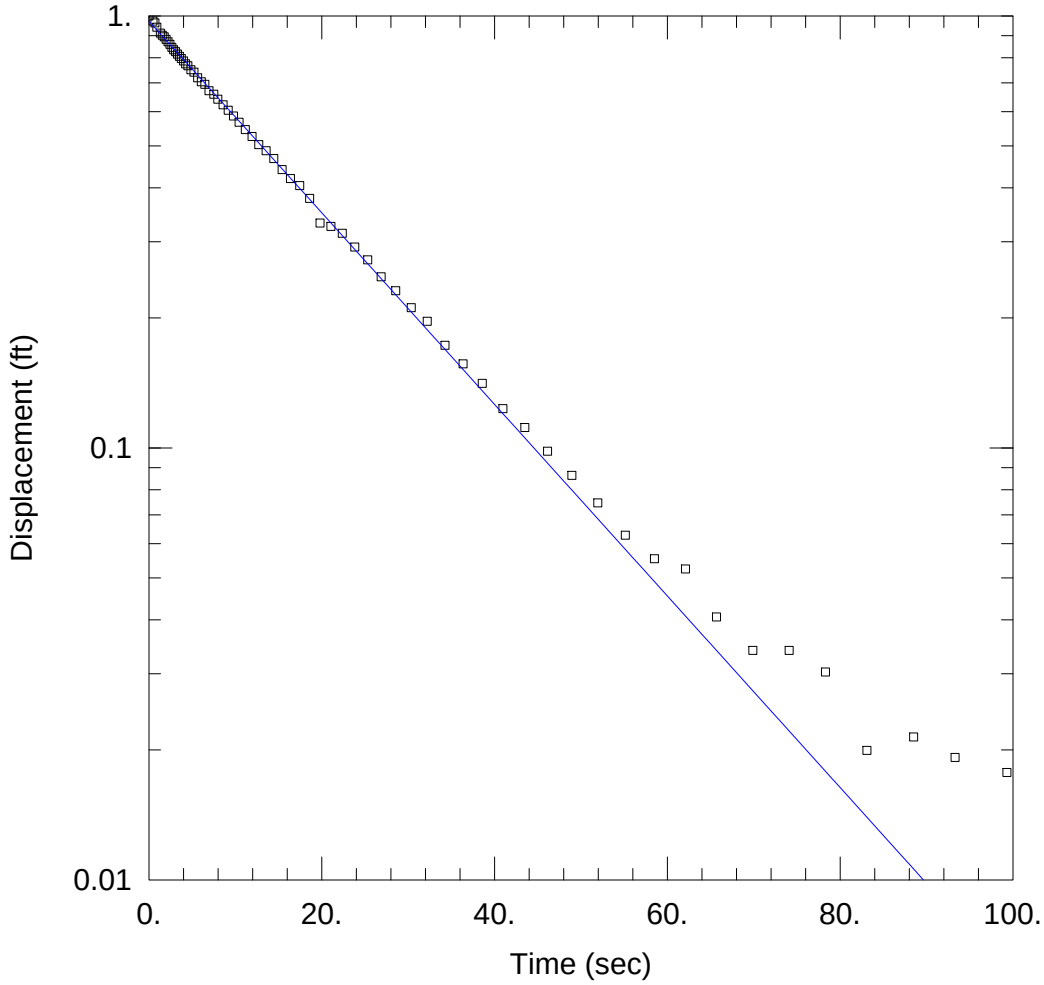
WELL DATA (MW70IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 16.12 ft/day y0 = 0.9587 ft



WELL TEST ANALYSIS

Data Set: \...\MW71IW-1.aqt
Date: 11/01/11 Time: 09:20:32

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW71IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

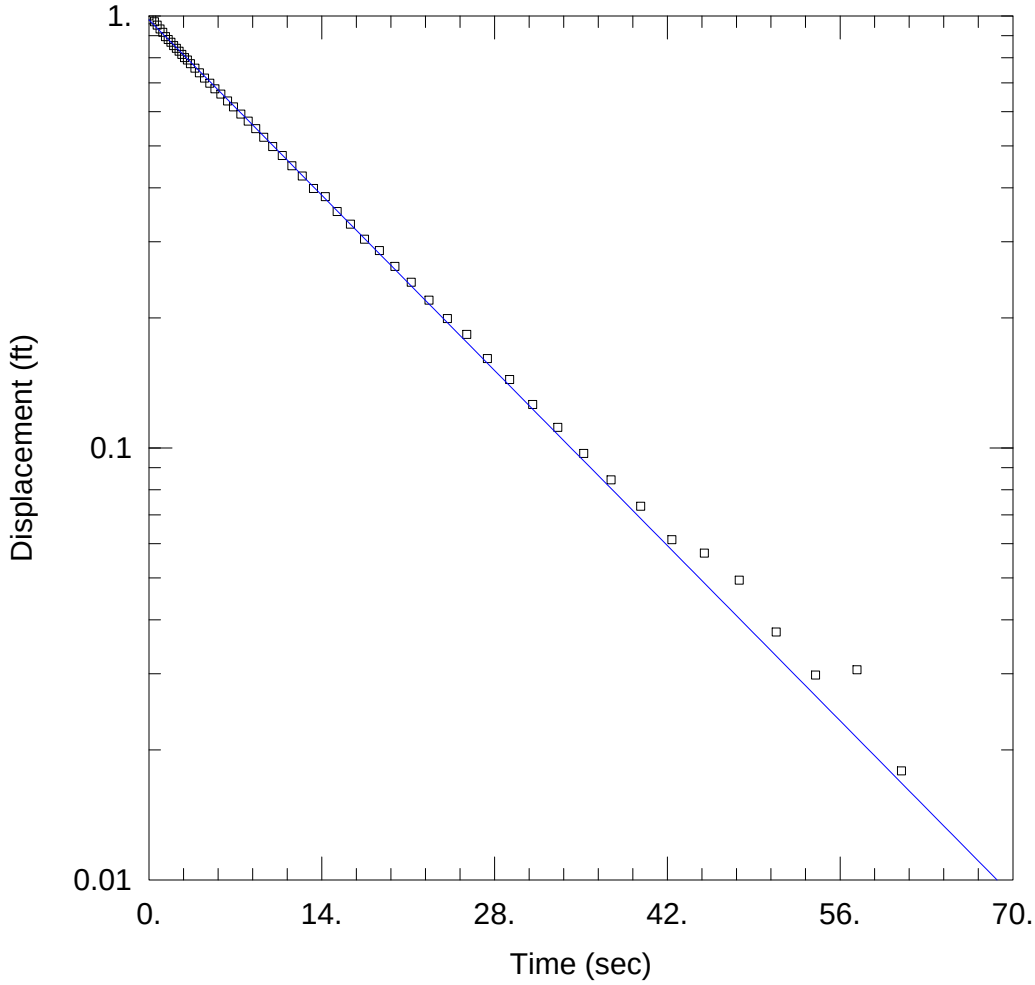
WELL DATA (MW71IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 4.884 ft/day y0 = 0.972 ft



WELL TEST ANALYSIS

Data Set: \...\MW71IW-2.aqt
Date: 11/01/11 Time: 09:34:10

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW71IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

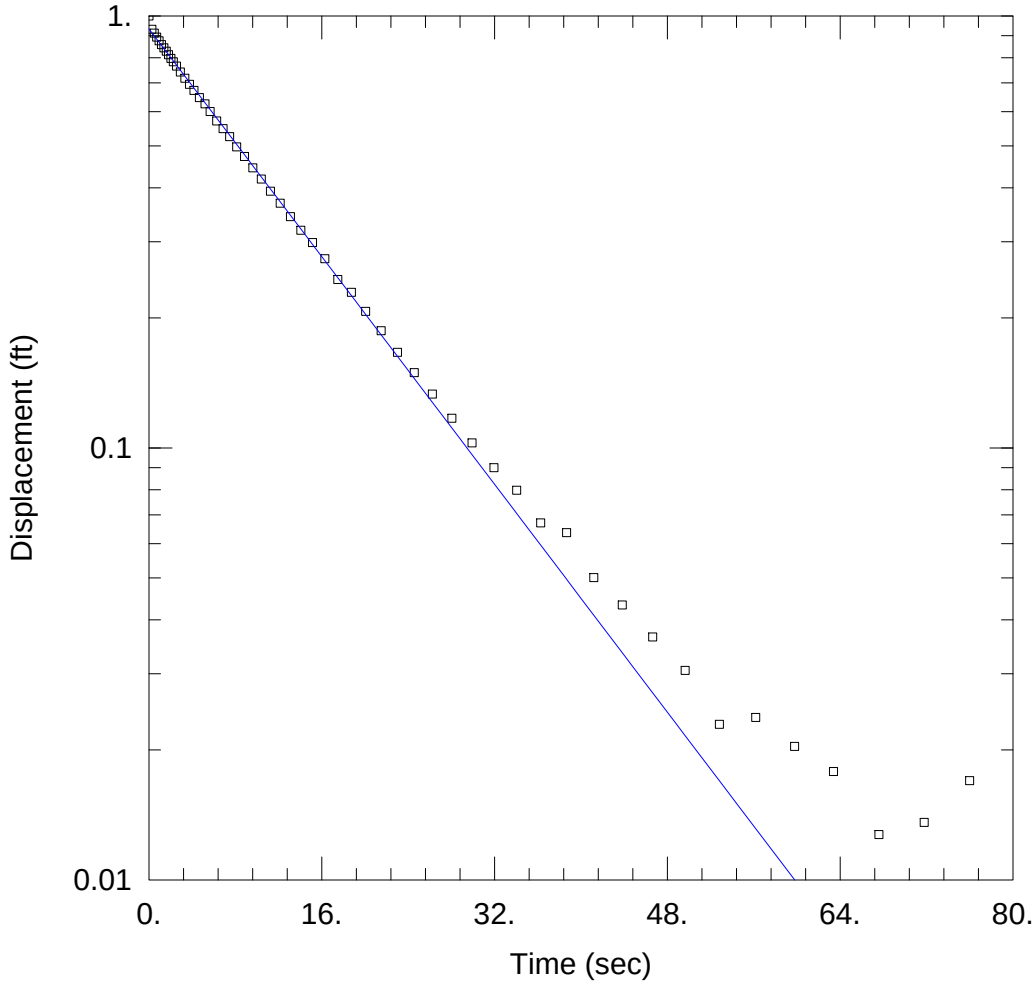
WELL DATA (MW71IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 6.383 ft/day y0 = 0.9793 ft



WELL TEST ANALYSIS

Data Set: \...\MW71IW-3.aqt
Date: 11/01/11 Time: 09:20:45

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW71IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

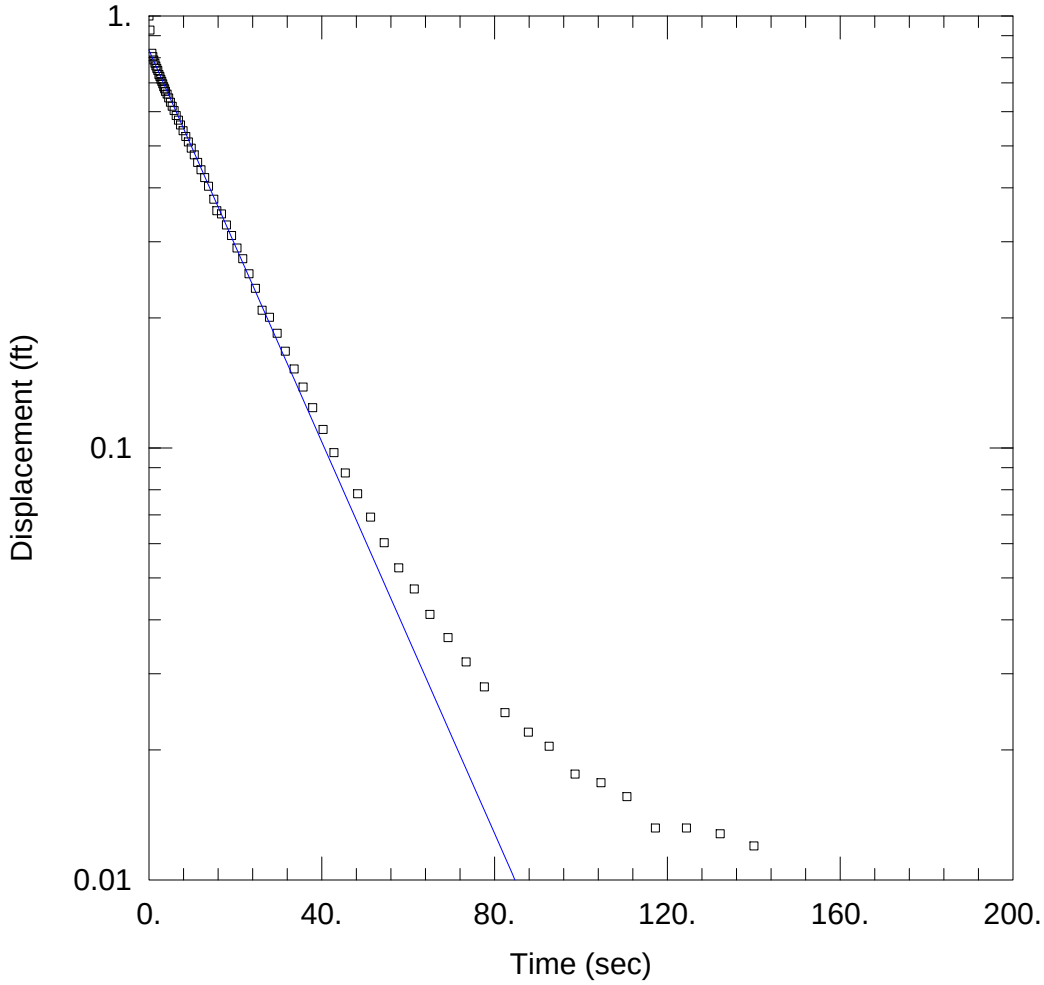
WELL DATA (MW71IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 7.257 ft/day y0 = 0.9332 ft



WELL TEST ANALYSIS

Data Set: \...\MW72IW-1.aqt
Date: 11/01/11 Time: 09:20:50

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW72IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

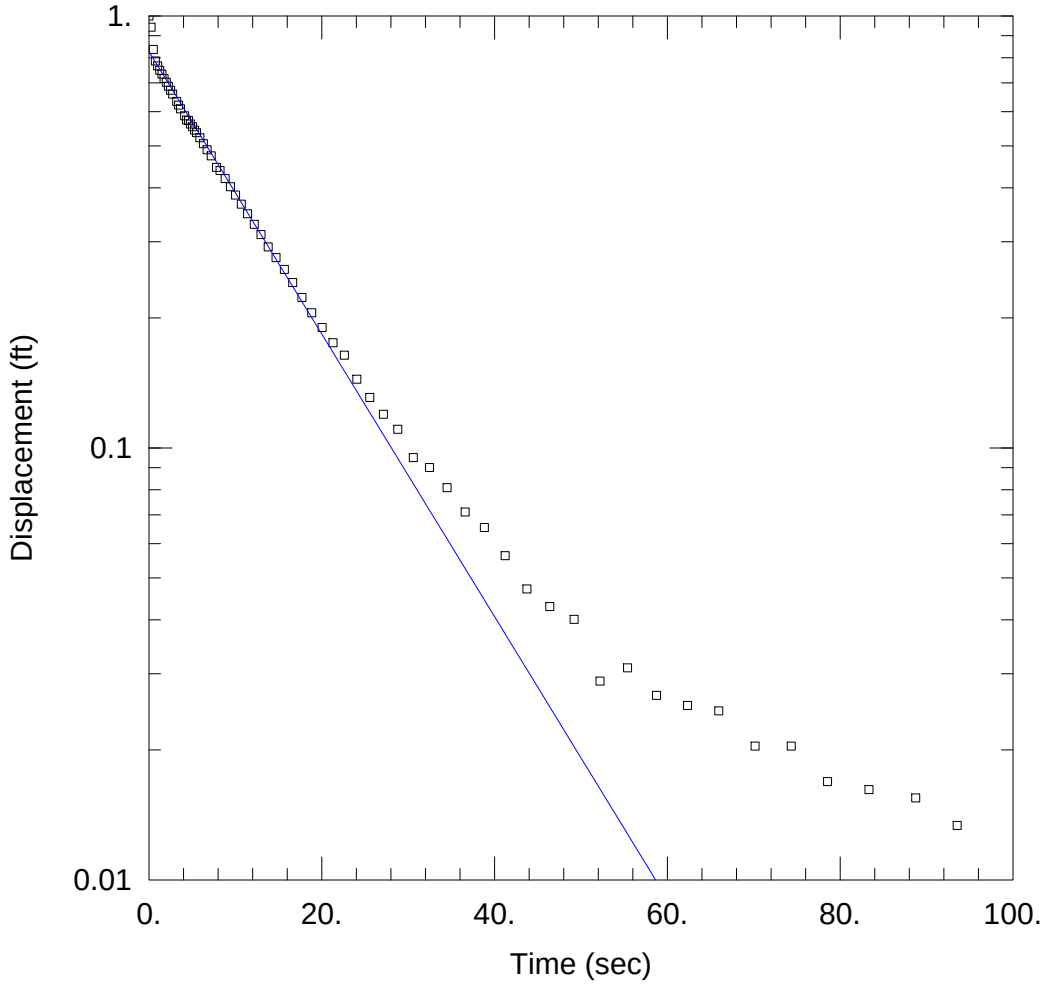
WELL DATA (MW72IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 4.992 ft/day y0 = 0.833 ft



WELL TEST ANALYSIS

Data Set: \...\MW72IW-3.aqt
Date: 11/01/11 Time: 09:20:54

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW72IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

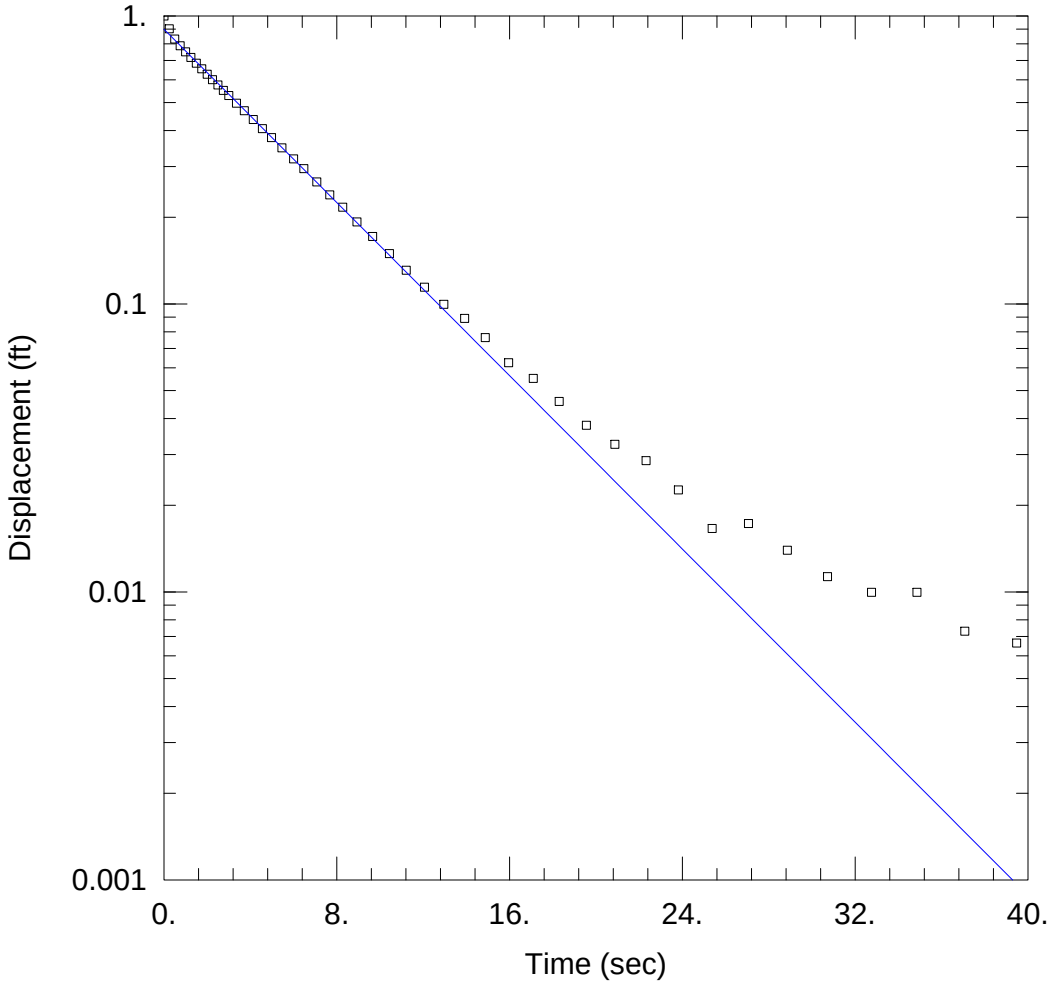
WELL DATA (MW72IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 7.203 ft/day y0 = 0.8268 ft



WELL TEST ANALYSIS

Data Set: \...\MW73IW-1.aqt
Date: 11/01/11 Time: 09:20:59

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW73IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

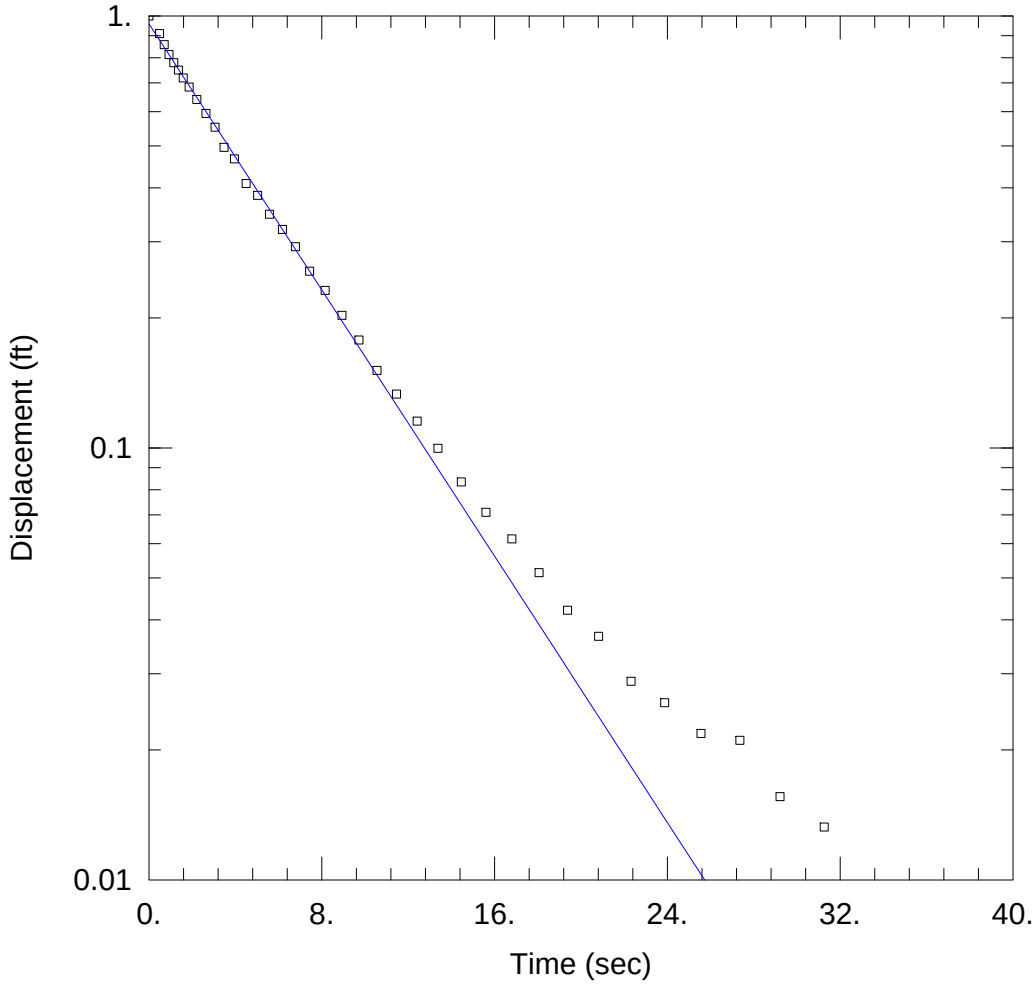
WELL DATA (MW73IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 16.56 ft/day y0 = 0.8985 ft



WELL TEST ANALYSIS

Data Set: \...\MW73IW-2.aqt
Date: 11/01/11 Time: 09:21:04

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW73IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

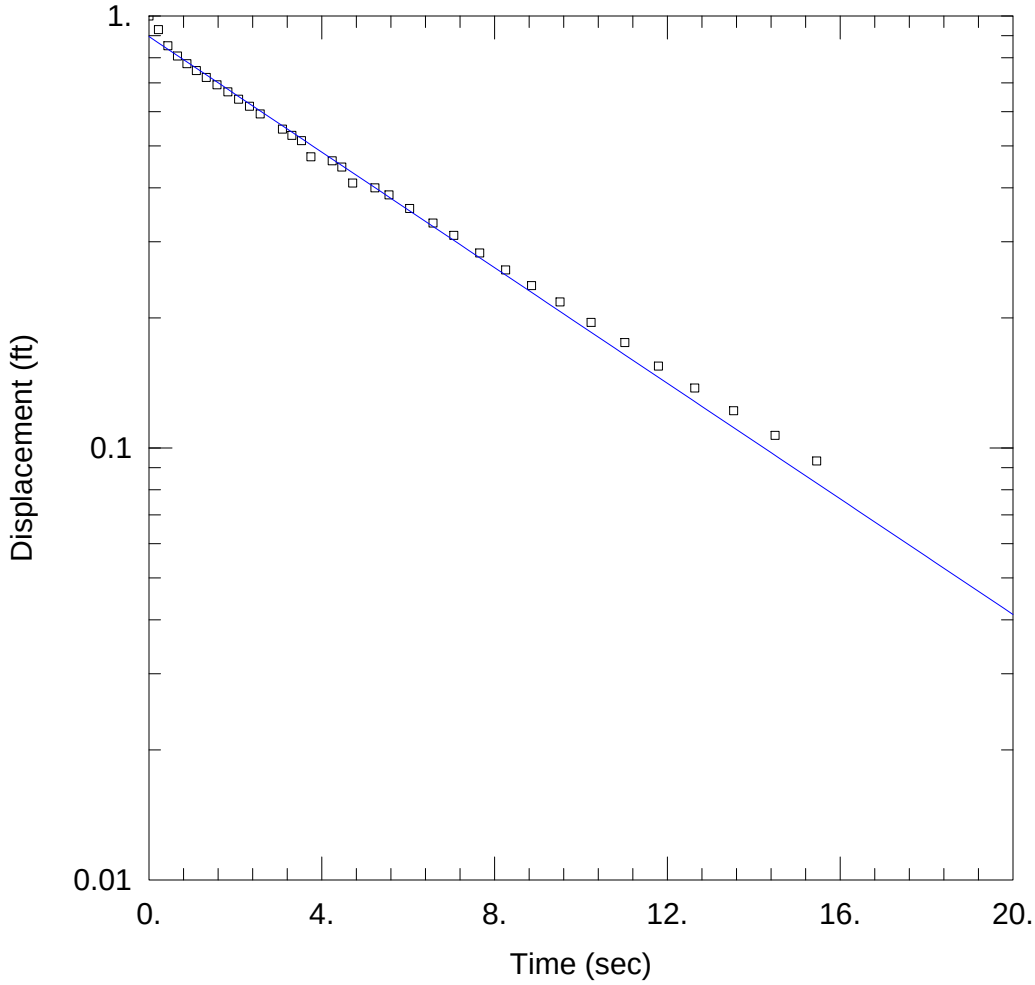
WELL DATA (MW73IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 16.96 ft/day y0 = 0.9588 ft



WELL TEST ANALYSIS

Data Set: \...\MW73IW-3.aqt
Date: 11/01/11 Time: 09:21:09

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW73IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

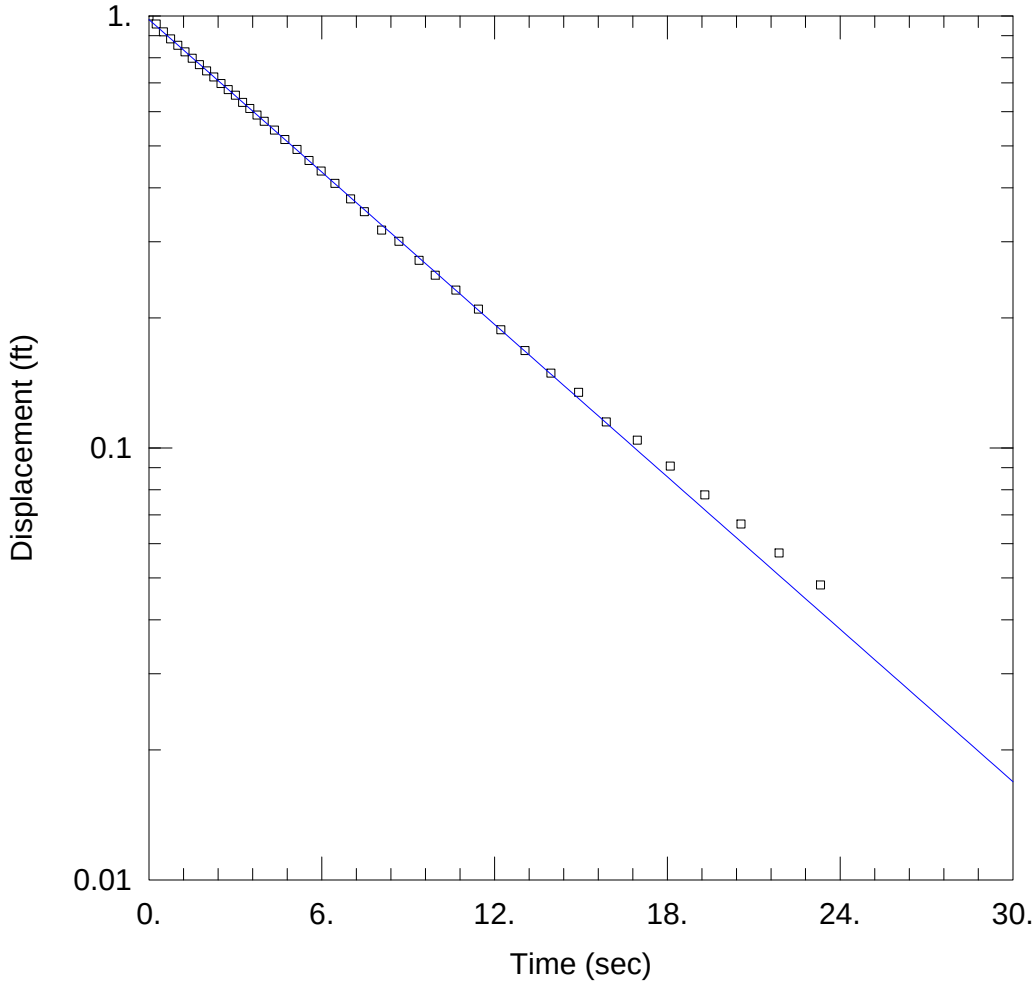
WELL DATA (MW73IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 14.73 ft/day y0 = 0.8958 ft



WELL TEST ANALYSIS

Data Set: \...\MW74IW-1.aqt
Date: 11/01/11 Time: 09:23:01

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW74IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

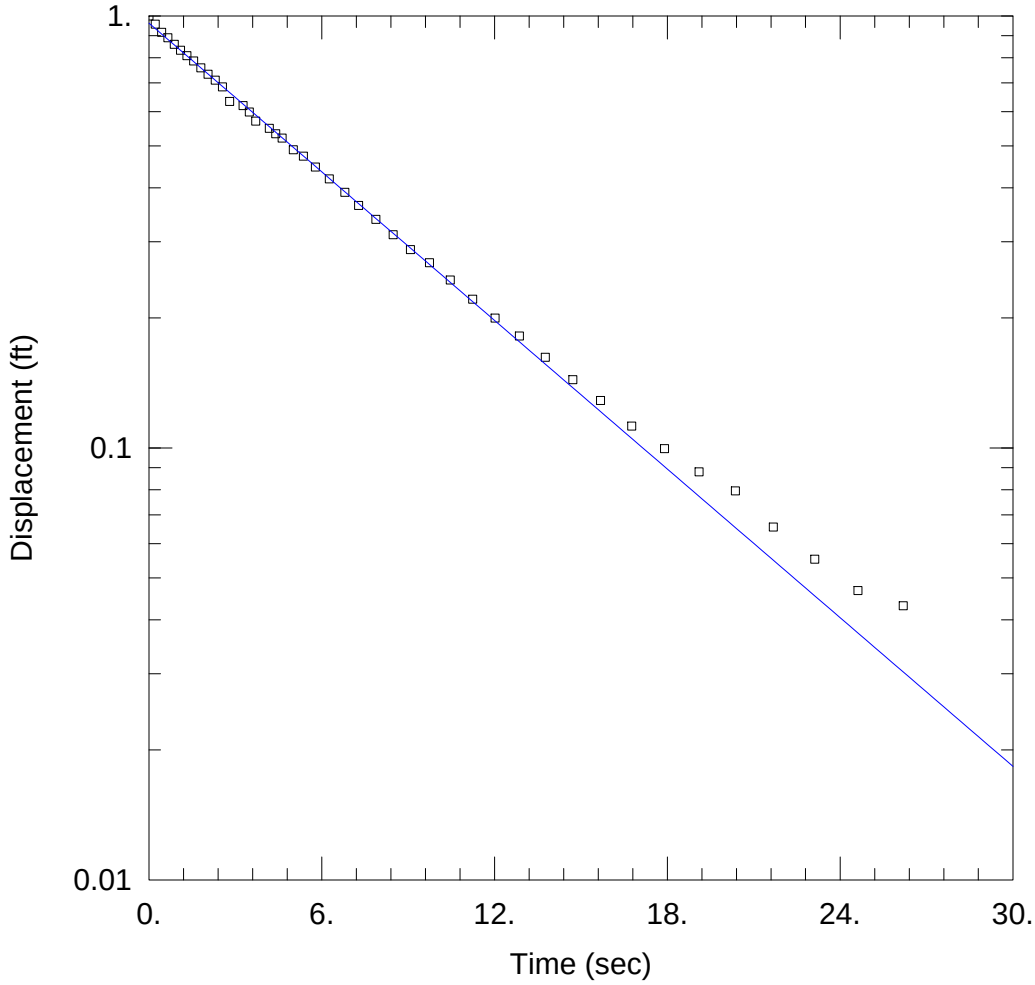
WELL DATA (MW74IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 12.95 ft/day y0 = 0.9805 ft



WELL TEST ANALYSIS

Data Set: \...\MW74IW-2.aqt
Date: 11/01/11 Time: 09:23:06

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW74IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

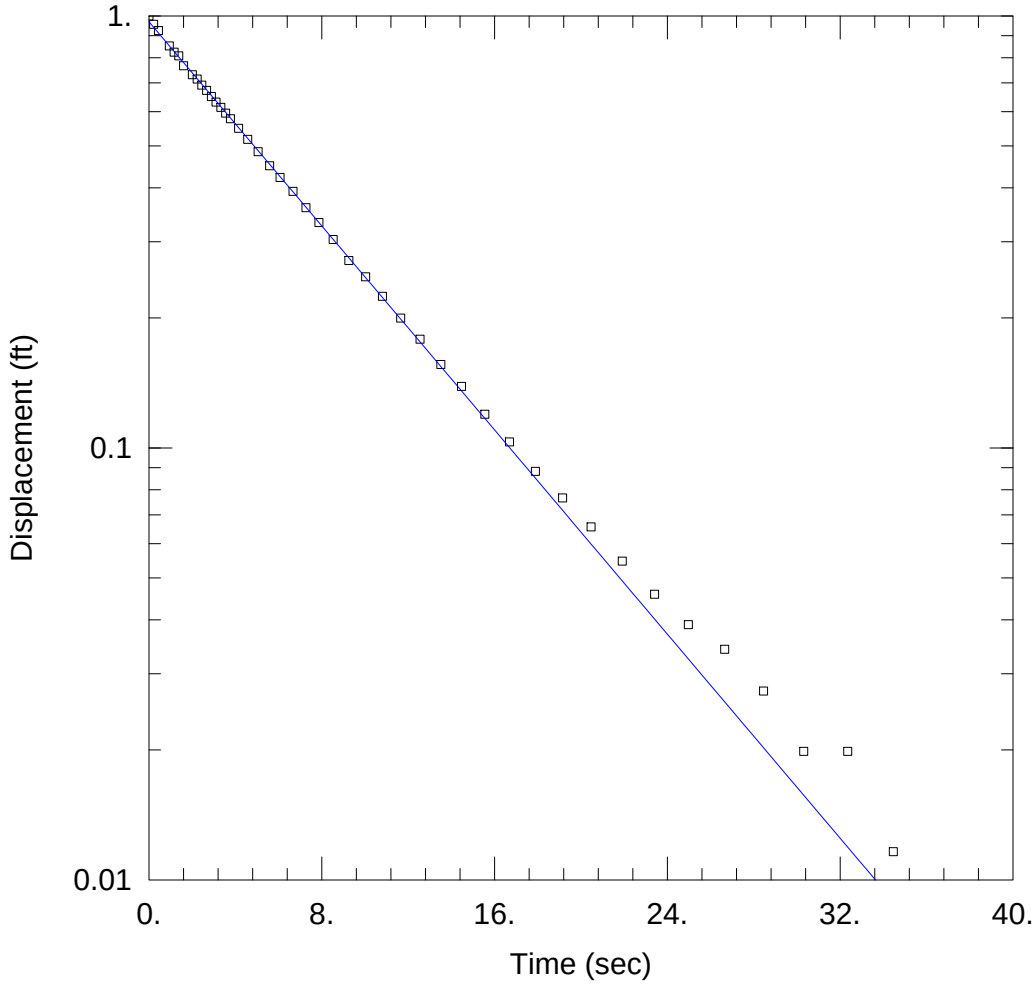
WELL DATA (MW74IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 12.63 ft/day y0 = 0.962 ft



WELL TEST ANALYSIS

Data Set: \...\MW74IW-3.aqt
Date: 11/01/11 Time: 09:23:10

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW74IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

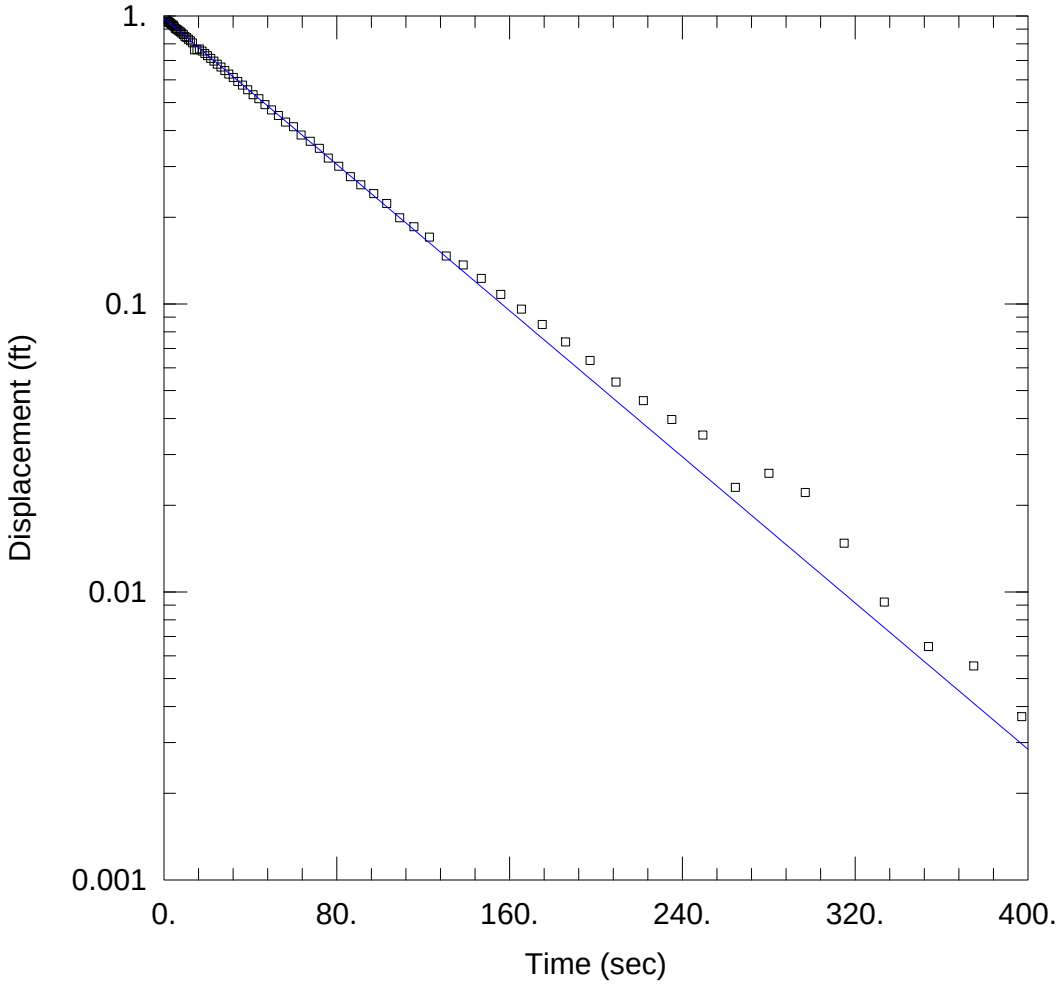
WELL DATA (MW74IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 13.01 ft/day y0 = 0.9691 ft



WELL TEST ANALYSIS

Data Set: \...\MW75IW-1.aqt
Date: 11/01/11 Time: 09:23:14

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW75IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

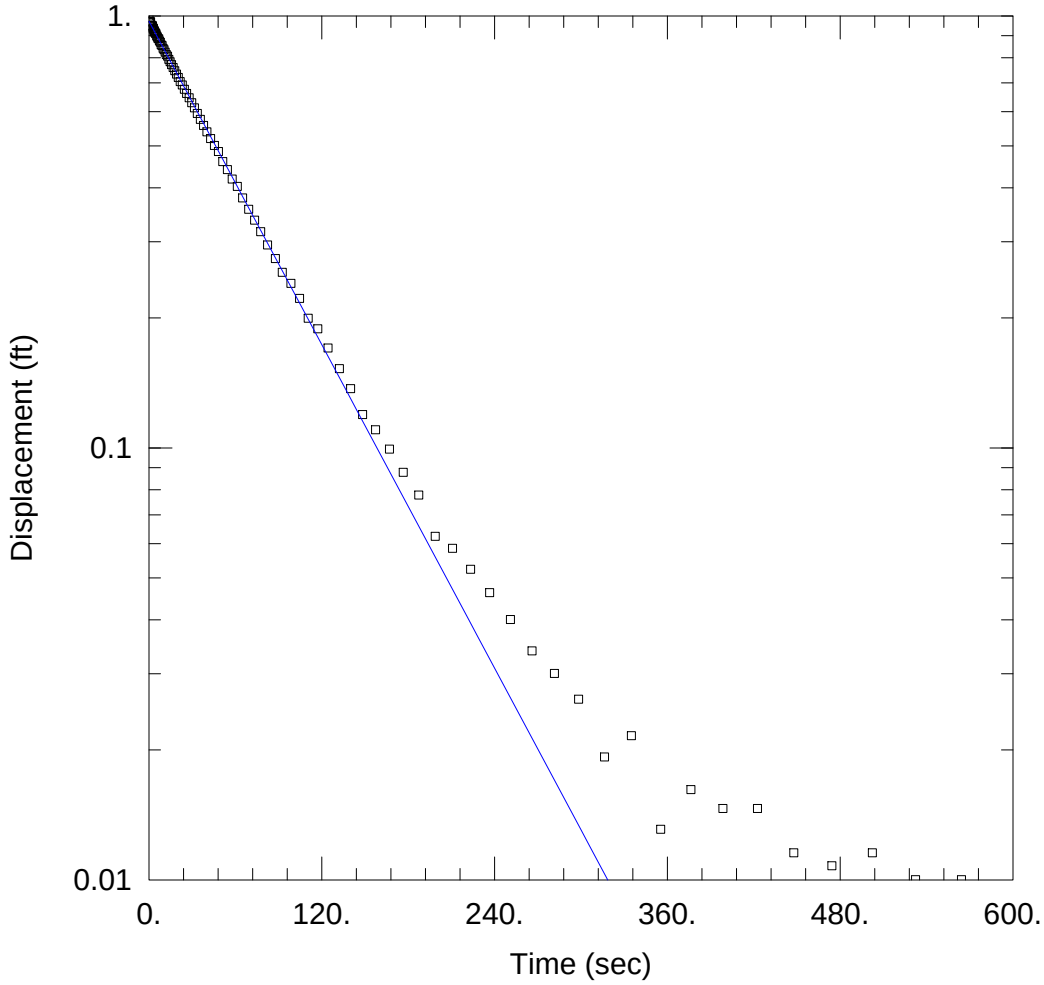
WELL DATA (MW75IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.398 ft/day y0 = 0.9815 ft



WELL TEST ANALYSIS

Data Set: \...\MW75IW-2.aqt
Date: 11/01/11 Time: 09:23:19

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW75IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

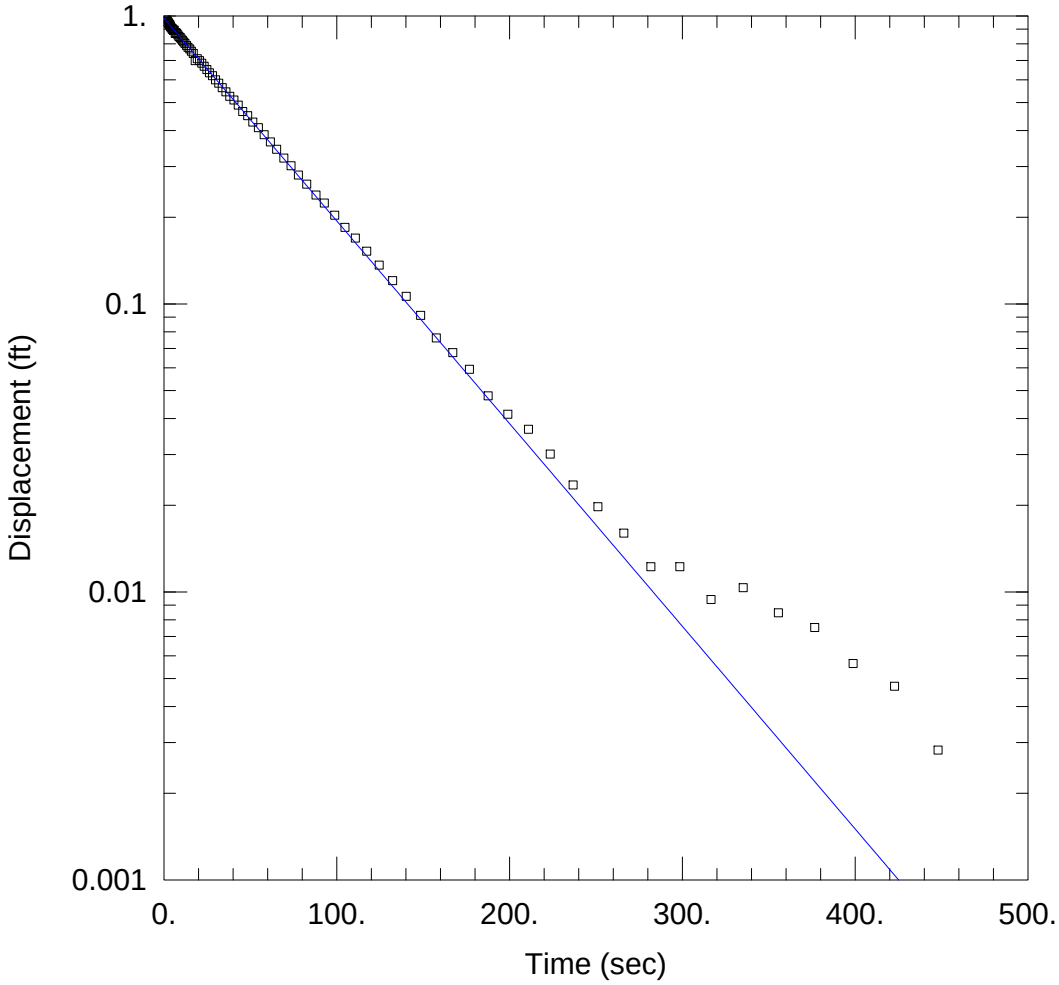
WELL DATA (MW75IW)

Initial Displacement: 1. ft
Total Well Penetration Depth: 40. ft
Casing Radius: 0.083 ft
Static Water Column Height: 40. ft
Screen Length: 10. ft
Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.374 ft/day
y0 = 0.9721 ft



WELL TEST ANALYSIS

Data Set: \...\MW75IW-3.aqt
Date: 11/01/11 Time: 09:23:25

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW75IW
Test Date: 10/20/2011

AQUIFER DATA

Saturated Thickness: 150. ft Anisotropy Ratio (Kz/Kr): 1.

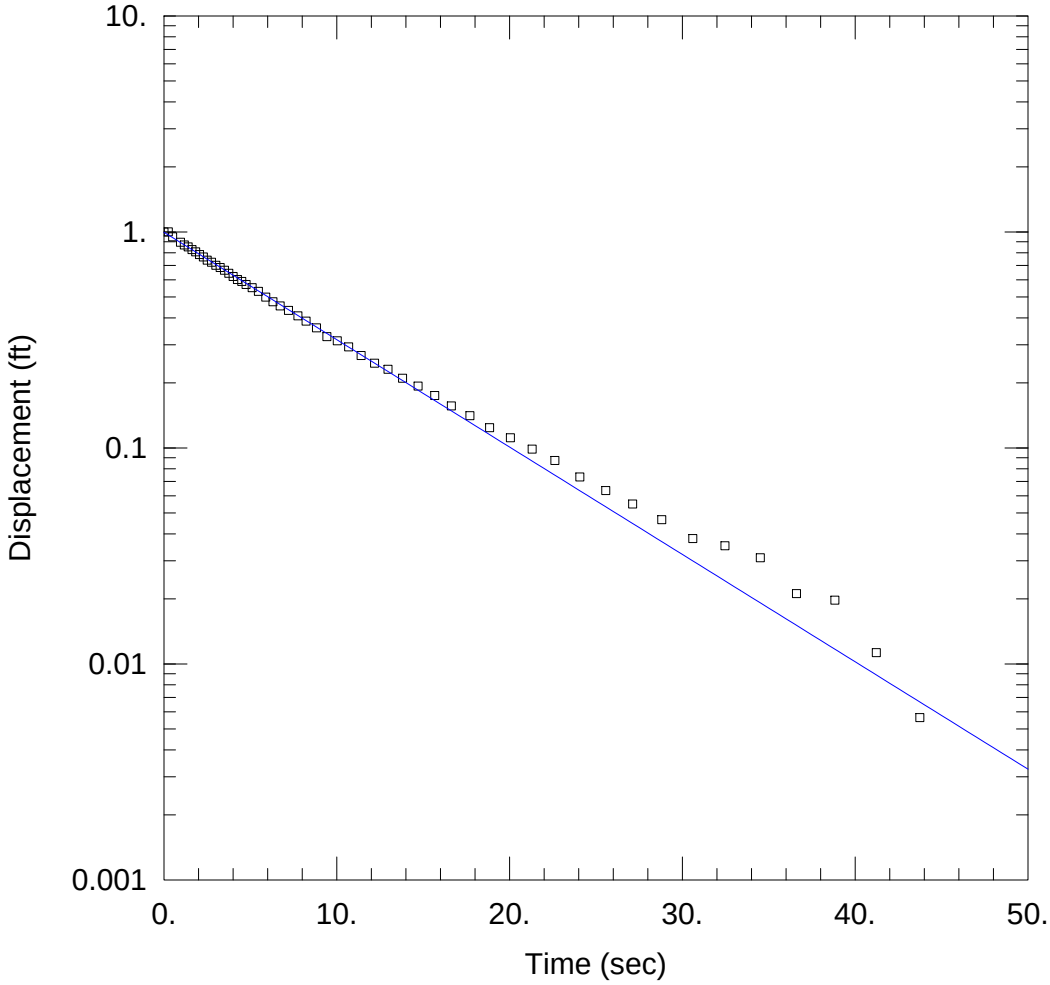
WELL DATA (MW75IW)

Initial Displacement: 1. ft Static Water Column Height: 40. ft
Total Well Penetration Depth: 40. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.55 ft/day y0 = 0.9814 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW61-1.aqt
Date: 10/31/11 Time: 14:19:24

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW61
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft Anisotropy Ratio (Kz/Kr): 1.

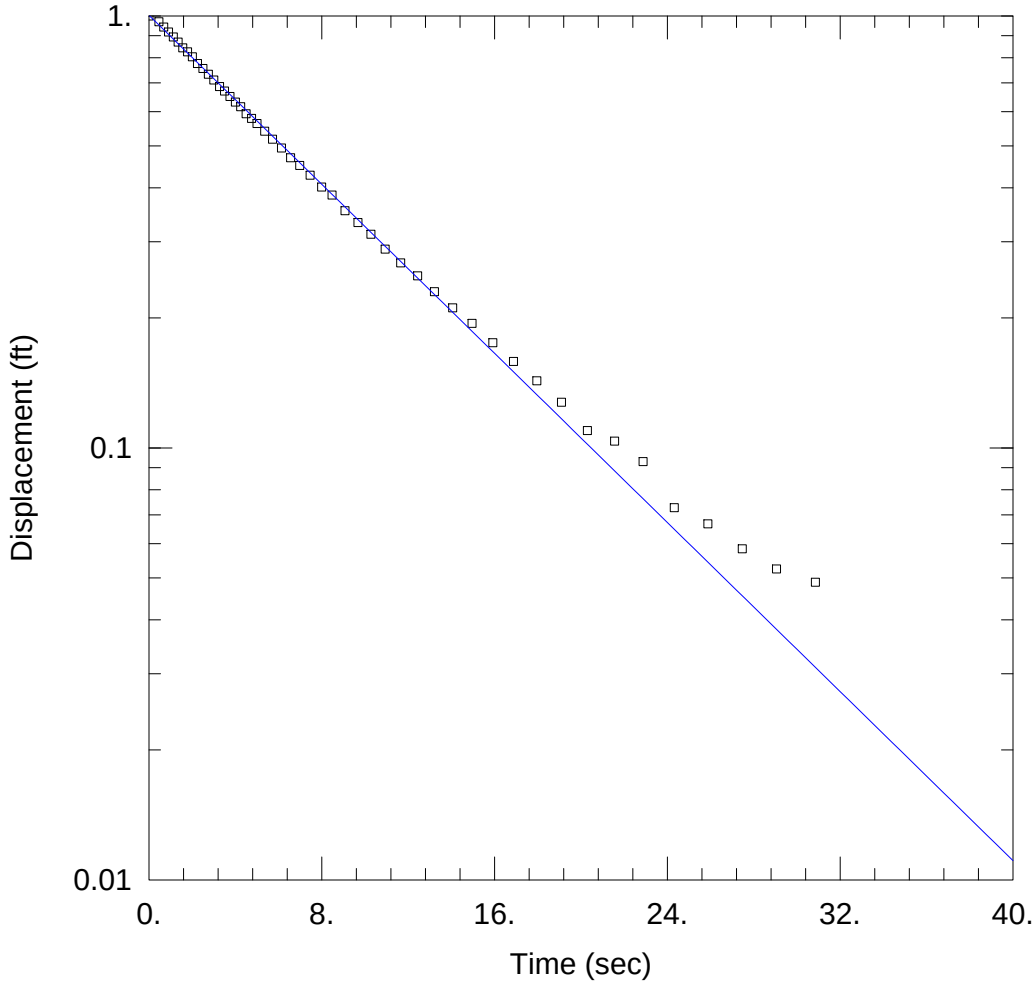
WELL DATA (MW61)

Initial Displacement: 1. ft Static Water Column Height: 25. ft
Total Well Penetration Depth: 25. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 10.61 ft/day y0 = 0.9961 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW61-2.aqt
Date: 10/31/11 Time: 14:19:33

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW61
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 1.

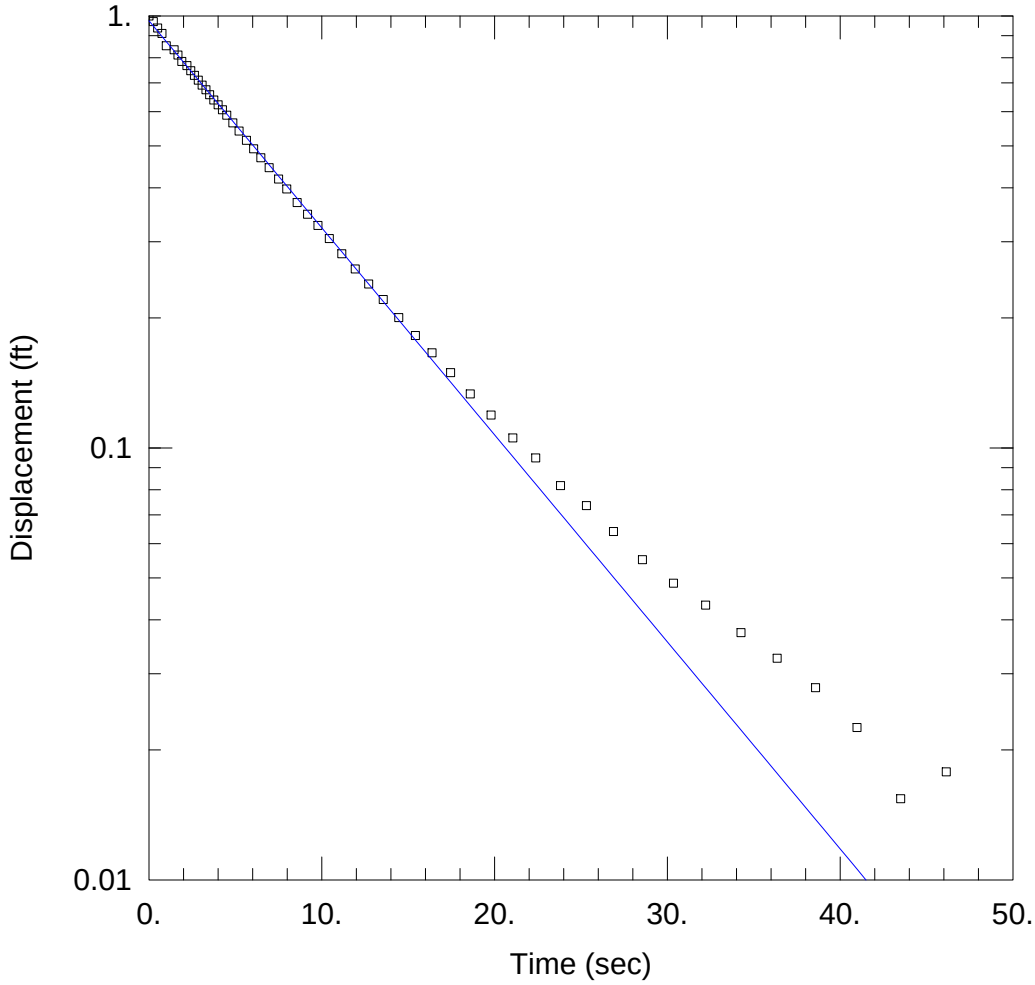
WELL DATA (MW61)

Initial Displacement: 1. ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25. ft
Screen Length: 10. ft
Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 10.44 ft/day
y0 = 1.004 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW61-3.aqt
Date: 10/31/11 Time: 14:19:39

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW61
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 1.

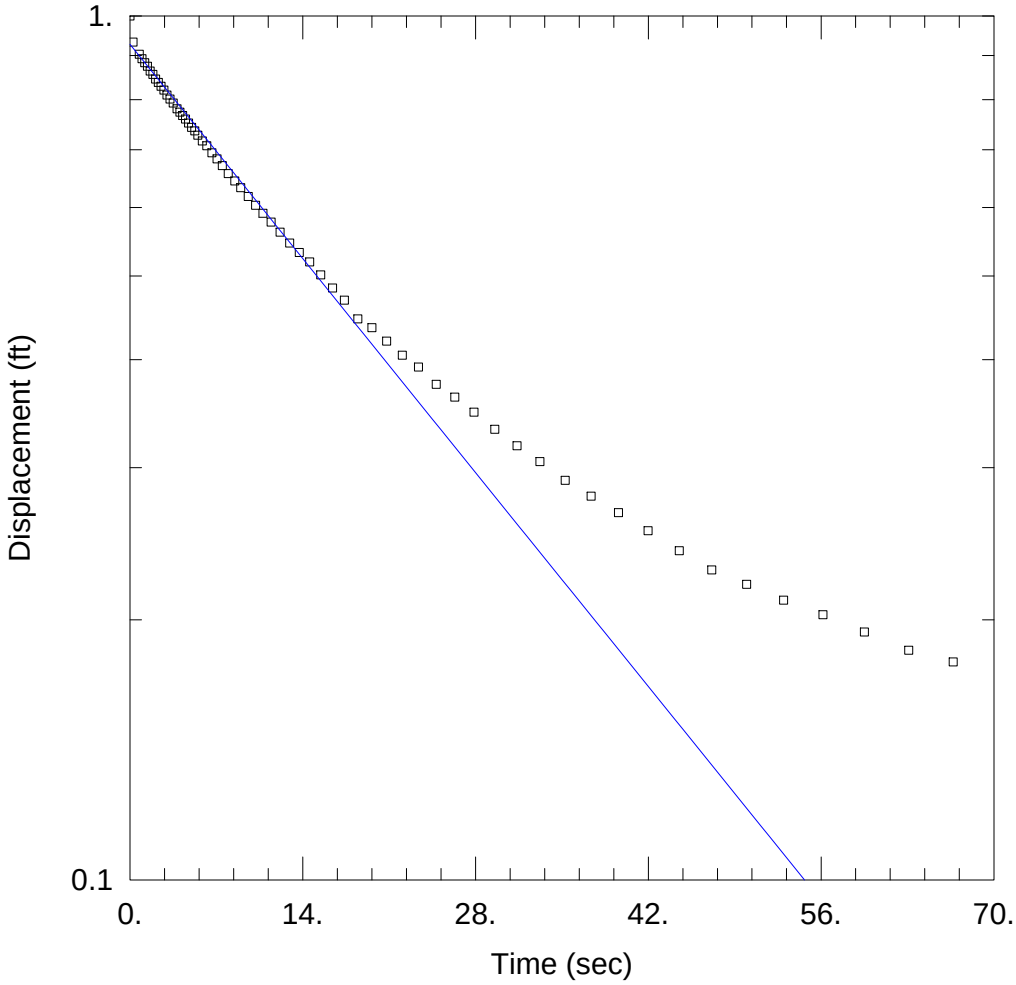
WELL DATA (MW61)

Initial Displacement: 1. ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25. ft
Screen Length: 10. ft
Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 10.23 ft/day
y0 = 0.9742 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW66-1.aqt
Date: 10/31/11 Time: 14:19:43

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW66
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft Anisotropy Ratio (Kz/Kr): 1.

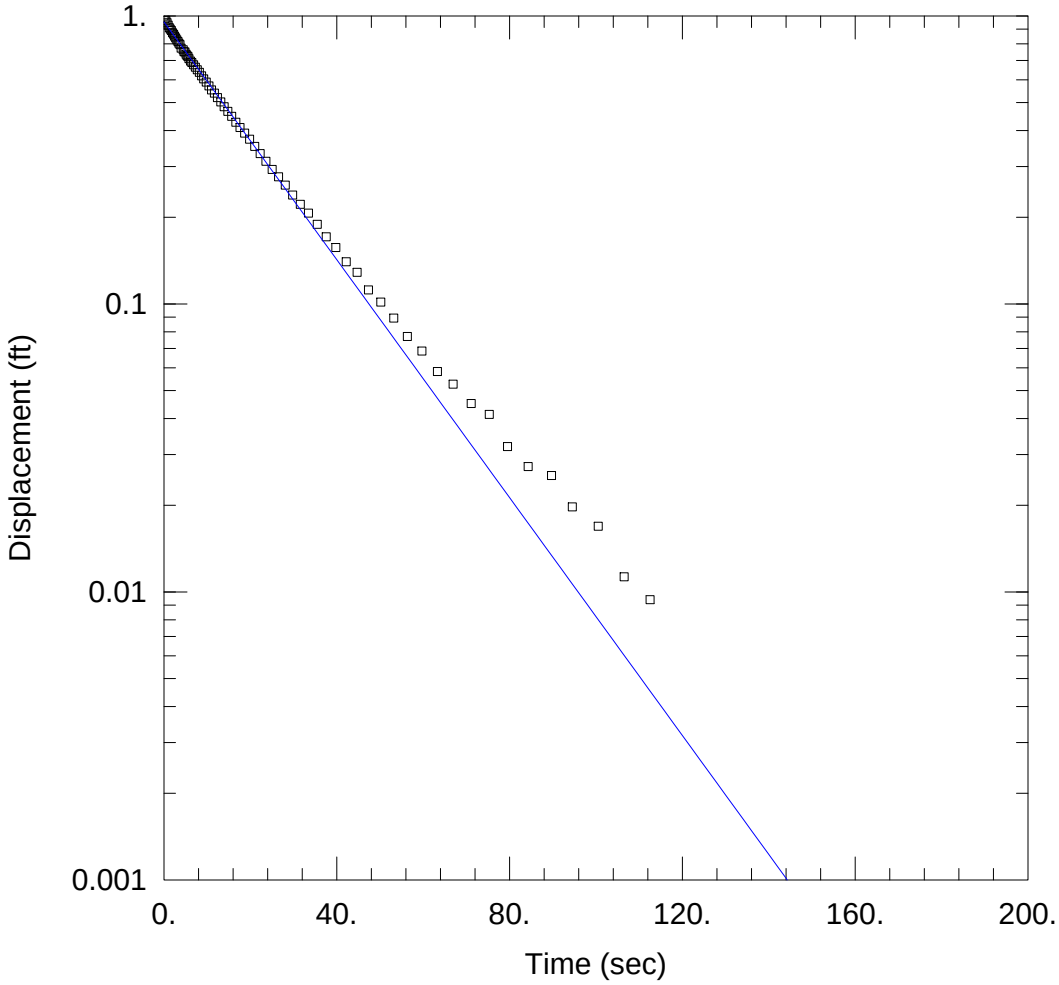
WELL DATA (MW66)

Initial Displacement: 1. ft Static Water Column Height: 25. ft
Total Well Penetration Depth: 25. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 3.778 ft/day y0 = 0.927 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW66-2.aqt
Date: 10/31/11 Time: 14:19:47

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW66
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft Anisotropy Ratio (Kz/Kr): 1.

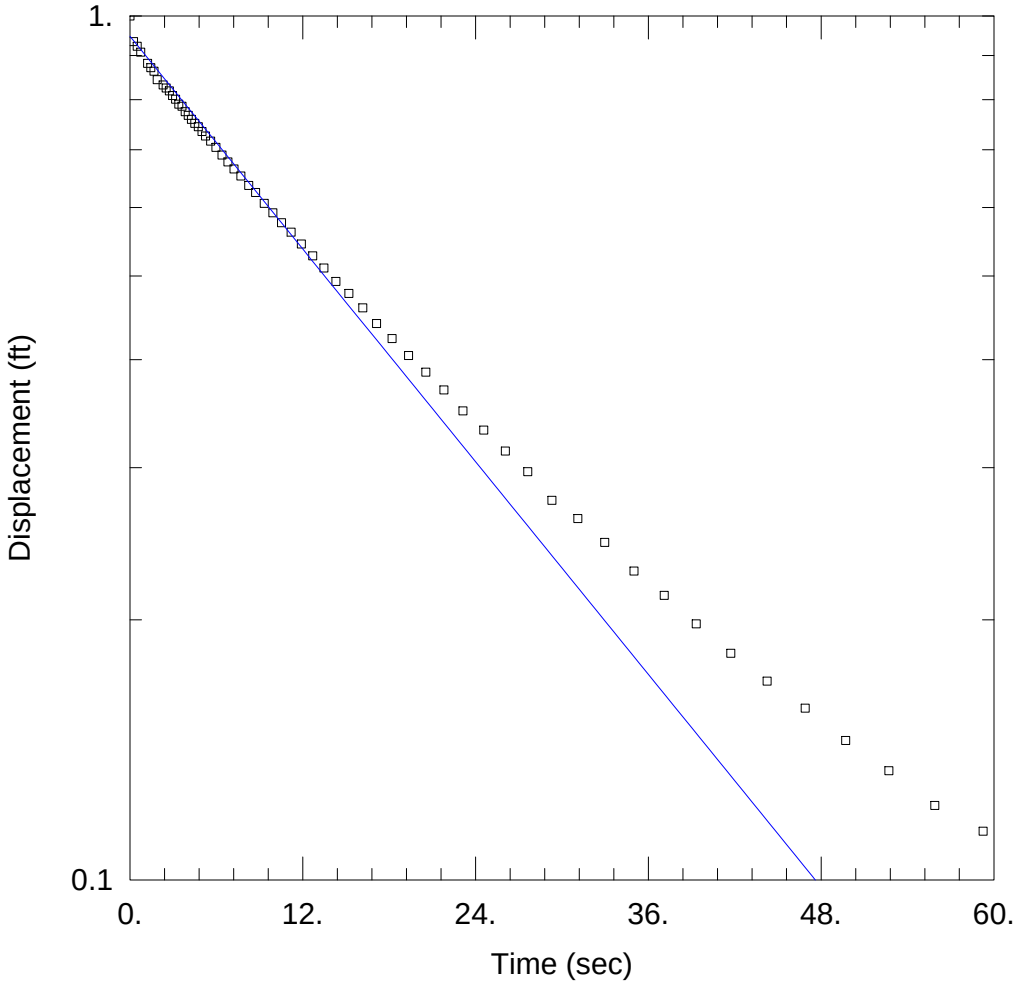
WELL DATA (MW66)

Initial Displacement: 1. ft Static Water Column Height: 25. ft
Total Well Penetration Depth: 25. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 4.408 ft/day y0 = 0.9536 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW66-3.aqt
Date: 10/31/11 Time: 14:19:52

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW66
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 1.

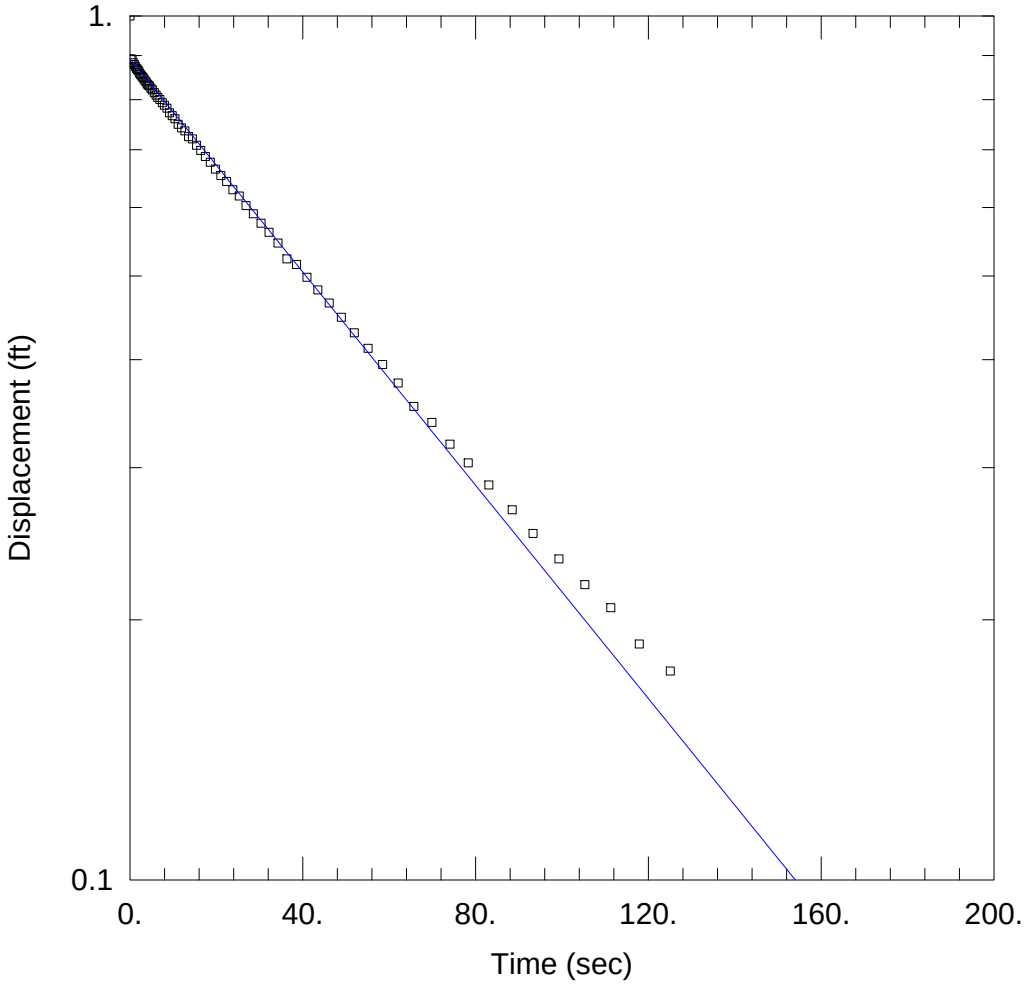
WELL DATA (MW66)

Initial Displacement: 1. ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25. ft
Screen Length: 10. ft
Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 4.379 ft/day
y0 = 0.9472 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW67-1.aqt
Date: 10/31/11 Time: 14:19:56

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW67
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft Anisotropy Ratio (Kz/Kr): 1.

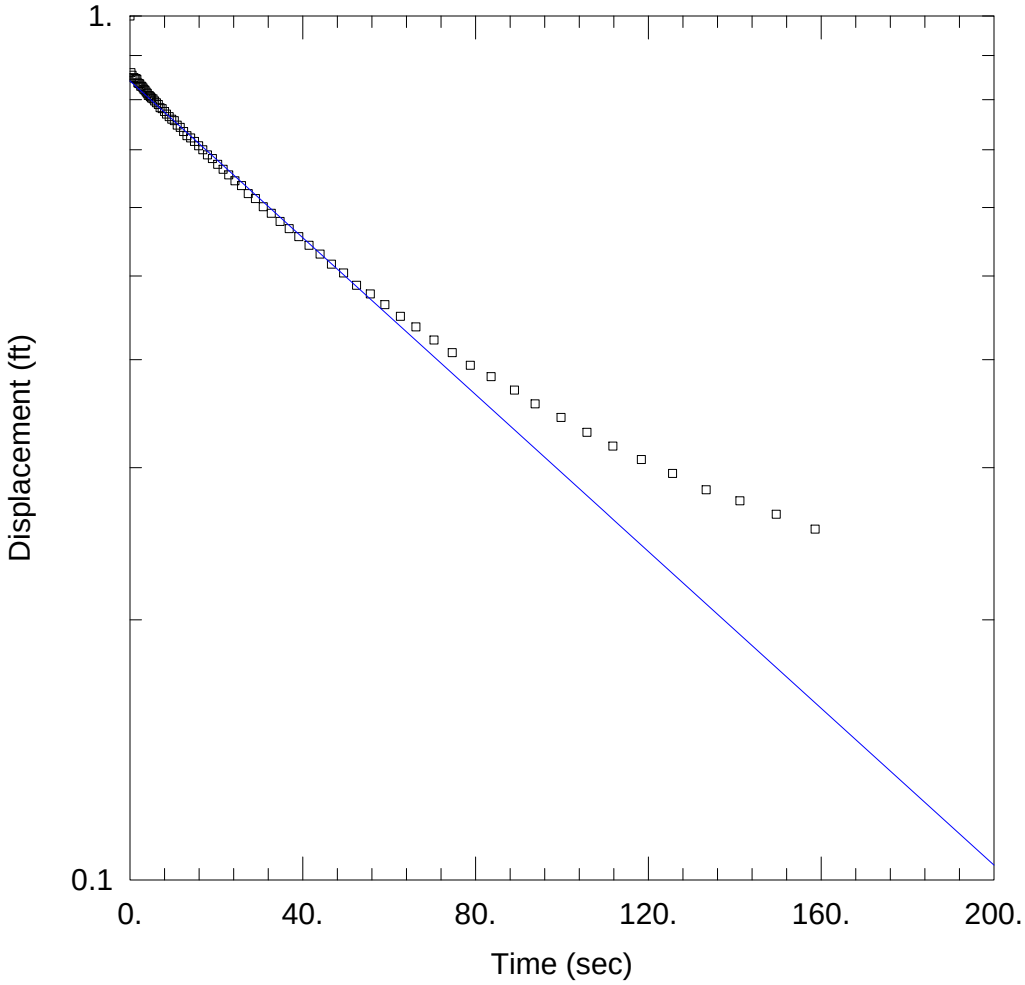
WELL DATA (MW67)

Initial Displacement: 1. ft Static Water Column Height: 25. ft
Total Well Penetration Depth: 25. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.317 ft/day y0 = 0.8923 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW67-2.aqt
Date: 10/31/11 Time: 14:19:59

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW67
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft Anisotropy Ratio (Kz/Kr): 1.

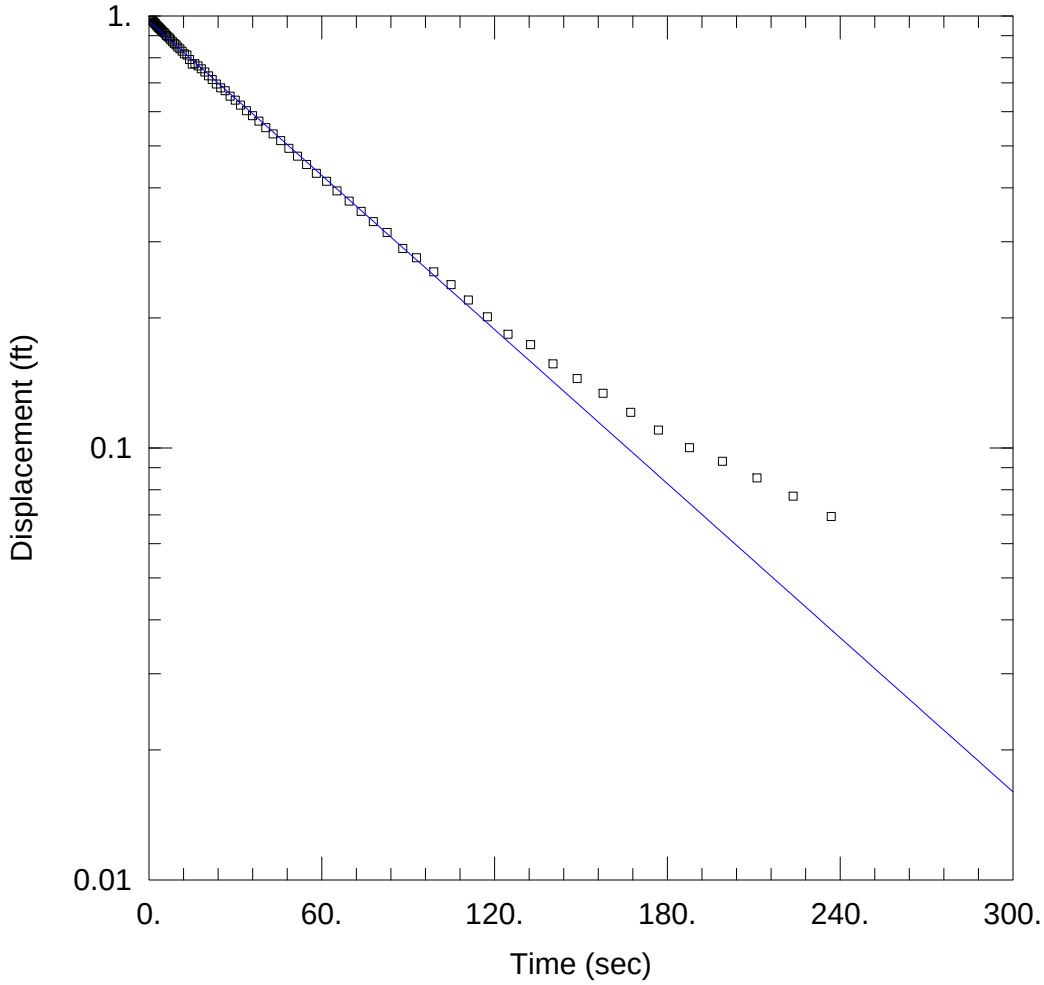
WELL DATA (MW67)

Initial Displacement: 1. ft Static Water Column Height: 25. ft
Total Well Penetration Depth: 25. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.9688 ft/day y0 = 0.841 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW67-3.aqt
Date: 10/31/11 Time: 14:20:03

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW67
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft Anisotropy Ratio (Kz/Kr): 1.

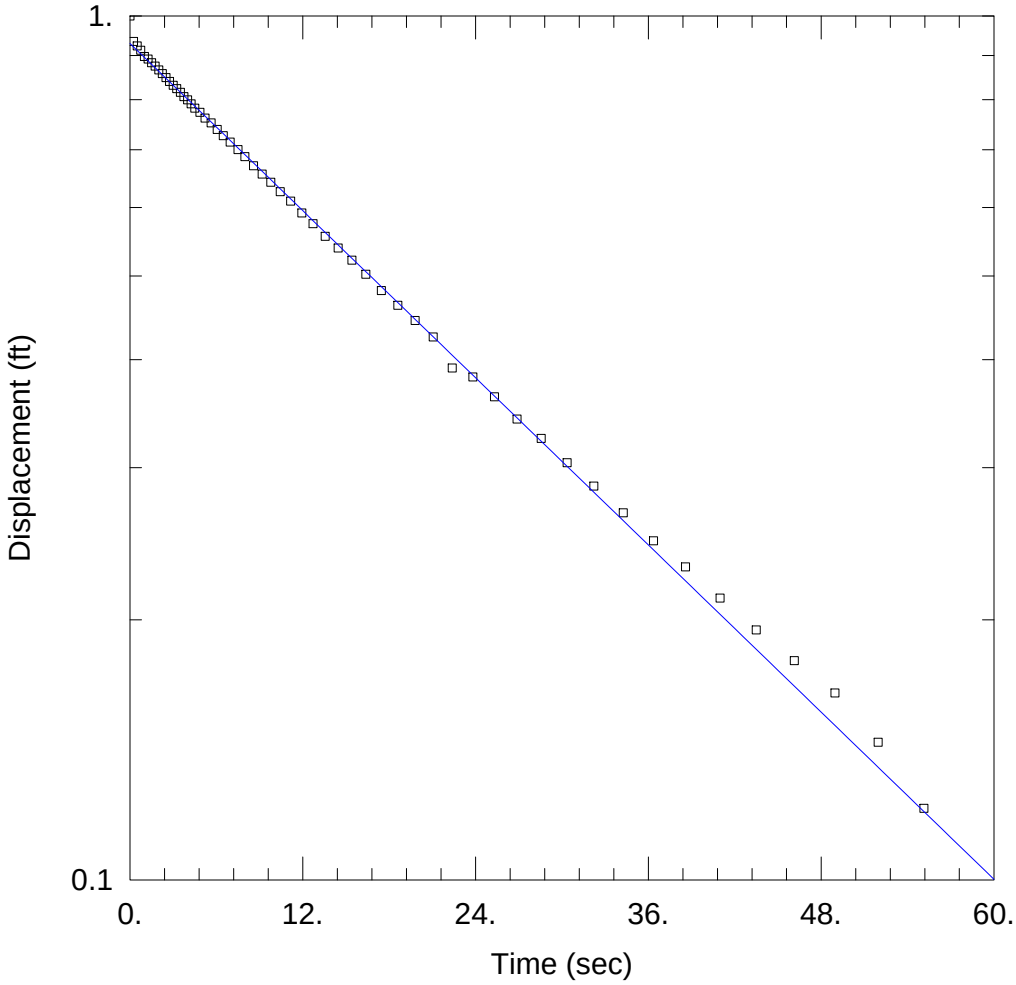
WELL DATA (MW67)

Initial Displacement: 1. ft Static Water Column Height: 25. ft
Total Well Penetration Depth: 25. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.269 ft/day y0 = 0.9716 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW68-1.aqt
Date: 10/31/11 Time: 14:20:08

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW68
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft Anisotropy Ratio (Kz/Kr): 1.

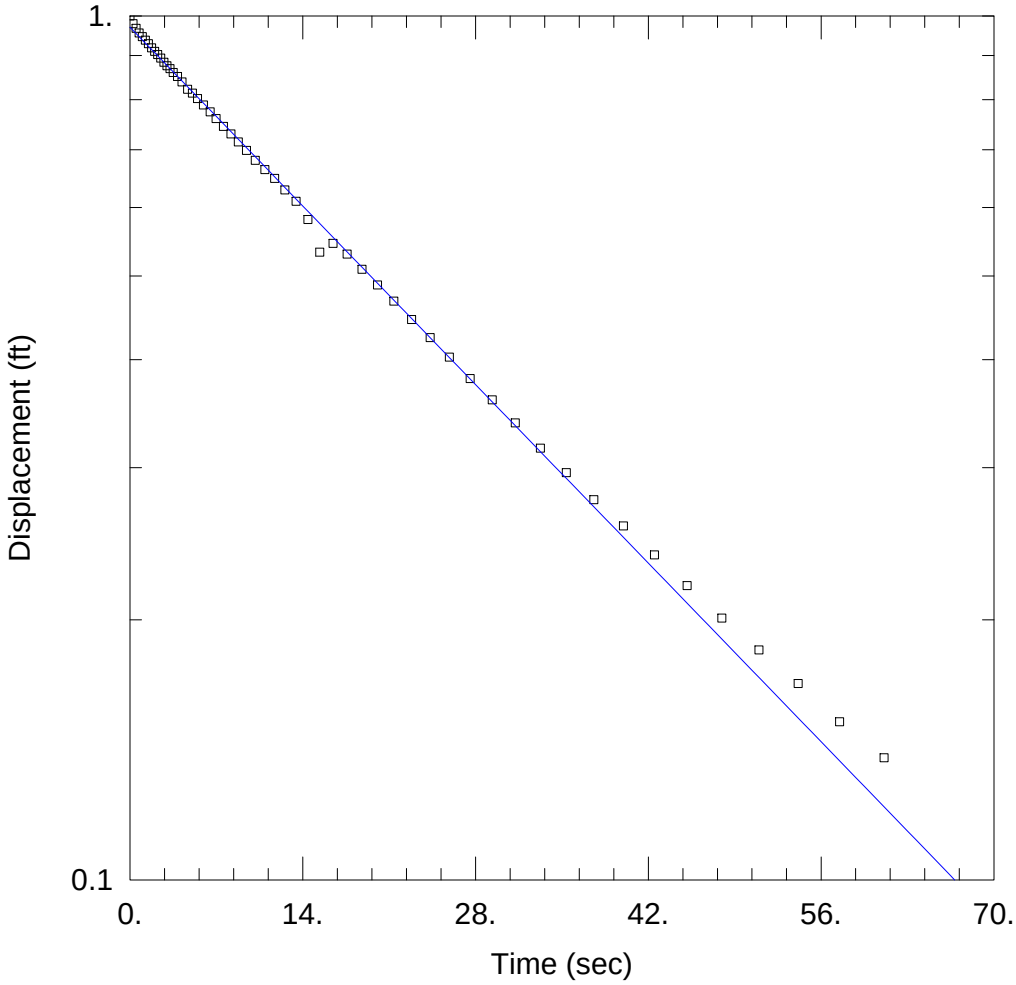
WELL DATA (MW68)

Initial Displacement: 1. ft Static Water Column Height: 25. ft
Total Well Penetration Depth: 25. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 3.442 ft/day y0 = 0.9292 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW68-2.aqt
Date: 10/31/11 Time: 14:20:13

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW68
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 1.

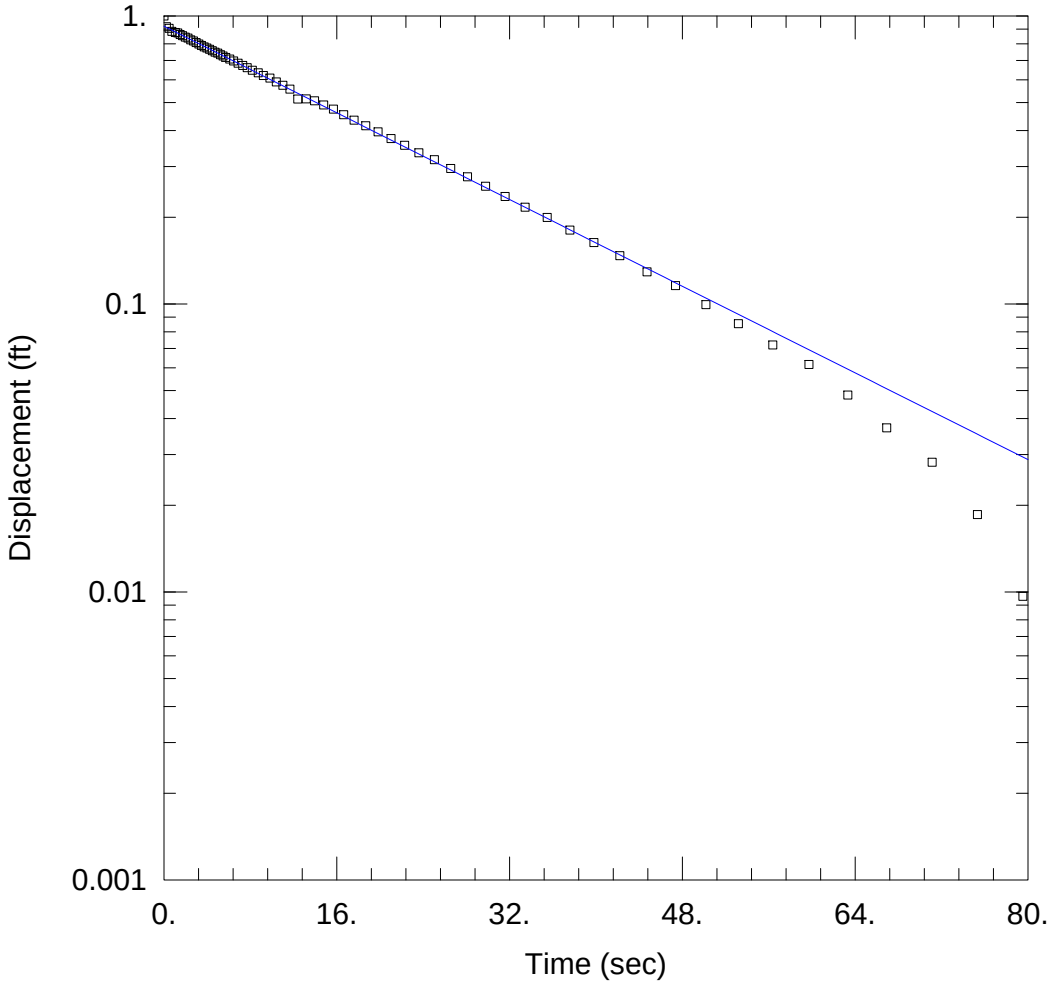
WELL DATA (MW68)

Initial Displacement: 1. ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25. ft
Screen Length: 10. ft
Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 3.153 ft/day
y0 = 0.9704 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW68-3.aqt
Date: 10/31/11 Time: 14:20:17

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW68
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft Anisotropy Ratio (Kz/Kr): 1.

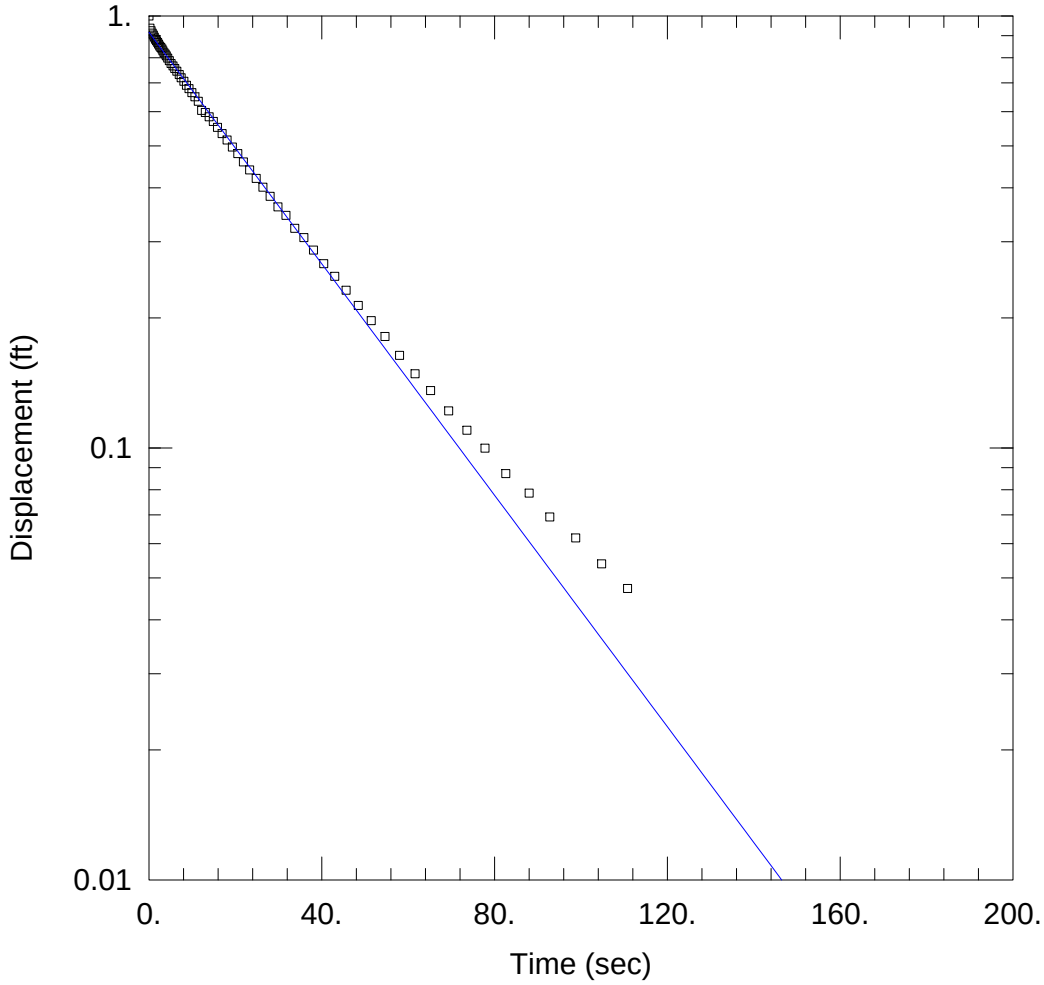
WELL DATA (MW68)

Initial Displacement: 1. ft Static Water Column Height: 25. ft
Total Well Penetration Depth: 25. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 4.015 ft/day y0 = 0.9212 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW69-1.aqt
Date: 10/31/11 Time: 14:20:21

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW69
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft Anisotropy Ratio (Kz/Kr): 1.

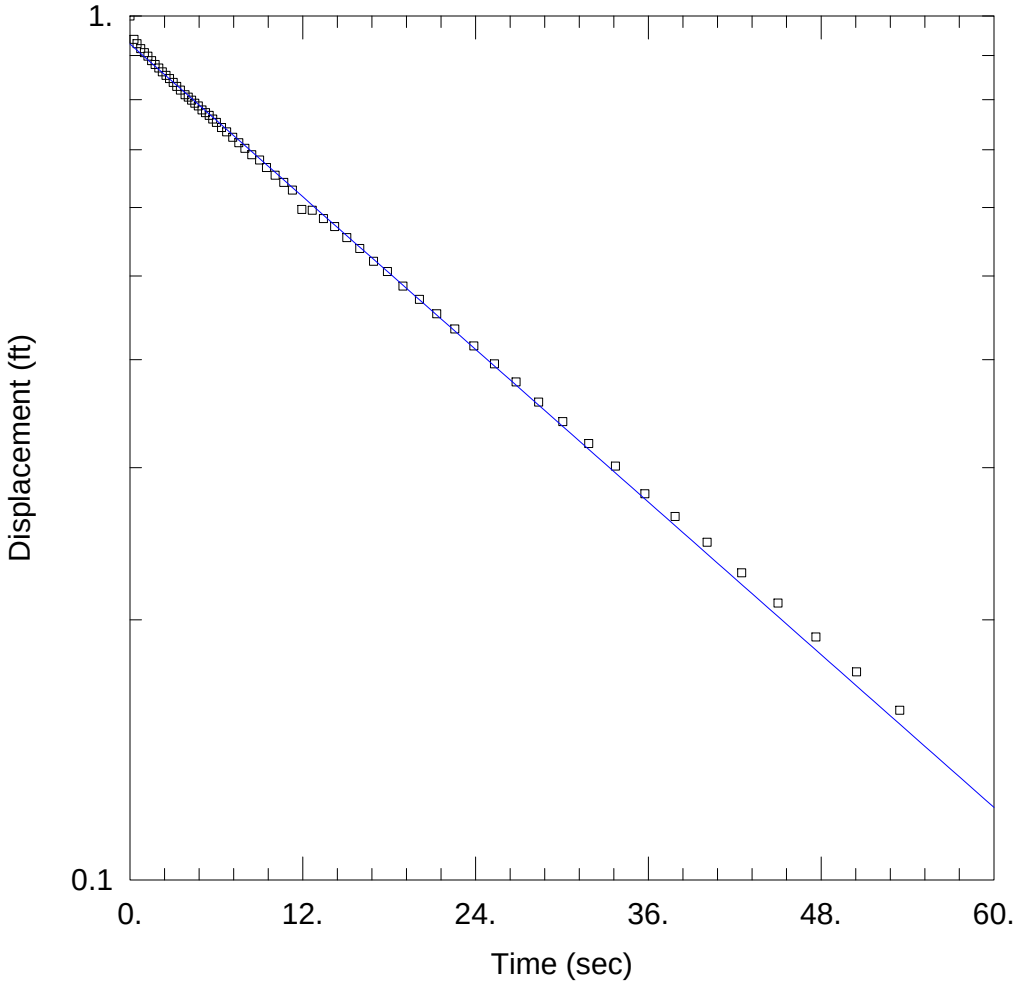
WELL DATA (MW69)

Initial Displacement: 1. ft Static Water Column Height: 25. ft
Total Well Penetration Depth: 25. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 2.859 ft/day y0 = 0.9162 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW69-2.aqt
Date: 10/31/11 Time: 14:20:25

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW69
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 1.

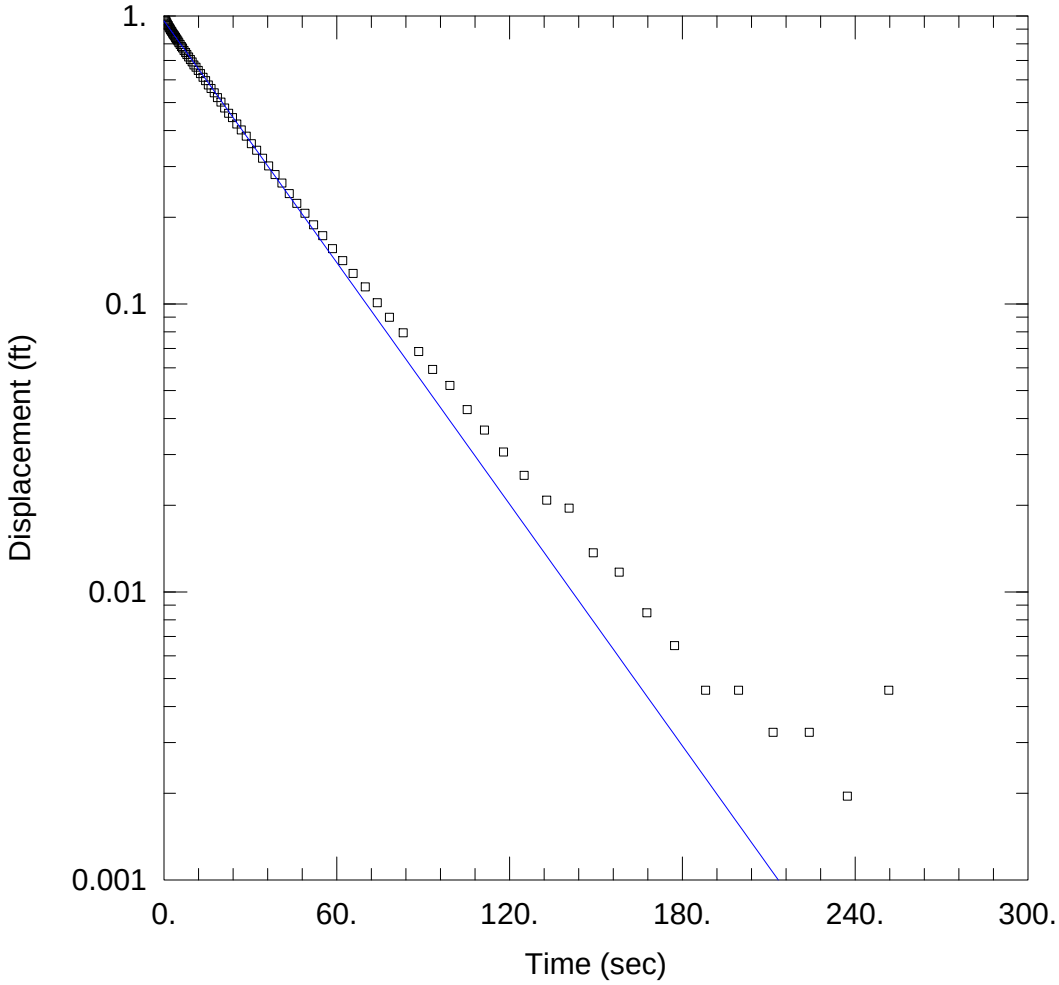
WELL DATA (MW69)

Initial Displacement: 1. ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25. ft
Screen Length: 10. ft
Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 3.143 ft/day
y0 = 0.9278 ft



WELL TEST ANALYSIS

Data Set: C:\...\MW69-3.aqt
Date: 10/31/11 Time: 14:20:30

PROJECT INFORMATION

Company: CH2M HILL
Client: Navy
Location: MCAS New River - Site 86
Test Well: MW69
Test Date: 10/19/2011

AQUIFER DATA

Saturated Thickness: 50. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW69)

Initial Displacement: 1. ft Static Water Column Height: 25. ft
Total Well Penetration Depth: 25. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 2.985 ft/day y0 = 0.9608 ft

Appendix C
Groundwater Analytical Laboratory Results

ENCO Orlando

SDG: CH025-058

CLASS: 31_WET

METHOD: EPA 9060A

ANALYSES DATA PACKAGE COVER PAGE

EPA 9060A

Laboratory: ENCO Orlando

SDG: CH025-058

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, Site 86 CTO-WE09

Client Sample Id:	Lab Sample Id:
IR86-GW70IW-11D	A106587-17
IR86-GW71IW-11D	A106587-18
IR86-GW72IW-11D	A106587-19
IR86-GW73IW-11D	A106587-20
IR86-GW74IW-11D	A106587-21
IR86-GW75IW-11D	A106587-22
IR86-GW55IW-11D	A106587-23
IR86-GW58IW-11D	A106587-24
IR86-GW59IW-11D	A106587-25
IR86-GW61IW-11D	A106587-26

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signatures.

Signature: _____ Name: _____

Date: _____ Title: _____

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW70IW-11D

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106587-17
File ID:
Sampled: 12/12/11 16:15
Prepared: 12/15/11 11:00
Analyzed: 12/15/11 11:42
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L15001
Sequence: AA17548
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	27	1		0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW71IW-11D

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106587-18
File ID:
Sampled: 12/13/11 11:15
Prepared: 12/15/11 11:00
Analyzed: 12/15/11 11:42
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L15001
Sequence: AA17548
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	310	5	D	1.1	4.5	5.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW72IW-11D

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106587-19
File ID:
Sampled: 12/13/11 13:05
Prepared: 12/15/11 11:00
Analyzed: 12/15/11 11:42
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L15001
Sequence: AA17548
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	400	5	D	1.1	4.5	5.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW73IW-11D

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106587-20
File ID:
Sampled: 12/14/11 10:10
Prepared: 12/15/11 11:00
Analyzed: 12/15/11 11:42
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L15001
Sequence: AA17548
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	330	5	D	1.1	4.5	5.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW74IW-11D

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106587-21
File ID:
Sampled: 12/13/11 13:00
Prepared: 12/15/11 11:00
Analyzed: 12/15/11 11:42
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L15001
Sequence: AA17548
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	270	5	D	1.1	4.5	5.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW75IW-11D

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106587-22
File ID:
Sampled: 12/13/11 10:00
Prepared: 12/15/11 11:00
Analyzed: 12/15/11 11:42
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L15001
Sequence: AA17548
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	260	5	D	1.1	4.5	5.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW55IW-11D

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106587-23
File ID:
Sampled: 12/14/11 10:45
Prepared: 12/15/11 11:00
Analyzed: 12/15/11 11:42
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L15001
Sequence: AA17548
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	3.5	1		0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW58IW-11D

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106587-24
File ID:
Sampled: 12/12/11 16:35
Prepared: 12/15/11 11:00
Analyzed: 12/15/11 11:42
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L15001
Sequence: AA17548
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	360	5	D	1.1	4.5	5.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW59IW-11D

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106587-25
File ID:
Sampled: 12/13/11 17:05
Prepared: 12/15/11 11:00
Analyzed: 12/15/11 11:42
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L15001
Sequence: AA17548
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	1.0	1		0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW61IW-11D

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106587-26
File ID:
Sampled: 12/13/11 17:00
Prepared: 12/15/11 11:00
Analyzed: 12/15/11 11:42
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L15001
Sequence: AA17548
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	2.2	1		0.22	0.90	1.0	EPA 9060A

PREPARATION BATCH SUMMARY

EPA 9060A

Laboratory: ENCO Orlando SDG: CH025-058

Client: CH2M Hill, Inc. (CH025) Project: MCB Camp Lejeune, Site 86 CTO-WE09

Batch: 1L15001 Batch Matrix: Water Preparation: NO PREP

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
Blank	1L15001-BLK1		12/15/11 09:00	
LCS	1L15001-BS1		12/15/11 09:00	
IR86-GW70IW-11D	1L15001-MS1		12/15/11 11:00	
IR86-GW70IW-11D	1L15001-MSD1		12/15/11 11:00	
IR86-GW70IW-11D	A106587-17		12/15/11 11:00	
IR86-GW71IW-11D	A106587-18		12/15/11 11:00	
IR86-GW72IW-11D	A106587-19		12/15/11 11:00	
IR86-GW73IW-11D	A106587-20		12/15/11 11:00	
IR86-GW74IW-11D	A106587-21		12/15/11 11:00	
IR86-GW75IW-11D	A106587-22		12/15/11 11:00	
IR86-GW55IW-11D	A106587-23		12/15/11 11:00	
IR86-GW58IW-11D	A106587-24		12/15/11 11:00	
IR86-GW59IW-11D	A106587-25		12/15/11 11:00	
IR86-GW61IW-11D	A106587-26		12/15/11 11:00	

METHOD BLANK DATA SHEET
EPA 9060A

Laboratory:	ENCO Orlando			SDG:	CH025-058
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Water	Laboratory ID:	1L15001-BLK1	File ID:	
Prepared:	12/15/11 09:00	Preparation:	NO PREP	Initial/Final:	20 mL / 20 mL
Analyzed:	12/15/11 09:17	Instrument:	OWETSTOC1		
Batch:	1L15001	Sequence:	AA17548	Calibration:	1103065

CAS NO.	COMPOUND	CONC. (mg/L)	Q
ECL-0165	Total Organic Carbon	<0.90	U

LCS / LCS DUPLICATE RECOVERY

EPA 9060A

Laboratory:	ENCO Orlando	SDG:	CH025-058
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Water		
Batch:	1L15001	Laboratory ID:	1L15001-BS1
Preparation:	NO PREP	Initial/Final:	100 mL / 100 mL

COMPOUND	SPIKE ADDED (mg/L)	LCS CONCENTRATION (mg/L)	LCS % REC. #	QC LIMITS REC.
Total Organic Carbon	40.0	41	104	85 - 115

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY

IR86-GW70IW-11D

EPA 9060A

Laboratory:	ENCO Orlando	SDG:	CH025-058
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Water		
Batch:	1L15001	Laboratory ID:	1L15001-MS1
Preparation:	NO PREP	Initial/Final:	20 mL / 20 mL

Source Sample Name: IR86-GW70IW-11D

COMPOUND	SPIKE ADDED (mg/L)	SAMPLE CONCENTRATION (mg/L)	MS CONCENTRATION (mg/L)	MS % REC. #	QC LIMITS REC.
Total Organic Carbon	40.0	27	70	109	85 - 115

COMPOUND	SPIKE ADDED (mg/L)	MSD CONCENTRATION (mg/L)	MSD % REC. #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
Total Organic Carbon	40.0	70	107	1	21	85 - 115

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 9060A

Laboratory:	ENCO Orlando	SDG:	CH025-058
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA14517	Instrument:	OWETSTOC1
		Calibration:	1103065

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
Initial Cal Blank	AA14517-ICB1		03/22/11 11:02
Cal Standard	AA14517-CAL1		03/22/11 11:02
Cal Standard	AA14517-CAL2		03/22/11 11:02
Cal Standard	AA14517-CAL3		03/22/11 11:02
Cal Standard	AA14517-CAL4		03/22/11 11:02
Cal Standard	AA14517-CAL5		03/22/11 11:02
Cal Standard	AA14517-CAL6		03/22/11 11:02
Cal Standard	AA14517-CAL7		03/22/11 11:02
Secondary Cal Check	AA14517-SCV1		03/22/11 11:02
Calibration Check	AA14517-CCV1		03/22/11 11:02
Calibration Blank	AA14517-CCB1		03/22/11 11:02

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 9060A

Laboratory: ENCO Orlando

Client: CH2M Hill, Inc. (CH025)

Sequence: AA17548

SDG: CH025-058

Project: MCB Camp Lejeune, Site 86 CTO-WE09

Instrument: OWETSTOC1

Calibration: 1103065

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
Calibration Check	AA17548-CCV1		12/15/11 09:17
Calibration Blank	AA17548-CCB1		12/15/11 09:17
Blank	1L15001-BLK1		12/15/11 09:17
LCS	1L15001-BS1		12/15/11 09:17
IR86-GW70IW-11D	1L15001-MS1		12/15/11 11:42
IR86-GW70IW-11D	1L15001-MSD1		12/15/11 11:42
IR86-GW70IW-11D	A106587-17		12/15/11 11:42
IR86-GW71IW-11D	A106587-18		12/15/11 11:42
IR86-GW72IW-11D	A106587-19		12/15/11 11:42
IR86-GW73IW-11D	A106587-20		12/15/11 11:42
IR86-GW74IW-11D	A106587-21		12/15/11 11:42
IR86-GW75IW-11D	A106587-22		12/15/11 11:42
Calibration Check	AA17548-CCV2		12/15/11 11:42
Calibration Blank	AA17548-CCB2		12/15/11 11:42
IR86-GW55IW-11D	A106587-23		12/15/11 11:42
IR86-GW58IW-11D	A106587-24		12/15/11 11:42
IR86-GW59IW-11D	A106587-25		12/15/11 11:42
IR86-GW61IW-11D	A106587-26		12/15/11 11:42
Calibration Check	AA17548-CCV3		12/15/11 11:42
Calibration Blank	AA17548-CCB3		12/15/11 11:42

BLANKS
EPA 9060A

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Instrument ID: OWETSTOC1
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Sequence: AA14517
Calibration: 1103065

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
AA14517-CCB1	Total Organic Carbon	0.0	1.0	mg/L		EPA 9060A
AA14517-ICB1	Total Organic Carbon	0.0	1.0	mg/L		EPA 9060A

BLANKS
EPA 9060A

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Instrument ID: OWETSTOC1
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Sequence: AA17548
Calibration: 1103065

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
1L15001-BLK1	Total Organic Carbon	0.0	1.0	mg/L		EPA 9060A
AA17548-CCB1	Total Organic Carbon	0.0	1.0	mg/L		EPA 9060A
AA17548-CCB2	Total Organic Carbon	0.0	1.0	mg/L		EPA 9060A
AA17548-CCB3	Total Organic Carbon	0.0	1.0	mg/L		EPA 9060A

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 9060A

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Instrument ID: OWETSTOC1
Calibration: 1103065
Control Limt: +/- 15.00%
Sequence: AA14517

Lab Sample ID	Analyte	True	Found	%R	Units	Method
AA14517-CCV1	Total Organic Carbon	40.0	40	99	mg/L	EPA 9060A

* Values outside of QC limits

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 9060A

Laboratory: ENCO Orlando
SDG: CH025-058
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Instrument ID: OWETSTOC1
Calibration: 1103065
Control Limt: +/- 15.00%
Sequence: AA17548

Lab Sample ID	Analyte	True	Found	%R	Units	Method
AA17548-CCV1	Total Organic Carbon	40.0	41	103	mg/L	EPA 9060A
AA17548-CCV2	Total Organic Carbon	40.0	44	110	mg/L	EPA 9060A
AA17548-CCV3	Total Organic Carbon	40.0	35	88	mg/L	EPA 9060A

* Values outside of QC limits

SECOND-SOURCE CALIBRATION VERIFICATION

EPA 9060A

Laboratory: ENCO Orlando

SDG: CH025-058

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, Site 86 CTO-WE09

Calibration: 1103065

Laboratory ID: AA14517-SCV1

Sequence: AA14517

Standard ID: A1A0228

ANALYTE	EXPECTED (mg/L)	FOUND (mg/L)	% DRIFT	QC LIMIT
Total Organic Carbon	40.0	40	-1.1	15.00

* Values outside of QC limits

Flags, Notes and Definitions

B	The analyte was detected in the associated method blank.
D	The sample was analyzed at dilution.
J	The reported result is an estimated value.
U	Analyte was not detected and is reported as less than the LOD or as defined by the client. The LOD has been adjusted for any dilution or concentration of the sample.
E	The concentration indicated for this analyte is an estimated value above the calibration range of the instrument. This value is considered an estimate.
N	Non-target analyte.
Q	One or more quality control criteria failed.

2340 Stock Creek Blvd.
Rockford TN 37853-3044
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Fax: (865) 573-8133
Email: info@microbe.com

Client: Troy Horn
CH2M HILL
5700 Cleveland Street
Suite 101
Virginia Beach, VA 23462

Phone: 751-671-6288

Fax: 751-497-6885

Identifier: 035IL **Date Rec:** 12/14/2011 **Report Date:** 12/21/2011

Client Project #: 423849 **Client Project Name:** Clean 8012 CTO-WE09 MCB Camp Leje

Purchase Order #: 945859

Analysis Requested: mRNA

Reviewed By:

Anita Biernacki

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MICROBIAL INSIGHTS, INC.

2340 Stock Creek Blvd. Rockford, TN 37853-3044
Tel. (865) 573-8188 Fax. (865) 573-8133

mRNA

Client: **CH2M HILL**
Project: Clean 8012 CTO-WE09 MCB Camp Lejeune, Site

MI Project Number: **035IL**
Date Received: 12/14/2011

Sample Information

Client Sample ID:		**IR86-GW71IW-1 1D**	**IR86-GW72IW-1 1D**	**IR86-GW74IW-1 1D**	**IR86-GW75IW-1 1D**
Sample Date:		12/13/2011	12/13/2011	12/13/2011	12/13/2011
Units:		gene copies/mL	gene copies/mL	gene copies/mL	gene copies/mL
Analyst:		AB	AB	AB	AB
Dechlorinating Bacteria					
Dehalococcoides spp.	*DHC*	**2.38E+04**	**1.24E+03**	**2.80E+04**	**2.92E+06**
Dehalobacter spp.	*DHBt*	**1.29E+04**	**2.45E+04**	**6.78E+03**	**2.22E+04**
Desulfuromonas spp.	*DSM*	**1.60E+03**	**3.04E+02**	**3.20E+03**	**1.22E+03**
Desulfitobacterium spp.	*DSB*	**2.86E+06**	**9.86E+06**	**5.90E+06**	**1.59E+07**
Functional Genes					
tceA Reductase	TCE	**2.54E+03**	**3.13E+01**	**1.71E+02**	**2.21E+05**
bvcA Reductase	BVC	**3.08E+02**	**1.16E+01**	**5.01E+02**	**3.24E+01**
Vinyl Chloride Reductase	VCR	**4.74E+02**	**4.10E+00**	**6.40E+00**	**4.08E+04**
Toluene Dioxygenase	TOD	<1.00E+00	**2.11E+03**	<1.00E+00	<1.00E+00
Phylogenetic Group					
Methane Oxidizing Bacteria	MOB	**3.14E+07**	**7.22E+07**	**6.05E+06**	**5.28E+07**

Legend:
NA = Not Analyzed NS = Not Sampled J = Estimated gene copies below PQL but above LQL I = Inhibited
< = Result not detected

ENCO Orlando

SDG: DRAFT CH025-064

CLASS: 01_VOA_MS

METHOD: EPA 8260B

ANALYSES DATA PACKAGE COVER PAGE

EPA 8260B

Laboratory: ENCO Orlando

SDG: DRAFT CH025-064

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, Site 86 CTO-WE09

Client Sample Id:	Lab Sample Id:
DRAFT: IR86-GW68-12A	A200224-01
DRAFT: IR86-GW66-12A	A200224-02
DRAFT: IR86-GW67-12A	A200224-03
DRAFT: IR86-GW61-12A	A200224-04
DRAFT: IR86-GW69-12A	A200224-05
DRAFT: IR86-GW61IW-12A	A200224-06
DRAFT: IR86-GW63-12A	A200224-07
DRAFT: IR86-GW63D-12A	A200224-08
DRAFT: IR86-GW55IW-12A	A200224-09
DRAFT: IR86-GW55IW-12A	A200224-09RE1
DRAFT: IR86-GW75IW-12A	A200224-10
DRAFT: IR86-GW73IW-12A	A200224-11
DRAFT: TB01-012512	A200224-12
DRAFT: IR86-GW71IW-12A	A200224-13
DRAFT: IR86-GW58IW-12A	A200224-14
DRAFT: IR86-GW58IW-12A	A200224-14RE1
DRAFT: IR86-GW58IWD-12A	A200224-15
DRAFT: IR86-GW58IWD-12A	A200224-15RE1
DRAFT: IR86-GW59IW-12A	A200224-16
DRAFT: IR86-GW74IW-12A	A200224-17
DRAFT: IR86-GW70IW-12A	A200224-18
DRAFT: IR86-GW72IW-12A	A200224-19
DRAFT: EB-012512	A200224-20
DRAFT: EB-012312	A200224-21
DRAFT: EB-012412	A200224-22

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signatures.

Signature: _____ Name: _____

Date: _____ Title: _____

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT: IR86-GW68-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-01	File ID:	3AV008.D
Sampled:	01/25/12 12:35	Prepared:	01/27/12 12:24	Analyzed:	01/27/12 15:25
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	1.2		0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	19		0.49	1.0	1.0
79-01-6	Trichloroethene	1	51		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	48	97	85 - 115	
Toluene-d8	50.0	49	97	85 - 120	
4-Bromofluorobenzene	50.0	42	84	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2112658	11.51	1684111	11.52	
1,4-Difluorobenzene	3091194	12.08	2430484	12.09	
Chlorobenzene-d5	2577687	14.78	2040661	14.77	
1,4-Dichlorobenzene-d4	1199819	17.18	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT: IR86-GW66-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-02	File ID:	3AV009.D
Sampled:	01/25/12 10:05	Prepared:	01/27/12 12:24	Analyzed:	01/27/12 15:55
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	4.5		0.49	1.0	1.0
79-01-6	Trichloroethene	1	13		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	51	102	85 - 115	
Toluene-d8	50.0	49	98	85 - 120	
4-Bromofluorobenzene	50.0	42	85	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2034091	11.51	1684111	11.52	
1,4-Difluorobenzene	3142945	12.09	2430484	12.09	
Chlorobenzene-d5	2509179	14.78	2040661	14.77	
1,4-Dichlorobenzene-d4	1169535	17.18	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT: IR86-GW67-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-03	File ID:	3AV010.D
Sampled:	01/25/12 13:20	Prepared:	01/27/12 12:24	Analyzed:	01/27/12 16:25
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	11		0.49	1.0	1.0
79-01-6	Trichloroethene	1	21		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	50	100	85 - 115	
Toluene-d8	50.0	48	96	85 - 120	
4-Bromofluorobenzene	50.0	41	82	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2079795	11.5	1684111	11.52	
1,4-Difluorobenzene	3216943	12.08	2430484	12.09	
Chlorobenzene-d5	2618167	14.78	2040661	14.77	
1,4-Dichlorobenzene-d4	1226006	17.17	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT: IR86-GW61-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-04	File ID:	3AV011.D
Sampled:	01/25/12 13:55	Prepared:	01/27/12 12:24	Analyzed:	01/27/12 16:55
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	2.4		0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	46		0.49	1.0	1.0
79-01-6	Trichloroethene	1	150		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	58	115	85 - 115	
Toluene-d8	50.0	56	112	85 - 120	
4-Bromofluorobenzene	50.0	47	94	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1817381	11.51	1684111	11.52	
1,4-Difluorobenzene	2732782	12.08	2430484	12.09	
Chlorobenzene-d5	2300136	14.78	2040661	14.77	
1,4-Dichlorobenzene-d4	1054148	17.18	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT: IR86-GW69-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-05	File ID:	3AV012.D
Sampled:	01/25/12 14:15	Prepared:	01/27/12 12:24	Analyzed:	01/27/12 17:25
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	1.1		0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	22		0.49	1.0	1.0
79-01-6	Trichloroethene	1	31		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	55	110	85 - 115	
Toluene-d8	50.0	51	101	85 - 120	
4-Bromofluorobenzene	50.0	45	90	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2036651	11.5	1684111	11.52	
1,4-Difluorobenzene	3125160	12.08	2430484	12.09	
Chlorobenzene-d5	2557916	14.77	2040661	14.77	
1,4-Dichlorobenzene-d4	1174626	17.17	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW61IW-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-06	File ID:	3AV013.D
Sampled:	01/25/12 11:15	Prepared:	01/27/12 12:24	Analyzed:	01/27/12 17:55
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	2.0		0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	35		0.49	1.0	1.0
79-01-6	Trichloroethene	1	50		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	53	107	85 - 115	
Toluene-d8	50.0	51	102	85 - 120	
4-Bromofluorobenzene	50.0	45	90	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1865612	11.5	1684111	11.52	
1,4-Difluorobenzene	2865979	12.08	2430484	12.09	
Chlorobenzene-d5	2326053	14.78	2040661	14.77	
1,4-Dichlorobenzene-d4	1091180	17.17	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT: IR86-GW63-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-07	File ID:	3AV014.D
Sampled:	01/25/12 10:20	Prepared:	01/27/12 12:24	Analyzed:	01/27/12 18:26
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	3.4		0.49	1.0	1.0
79-01-6	Trichloroethene	1	4.9		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	53	106	85 - 115	
Toluene-d8	50.0	46	93	85 - 120	
4-Bromofluorobenzene	50.0	43	86	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1997099	11.5	1684111	11.52	
1,4-Difluorobenzene	3154202	12.08	2430484	12.09	
Chlorobenzene-d5	2538466	14.78	2040661	14.77	
1,4-Dichlorobenzene-d4	1213028	17.17	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT: IR86-GW63D-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-08	File ID:	3AV015.D
Sampled:	01/25/12 10:25	Prepared:	01/27/12 12:24	Analyzed:	01/28/12 10:40
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	3.4		0.49	1.0	1.0
79-01-6	Trichloroethene	1	4.6		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	104	85 - 115	
Toluene-d8	50.0	49	99	85 - 120	
4-Bromofluorobenzene	50.0	45	90	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2078803	11.49	1684111	11.52	
1,4-Difluorobenzene	3153384	12.06	2430484	12.09	
Chlorobenzene-d5	2486946	14.76	2040661	14.77	
1,4-Dichlorobenzene-d4	1163200	17.16	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW55IW-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-09	File ID:	3AV016.D
Sampled:	01/23/12 15:20	Prepared:	01/27/12 12:24	Analyzed:	01/28/12 11:11
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	45		0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	5.7		0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	220	E	0.49	1.0	1.0
79-01-6	Trichloroethene	1	<1.0	U	0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	53	106	85 - 115	
Toluene-d8	50.0	50	100	85 - 120	
4-Bromofluorobenzene	50.0	45	90	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2010568	11.49	1684111	11.52	
1,4-Difluorobenzene	3066657	12.07	2430484	12.09	
Chlorobenzene-d5	2416266	14.76	2040661	14.77	
1,4-Dichlorobenzene-d4	1137400	17.17	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW55IW-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-09RE1	File ID:	3AV034.D
Sampled:	01/23/12 15:20	Prepared:	01/27/12 12:29	Analyzed:	01/28/12 20:13
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27017 Sequence: AA18061 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	2	64	D	1.4	2.0	2.0
75-35-4	1,1-Dichloroethene	2	8.3	D	1.9	2.0	2.0
156-59-2	cis-1,2-Dichloroethene	2	290	D	0.98	2.0	2.0
79-01-6	Trichloroethene	2	<2.0	UD	1.1	2.0	2.0
127-18-4	Tetrachloroethene	2	<2.0	UD	1.5	2.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	55	110	85 - 115	
Toluene-d8	50.0	59	117	85 - 120	
4-Bromofluorobenzene	50.0	50	101	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1700256	11.49	1684111	11.52	
1,4-Difluorobenzene	2651739	12.06	2430484	12.09	
Chlorobenzene-d5	2175870	14.76	2040661	14.77	
1,4-Dichlorobenzene-d4	1012396	17.16	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW75IW-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-10	File ID:	3AV017.D
Sampled:	01/23/12 15:05	Prepared:	01/27/12 12:24	Analyzed:	01/28/12 11:41
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	43		0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	15		0.49	1.0	1.0
79-01-6	Trichloroethene	1	4.5		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	55	109	85 - 115	
Toluene-d8	50.0	51	101	85 - 120	
4-Bromofluorobenzene	50.0	45	90	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2088918	11.49	1684111	11.52	
1,4-Difluorobenzene	3150459	12.07	2430484	12.09	
Chlorobenzene-d5	2540108	14.76	2040661	14.77	
1,4-Dichlorobenzene-d4	1221329	17.16	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW73IW-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-11	File ID:	3AV018.D
Sampled:	01/23/12 15:15	Prepared:	01/27/12 12:24	Analyzed:	01/28/12 12:11
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	31		0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	31		0.49	1.0	1.0
79-01-6	Trichloroethene	1	9.1		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	49	97	85 - 115	
Toluene-d8	50.0	45	91	85 - 120	
4-Bromofluorobenzene	50.0	39	78	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2288366	11.49	1684111	11.52	
1,4-Difluorobenzene	3449053	12.07	2430484	12.09	
Chlorobenzene-d5	2865511	14.77	2040661	14.77	
1,4-Dichlorobenzene-d4	1314882	17.16	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT: TB01-012512

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Water	Laboratory ID:	A200224-12	File ID:	3AV019.D
Sampled:	01/23/12 00:00	Prepared:	01/27/12 12:24	Analyzed:	01/28/12 12:41
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.49	1.0	1.0
79-01-6	Trichloroethene	1	<1.0	U	0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	55	110	85 - 115	
Toluene-d8	50.0	50	100	85 - 120	
4-Bromofluorobenzene	50.0	45	89	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1968350	11.51	1684111	11.52	
1,4-Difluorobenzene	3124544	12.09	2430484	12.09	
Chlorobenzene-d5	2503678	14.78	2040661	14.77	
1,4-Dichlorobenzene-d4	1170903	17.18	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW71IW-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-13	File ID:	3AV020.D
Sampled:	01/24/12 10:00	Prepared:	01/27/12 12:24	Analyzed:	01/28/12 13:11
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	51		0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	13		0.49	1.0	1.0
79-01-6	Trichloroethene	1	<1.0	U	0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	104	85 - 115	
Toluene-d8	50.0	49	99	85 - 120	
4-Bromofluorobenzene	50.0	42	84	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2075584	11.49	1684111	11.52	
1,4-Difluorobenzene	3058881	12.07	2430484	12.09	
Chlorobenzene-d5	2578320	14.76	2040661	14.77	
1,4-Dichlorobenzene-d4	1182375	17.17	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW58IW-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-14	File ID:	3AV021.D
Sampled:	01/24/12 11:30	Prepared:	01/27/12 12:24	Analyzed:	01/28/12 13:41
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	170		0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	36		0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	370	E	0.49	1.0	1.0
79-01-6	Trichloroethene	1	67		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	104	85 - 115	
Toluene-d8	50.0	50	101	85 - 120	
4-Bromofluorobenzene	50.0	43	85	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2171001	11.49	1684111	11.52	
1,4-Difluorobenzene	3222219	12.07	2430484	12.09	
Chlorobenzene-d5	2727648	14.77	2040661	14.77	
1,4-Dichlorobenzene-d4	1257228	17.16	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW58IW-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-14RE1	File ID:	3AV035.D
Sampled:	01/24/12 11:30	Prepared:	01/27/12 12:29	Analyzed:	01/28/12 20:43
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27017 Sequence: AA18061 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	5	180	D	3.6	5.0	5.0
75-35-4	1,1-Dichloroethene	5	39	D	4.7	5.0	5.0
156-59-2	cis-1,2-Dichloroethene	5	410	D	2.4	5.0	5.0
79-01-6	Trichloroethene	5	68	D	2.8	5.0	5.0
127-18-4	Tetrachloroethene	5	<5.0	UD	3.8	5.0	5.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	57	114	85 - 115	
Toluene-d8	50.0	57	115	85 - 120	
4-Bromofluorobenzene	50.0	56	112	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2446186	11.49	1684111	11.52	
1,4-Difluorobenzene	3736098	12.06	2430484	12.09	
Chlorobenzene-d5	3047783	14.76	2040661	14.77	
1,4-Dichlorobenzene-d4	1473083	17.17	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW58IWD-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-15	File ID:	3AV022.D
Sampled:	01/24/12 11:35	Prepared:	01/27/12 12:24	Analyzed:	01/28/12 14:11
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	160		0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	36		0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	380	E	0.49	1.0	1.0
79-01-6	Trichloroethene	1	67		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	105	85 - 115	
Toluene-d8	50.0	49	98	85 - 120	
4-Bromofluorobenzene	50.0	42	84	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2157258	11.49	1684111	11.52	
1,4-Difluorobenzene	3230744	12.07	2430484	12.09	
Chlorobenzene-d5	2641724	14.77	2040661	14.77	
1,4-Dichlorobenzene-d4	1252591	17.17	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW58IWD-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-15RE1	File ID:	3AV036.D
Sampled:	01/24/12 11:35	Prepared:	01/27/12 12:29	Analyzed:	01/28/12 21:13
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27017 Sequence: AA18061 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	5	210	D	3.6	5.0	5.0
75-35-4	1,1-Dichloroethene	5	43	D	4.7	5.0	5.0
156-59-2	cis-1,2-Dichloroethene	5	470	D	2.4	5.0	5.0
79-01-6	Trichloroethene	5	79	D	2.8	5.0	5.0
127-18-4	Tetrachloroethene	5	<5.0	UD	3.8	5.0	5.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	56	112	85 - 115	
Toluene-d8	50.0	50	100	85 - 120	
4-Bromofluorobenzene	50.0	45	90	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2150961	11.49	1684111	11.52	
1,4-Difluorobenzene	3305290	12.07	2430484	12.09	
Chlorobenzene-d5	2658159	14.76	2040661	14.77	
1,4-Dichlorobenzene-d4	1256894	17.16	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW59IW-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-16	File ID:	3AV023.D
Sampled:	01/24/12 15:35	Prepared:	01/27/12 12:24	Analyzed:	01/28/12 14:41
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.49	1.0	1.0
79-01-6	Trichloroethene	1	<1.0	U	0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	50	100	85 - 115	
Toluene-d8	50.0	46	93	85 - 120	
4-Bromofluorobenzene	50.0	39	79	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2101876	11.49	1684111	11.52	
1,4-Difluorobenzene	3299735	12.07	2430484	12.09	
Chlorobenzene-d5	2681189	14.77	2040661	14.77	
1,4-Dichlorobenzene-d4	1224341	17.17	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW74IW-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-17	File ID:	3AV024.D
Sampled:	01/24/12 14:40	Prepared:	01/27/12 12:24	Analyzed:	01/28/12 15:11
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	86		0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	3.1		0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	51		0.49	1.0	1.0
79-01-6	Trichloroethene	1	12		0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	103	85 - 115	
Toluene-d8	50.0	51	102	85 - 120	
4-Bromofluorobenzene	50.0	43	85	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2152297	11.49	1684111	11.52	
1,4-Difluorobenzene	3093085	12.07	2430484	12.09	
Chlorobenzene-d5	2638405	14.76	2040661	14.77	
1,4-Dichlorobenzene-d4	1226383	17.17	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW70IW-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-18	File ID:	3AV007.D
Sampled:	01/24/12 14:20	Prepared:	01/27/12 12:24	Analyzed:	01/27/12 14:55
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27016 Sequence: AA18060 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	110		0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	2.9		0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	53		0.49	1.0	1.0
79-01-6	Trichloroethene	1	<1.0	U	0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	47	95	85 - 115	
Toluene-d8	50.0	47	94	85 - 120	
4-Bromofluorobenzene	50.0	41	82	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2272100	11.5	1684111	11.52	
1,4-Difluorobenzene	3343997	12.08	2430484	12.09	
Chlorobenzene-d5	2770070	14.78	2040661	14.77	
1,4-Dichlorobenzene-d4	1276294	17.18	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT:
IR86-GW72IW-12A

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-19	File ID:	3AV030.D
Sampled:	01/24/12 10:25	Prepared:	01/27/12 12:29	Analyzed:	01/28/12 18:13
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27017 Sequence: AA18061 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	24		0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	3.4		0.49	1.0	1.0
79-01-6	Trichloroethene	1	<1.0	U	0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	48	95	85 - 115	
Toluene-d8	50.0	47	94	85 - 120	
4-Bromofluorobenzene	50.0	42	83	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2227323	11.49	1684111	11.52	
1,4-Difluorobenzene	3201294	12.07	2430484	12.09	
Chlorobenzene-d5	2657407	14.76	2040661	14.77	
1,4-Dichlorobenzene-d4	1307266	17.17	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT: EB-012512

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-20	File ID:	3AV031.D
Sampled:	01/25/12 14:30	Prepared:	01/27/12 12:29	Analyzed:	01/28/12 18:42
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27017 Sequence: AA18061 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.49	1.0	1.0
79-01-6	Trichloroethene	1	<1.0	U	0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	49	98	85 - 115	
Toluene-d8	50.0	46	92	85 - 120	
4-Bromofluorobenzene	50.0	41	83	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2217332	11.49	1684111	11.52	
1,4-Difluorobenzene	3399709	12.07	2430484	12.09	
Chlorobenzene-d5	2806864	14.76	2040661	14.77	
1,4-Dichlorobenzene-d4	1306770	17.16	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT: EB-012312

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-21	File ID:	3AV032.D
Sampled:	01/23/12 16:30	Prepared:	01/27/12 12:29	Analyzed:	01/28/12 19:12
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27017 Sequence: AA18061 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.49	1.0	1.0
79-01-6	Trichloroethene	1	<1.0	U	0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	48	96	85 - 115	
Toluene-d8	50.0	46	92	85 - 120	
4-Bromofluorobenzene	50.0	39	78	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2195696	11.49	1684111	11.52	
1,4-Difluorobenzene	3282548	12.07	2430484	12.09	
Chlorobenzene-d5	2803273	14.76	2040661	14.77	
1,4-Dichlorobenzene-d4	1317575	17.16	1021309	17.17	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

DRAFT: EB-012412

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A200224-22	File ID:	3AV033.D
Sampled:	01/24/12 16:00	Prepared:	01/27/12 12:29	Analyzed:	01/28/12 19:42
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2A27017 Sequence: AA18061 Calibration: 1112016 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	1.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.49	1.0	1.0
79-01-6	Trichloroethene	1	<1.0	U	0.55	1.0	1.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	1.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	51	103	85 - 115	
Toluene-d8	50.0	46	93	85 - 120	
4-Bromofluorobenzene	50.0	40	80	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2018024	11.49	1684111	11.52	
1,4-Difluorobenzene	3224914	12.07	2430484	12.09	
Chlorobenzene-d5	2636529	14.77	2040661	14.77	
1,4-Dichlorobenzene-d4	1223719	17.16	1021309	17.17	

* Values outside of QC limits

HOLDING TIME SUMMARY

EPA 8260B

Laboratory: ENCO Orlando SDG: DRAFT CH025-064

Client: CH2M Hill, Inc. (CH025) Project: MCB Camp Lejeune, Site 86 CTO-WE09

Sample Name	Date Collected	Date Received	Date Prepared	Days to Prep	Max Days to Prep	Date Analyzed	Days to Analysis	Max Days to Analysis	Q
DRAFT: IR86-GW68-12A	01/25/12 12:35	01/26/12 09:40	01/27/12 12:24	NA	NA	01/27/12 15:25	2.00	14.00	
DRAFT: IR86-GW66-12A	01/25/12 10:05	01/26/12 09:40	01/27/12 12:24	NA	NA	01/27/12 15:55	2.00	14.00	
DRAFT: IR86-GW67-12A	01/25/12 13:20	01/26/12 09:40	01/27/12 12:24	NA	NA	01/27/12 16:25	2.00	14.00	
DRAFT: IR86-GW61-12A	01/25/12 13:55	01/26/12 09:40	01/27/12 12:24	NA	NA	01/27/12 16:55	2.00	14.00	
DRAFT: IR86-GW69-12A	01/25/12 14:15	01/26/12 09:40	01/27/12 12:24	NA	NA	01/27/12 17:25	2.00	14.00	
DRAFT: IR86-GW61IW-12A	01/25/12 11:15	01/26/12 09:40	01/27/12 12:24	NA	NA	01/27/12 17:55	2.00	14.00	
DRAFT: IR86-GW63-12A	01/25/12 10:20	01/26/12 09:40	01/27/12 12:24	NA	NA	01/27/12 18:26	2.00	14.00	
DRAFT: IR86-GW63D-12A	01/25/12 10:25	01/26/12 09:40	01/27/12 12:24	NA	NA	01/28/12 10:40	3.00	14.00	
DRAFT: IR86-GW55IW-12A	01/23/12 15:20	01/26/12 09:40	01/27/12 12:24	NA	NA	01/28/12 11:11	4.00	14.00	
DRAFT: IR86-GW55IW-12A	01/23/12 15:20	01/26/12 09:40	01/27/12 12:29	NA	NA	01/28/12 20:13	5.00	14.00	
DRAFT: IR86-GW75IW-12A	01/23/12 15:05	01/26/12 09:40	01/27/12 12:24	NA	NA	01/28/12 11:41	4.00	14.00	
DRAFT: IR86-GW73IW-12A	01/23/12 15:15	01/26/12 09:40	01/27/12 12:24	NA	NA	01/28/12 12:11	4.00	14.00	
DRAFT: TB01-012512	01/23/12 00:00	01/26/12 09:40	01/27/12 12:24	NA	NA	01/28/12 12:41	5.00	14.00	
DRAFT: IR86-GW71IW-12A	01/24/12 10:00	01/26/12 09:40	01/27/12 12:24	NA	NA	01/28/12 13:11	4.00	14.00	
DRAFT: IR86-GW58IW-12A	01/24/12 11:30	01/26/12 09:40	01/27/12 12:24	NA	NA	01/28/12 13:41	4.00	14.00	
DRAFT: IR86-GW58IW-12A	01/24/12 11:30	01/26/12 09:40	01/27/12 12:29	NA	NA	01/28/12 20:43	4.00	14.00	
DRAFT: IR86-GW58IWD-12A	01/24/12 11:35	01/26/12 09:40	01/27/12 12:24	NA	NA	01/28/12 14:11	4.00	14.00	
DRAFT: IR86-GW58IWD-12A	01/24/12 11:35	01/26/12 09:40	01/27/12 12:29	NA	NA	01/28/12 21:13	4.00	14.00	
DRAFT: IR86-GW59IW-12A	01/24/12 15:35	01/26/12 09:40	01/27/12 12:24	NA	NA	01/28/12 14:41	3.00	14.00	
DRAFT: IR86-GW74IW-12A	01/24/12 14:40	01/26/12 09:40	01/27/12 12:24	NA	NA	01/28/12 15:11	4.00	14.00	
DRAFT: IR86-GW70IW-12A	01/24/12 14:20	01/26/12 09:40	01/27/12 12:24	NA	NA	01/27/12 14:55	3.00	14.00	
DRAFT: IR86-GW72IW-12A	01/24/12 10:25	01/26/12 09:40	01/27/12 12:29	NA	NA	01/28/12 18:13	4.00	14.00	
DRAFT: EB-012512	01/25/12 14:30	01/26/12 09:40	01/27/12 12:29	NA	NA	01/28/12 18:42	3.00	14.00	

HOLDING TIME SUMMARY

EPA 8260B

Laboratory: ENCO Orlando

SDG: DRAFT CH025-064

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, Site 86 CTO-WE09

Sample Name	Date Collected	Date Received	Date Prepared	Days to Prep	Max Days to Prep	Date Analyzed	Days to Analysis	Max Days to Analysis	Q
DRAFT: EB-012312	01/23/12 16:30	01/26/12 09:40	01/27/12 12:29	NA	NA	01/28/12 19:12	5.00	14.00	
DRAFT: EB-012412	01/24/12 16:00	01/26/12 09:40	01/27/12 12:29	NA	NA	01/28/12 19:42	4.00	14.00	

PREPARATION BATCH SUMMARY

EPA 8260B

Laboratory: ENCO Orlando SDG: DRAFT CH025-064

Client: CH2M Hill, Inc. (CH025) Project: MCB Camp Lejeune, Site 86 CTO-WE09

Batch: 2A27016 Batch Matrix: Water Preparation: EPA 5030B_MS

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
Blank	2A27016-BLK1	3AV004.D	01/27/12 12:24	
Blank	2A27016-BLK2	3AV102.D	01/27/12 12:24	
LCS	2A27016-BS1	3AV003.D	01/27/12 12:24	
IR86-GW70IW-12A	2A27016-MS1	3AV005.D	01/27/12 12:24	
IR86-GW70IW-12A	2A27016-MSD1	3AV006.D	01/27/12 12:24	
DRAFT: IR86-GW68-12A	A200224-01	3AV008.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW66-12A	A200224-02	3AV009.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW67-12A	A200224-03	3AV010.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW61-12A	A200224-04	3AV011.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW69-12A	A200224-05	3AV012.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW61IW-12A	A200224-06	3AV013.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW63-12A	A200224-07	3AV014.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW63D-12A	A200224-08	3AV015.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW55IW-12A	A200224-09	3AV016.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW75IW-12A	A200224-10	3AV017.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW73IW-12A	A200224-11	3AV018.D	01/27/12 12:24	*custom list*
DRAFT: TB01-012512	A200224-12	3AV019.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW71IW-12A	A200224-13	3AV020.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW58IW-12A	A200224-14	3AV021.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW58IWD-12A	A200224-15	3AV022.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW59IW-12A	A200224-16	3AV023.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW74IW-12A	A200224-17	3AV024.D	01/27/12 12:24	*custom list*
DRAFT: IR86-GW70IW-12A	A200224-18	3AV007.D	01/27/12 12:24	*custom list* MS/MSD

PREPARATION BATCH SUMMARY

EPA 8260B

Laboratory: ENCO Orlando SDG: DRAFT CH025-064

Client: CH2M Hill, Inc. (CH025) Project: MCB Camp Lejeune, Site 86 CTO-WE09

Batch: 2A27017 Batch Matrix: Water Preparation: EPA 5030B_MS

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
Blank	2A27017-BLK1	3AV029.D	01/27/12 12:29	
LCS	2A27017-BS1	3AV027.D	01/27/12 12:29	
LCS Dup	2A27017-BSD1	3AV028.D	01/27/12 12:29	
DRAFT: IR86-GW55IW-12A	A200224-09RE1	3AV034.D	01/27/12 12:29	rr 2x Re-extract added 1/28/2012 by KAT
DRAFT: IR86-GW58IW-12A	A200224-14RE1	3AV035.D	01/27/12 12:29	rr 5xx Re-extract added 1/28/2012 by KAT
DRAFT: IR86-GW58IWD-12A	A200224-15RE1	3AV036.D	01/27/12 12:29	rr 5xx Re-extract added 1/28/2012 by KAT
DRAFT: IR86-GW72IW-12A	A200224-19	3AV030.D	01/27/12 12:29	*custom list*
DRAFT: EB-012512	A200224-20	3AV031.D	01/27/12 12:29	*custom list*
DRAFT: EB-012312	A200224-21	3AV032.D	01/27/12 12:29	*custom list*
DRAFT: EB-012412	A200224-22	3AV033.D	01/27/12 12:29	*custom list*

METHOD BLANK DATA SHEET
EPA 8260B

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Water	Laboratory ID:	2A27016-BLK1	File ID:	3AV004.D
Prepared:	01/27/12 12:24	Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL
Analyzed:	01/27/12 13:24	Instrument:	OVGCMS3		
Batch:	2A27016	Sequence:	AA18060	Calibration:	1112016

CAS NO.	COMPOUND	CONC. (ug/L)	Q
75-01-4	Vinyl chloride	<1.0	U
75-35-4	1,1-Dichloroethene	<1.0	U
156-59-2	cis-1,2-Dichloroethene	<1.0	U
79-01-6	Trichloroethene	<1.0	U
127-18-4	Tetrachloroethene	<1.0	U

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	48	96	85 - 115	
Toluene-d8	50.0	47	94	85 - 120	
4-Bromofluorobenzene	50.0	41	82	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2151513	11.51	1684111	11.52	
1,4-Difluorobenzene	3233798	12.08	2430484	12.09	
Chlorobenzene-d5	2627917	14.78	2040661	14.77	
1,4-Dichlorobenzene-d4	1221804	17.18	1021309	17.17	

METHOD BLANK DATA SHEET
EPA 8260B

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Water	Laboratory ID:	2A27016-BLK2	File ID:	3AV102.D
Prepared:	01/27/12 12:24	Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL
Analyzed:	01/28/12 10:10	Instrument:	OVGCMS3		
Batch:	2A27016	Sequence:	AA18060	Calibration:	1112016

CAS NO.	COMPOUND	CONC. (ug/L)	Q
75-01-4	Vinyl chloride	<1.0	U
75-35-4	1,1-Dichloroethene	<1.0	U
156-59-2	cis-1,2-Dichloroethene	<1.0	U
79-01-6	Trichloroethene	<1.0	U
127-18-4	Tetrachloroethene	<1.0	U

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	53	106	85 - 115	
Toluene-d8	50.0	50	100	85 - 120	
4-Bromofluorobenzene	50.0	46	92	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2035158	11.49	1684111	11.52	
1,4-Difluorobenzene	3110228	12.07	2430484	12.09	
Chlorobenzene-d5	2416504	14.76	2040661	14.77	
1,4-Dichlorobenzene-d4	1130166	17.17	1021309	17.17	

METHOD BLANK DATA SHEET
EPA 8260B

Laboratory:	ENCO Orlando			SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Water	Laboratory ID:	2A27017-BLK1	File ID:	3AV029.D
Prepared:	01/27/12 12:29	Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL
Analyzed:	01/28/12 17:42	Instrument:	OVGCMS3		
Batch:	2A27017	Sequence:	AA18061	Calibration:	1112016

CAS NO.	COMPOUND	CONC. (ug/L)	Q
75-01-4	Vinyl chloride	<1.0	U
75-35-4	1,1-Dichloroethene	<1.0	U
156-59-2	cis-1,2-Dichloroethene	<1.0	U
79-01-6	Trichloroethene	<1.0	U
127-18-4	Tetrachloroethene	<1.0	U

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	50	101	85 - 115	
Toluene-d8	50.0	47	93	85 - 120	
4-Bromofluorobenzene	50.0	42	83	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	2181093	11.49	1684111	11.52	
1,4-Difluorobenzene	3378171	12.07	2430484	12.09	
Chlorobenzene-d5	2692924	14.77	2040661	14.77	
1,4-Dichlorobenzene-d4	1280523	17.17	1021309	17.17	

LCS / LCS DUPLICATE RECOVERY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Water		
Batch:	2A27016	Laboratory ID:	2A27016-BS1
Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

COMPOUND	SPIKE ADDED (ug/L)	LCS CONCENTRATION (ug/L)	LCS % REC. #	QC LIMITS REC.
Vinyl chloride	20.0	16	81	50 - 145
1,1-Dichloroethene	20.0	23	117	70 - 130
cis-1,2-Dichloroethene	20.0	16	81	70 - 125
Trichloroethene	20.0	19	96	70 - 125
Tetrachloroethene	20.0	21	103	45 - 150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

LCS / LCS DUPLICATE RECOVERY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Water		
Batch:	2A27017	Laboratory ID:	2A27017-BS1
Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

COMPOUND	SPIKE ADDED (ug/L)	LCS CONCENTRATION (ug/L)	LCS % REC. #	QC LIMITS REC.
Vinyl chloride	20.0	15	74	50 - 145
1,1-Dichloroethene	20.0	21	107	70 - 130
cis-1,2-Dichloroethene	20.0	15	75	70 - 125
Trichloroethene	20.0	18	89	70 - 125
Tetrachloroethene	20.0	18	91	45 - 150

COMPOUND	SPIKE ADDED (ug/L)	LCSD CONCENTRATION (ug/L)	LCSD % REC. #	% RPD #	QC LIMITS	
					RPD	REC.
Vinyl chloride	20.0	15	76	4	30	50 - 145
1,1-Dichloroethene	20.0	20	102	5	30	70 - 130
cis-1,2-Dichloroethene	20.0	16	79	5	30	70 - 125
Trichloroethene	20.0	18	92	3	30	70 - 125
Tetrachloroethene	20.0	18	92	1	30	45 - 150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY

IR86-GW70IW-12A

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Water		
Batch:	2A27016	Laboratory ID:	2A27016-MS1
Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Source Sample Name: IR86-GW70IW-12A

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	MS CONCENTRATION (ug/L)	MS % REC. #	QC LIMITS REC.
Vinyl chloride	20.0	110	120	88	50 - 145
1,1-Dichloroethene	20.0	2.9	25	112	70 - 130
cis-1,2-Dichloroethene	20.0	53	71	89	70 - 125
Trichloroethene	20.0	ND	19	97	70 - 125
Tetrachloroethene	20.0	ND	20	102	45 - 150

COMPOUND	SPIKE ADDED (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC. #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
Vinyl chloride	20.0	120	85	0.6	30	50 - 145
1,1-Dichloroethene	20.0	25	109	3	30	70 - 130
cis-1,2-Dichloroethene	20.0	71	87	0.4	30	70 - 125
Trichloroethene	20.0	20	98	0.7	30	70 - 125
Tetrachloroethene	20.0	20	101	0.5	30	45 - 150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

SURROGATE STANDARD RECOVERY AND RT SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA17439	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
Initial Cal Blank (AA17439-ICB1)			Lab File ID: 3LA002.D		Analyzed: 12/06/11 10:49			
Dibromofluoromethane			85 - 115	11.11	11.112	-0.0020	+/-0.5	
Toluene-d8			85 - 120	13.37	13.366	0.0040	+/-0.5	
4-Bromofluorobenzene			75 - 120	15.92	15.916	0.0040	+/-0.5	
Secondary Cal Check (AA17439-SCV1)			Lab File ID: 3LA014.D		Analyzed: 12/06/11 16:52			
Dibromofluoromethane	50.0	86	80 - 120	11.11	11.112	-0.0020	+/-0.5	
Toluene-d8	50.0	91	80 - 120	13.37	13.366	0.0040	+/-0.5	
4-Bromofluorobenzene	50.0	85	80 - 120	15.92	15.916	0.0040	+/-0.5	
Secondary Cal Check (AA17439-SCV2)			Lab File ID: 3LA015.D		Analyzed: 12/06/11 17:23			
Dibromofluoromethane	50.0	82	80 - 120	11.12	11.112	0.0080	+/-0.5	
Toluene-d8	50.0	92	80 - 120	13.36	13.366	-0.0060	+/-0.5	
4-Bromofluorobenzene	50.0	87	80 - 120	15.92	15.916	0.0040	+/-0.5	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA18060	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
Calibration Check (AA18060-CCV1)			Lab File ID: 3AV002.D		Analyzed: 01/27/12 12:25			
Dibromofluoromethane	50.0	95	80 - 120	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	102	80 - 120	13.37	13.366	0.0040	+/-0.5	
4-Bromofluorobenzene	50.0	83	80 - 120	15.92	15.916	0.0040	+/-0.5	
LCS (2A27016-BS1)			Lab File ID: 3AV003.D		Analyzed: 01/27/12 12:54			
Dibromofluoromethane	50.0	101	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	101	85 - 120	13.36	13.366	-0.0060	+/-0.5	
4-Bromofluorobenzene	50.0	83	75 - 120	15.92	15.916	0.0040	+/-0.5	
Blank (2A27016-BLK1)			Lab File ID: 3AV004.D		Analyzed: 01/27/12 13:24			
Dibromofluoromethane	50.0	96	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	94	85 - 120	13.36	13.366	-0.0060	+/-0.5	
4-Bromofluorobenzene	50.0	82	75 - 120	15.92	15.916	0.0040	+/-0.5	
Matrix Spike (2A27016-MS1)			Lab File ID: 3AV005.D		Analyzed: 01/27/12 13:55			
Dibromofluoromethane	50.0	96	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	96	85 - 120	13.36	13.366	-0.0060	+/-0.5	
4-Bromofluorobenzene	50.0	80	75 - 120	15.92	15.916	0.0040	+/-0.5	
Matrix Spike Dup (2A27016-MSD1)			Lab File ID: 3AV006.D		Analyzed: 01/27/12 14:25			
Dibromofluoromethane	50.0	91	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	94	85 - 120	13.37	13.366	0.0040	+/-0.5	
4-Bromofluorobenzene	50.0	78	75 - 120	15.92	15.916	0.0040	+/-0.5	
DRAFT: IR86-GW70IW-12A (A200224-18)			Lab File ID: 3AV007.D		Analyzed: 01/27/12 14:55			
Dibromofluoromethane	50.0	95	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	94	85 - 120	13.37	13.366	0.0040	+/-0.5	
4-Bromofluorobenzene	50.0	82	75 - 120	15.92	15.916	0.0040	+/-0.5	
DRAFT: IR86-GW68-12A (A200224-01)			Lab File ID: 3AV008.D		Analyzed: 01/27/12 15:25			
Dibromofluoromethane	50.0	97	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	97	85 - 120	13.36	13.366	-0.0060	+/-0.5	
4-Bromofluorobenzene	50.0	84	75 - 120	15.92	15.916	0.0040	+/-0.5	
DRAFT: IR86-GW66-12A (A200224-02)			Lab File ID: 3AV009.D		Analyzed: 01/27/12 15:55			
Dibromofluoromethane	50.0	102	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	98	85 - 120	13.37	13.366	0.0040	+/-0.5	
4-Bromofluorobenzene	50.0	85	75 - 120	15.93	15.916	0.0140	+/-0.5	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA18060	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
DRAFT: IR86-GW67-12A (A200224-03)			Lab File ID: 3AV010.D		Analyzed: 01/27/12 16:25			
Dibromofluoromethane	50.0	100	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	96	85 - 120	13.36	13.366	-0.0060	+/-0.5	
4-Bromofluorobenzene	50.0	82	75 - 120	15.92	15.916	0.0040	+/-0.5	
DRAFT: IR86-GW61-12A (A200224-04)			Lab File ID: 3AV011.D		Analyzed: 01/27/12 16:55			
Dibromofluoromethane	50.0	115	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	112	85 - 120	13.36	13.366	-0.0060	+/-0.5	
4-Bromofluorobenzene	50.0	94	75 - 120	15.92	15.916	0.0040	+/-0.5	
DRAFT: IR86-GW69-12A (A200224-05)			Lab File ID: 3AV012.D		Analyzed: 01/27/12 17:25			
Dibromofluoromethane	50.0	110	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	101	85 - 120	13.36	13.366	-0.0060	+/-0.5	
4-Bromofluorobenzene	50.0	90	75 - 120	15.92	15.916	0.0040	+/-0.5	
DRAFT: IR86-GW61IW-12A (A200224-06)			Lab File ID: 3AV013.D		Analyzed: 01/27/12 17:55			
Dibromofluoromethane	50.0	107	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	102	85 - 120	13.37	13.366	0.0040	+/-0.5	
4-Bromofluorobenzene	50.0	90	75 - 120	15.92	15.916	0.0040	+/-0.5	
DRAFT: IR86-GW63-12A (A200224-07)			Lab File ID: 3AV014.D		Analyzed: 01/27/12 18:26			
Dibromofluoromethane	50.0	106	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	93	85 - 120	13.36	13.366	-0.0060	+/-0.5	
4-Bromofluorobenzene	50.0	86	75 - 120	15.91	15.916	-0.0060	+/-0.5	
Calibration Check (AA18060-CCV2)			Lab File ID: 3AV101.D		Analyzed: 01/28/12 09:28			
Dibromofluoromethane	50.0	101	80 - 120	11.08	11.112	-0.0320	+/-0.5	
Toluene-d8	50.0	103	80 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	86	80 - 120	15.91	15.916	-0.0060	+/-0.5	
Blank (2A27016-BLK2)			Lab File ID: 3AV102.D		Analyzed: 01/28/12 10:10			
Dibromofluoromethane	50.0	106	85 - 115	11.08	11.112	-0.0320	+/-0.5	
Toluene-d8	50.0	100	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	92	75 - 120	15.91	15.916	-0.0060	+/-0.5	
DRAFT: IR86-GW63D-12A (A200224-08)			Lab File ID: 3AV015.D		Analyzed: 01/28/12 10:40			
Dibromofluoromethane	50.0	104	85 - 115	11.08	11.112	-0.0320	+/-0.5	
Toluene-d8	50.0	99	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	90	75 - 120	15.91	15.916	-0.0060	+/-0.5	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA18060	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
DRAFT: IR86-GW55IW-12A (A200224-09)			Lab File ID: 3AV016.D		Analyzed: 01/28/12 11:11			
Dibromofluoromethane	50.0	106	85 - 115	11.08	11.112	-0.0320	+/-0.5	
Toluene-d8	50.0	100	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	90	75 - 120	15.91	15.916	-0.0060	+/-0.5	
DRAFT: IR86-GW75IW-12A (A200224-10)			Lab File ID: 3AV017.D		Analyzed: 01/28/12 11:41			
Dibromofluoromethane	50.0	109	85 - 115	11.08	11.112	-0.0320	+/-0.5	
Toluene-d8	50.0	101	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	90	75 - 120	15.91	15.916	-0.0060	+/-0.5	
DRAFT: IR86-GW73IW-12A (A200224-11)			Lab File ID: 3AV018.D		Analyzed: 01/28/12 12:11			
Dibromofluoromethane	50.0	97	85 - 115	11.09	11.112	-0.0220	+/-0.5	
Toluene-d8	50.0	91	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	78	75 - 120	15.9	15.916	-0.0160	+/-0.5	
DRAFT: TB01-012512 (A200224-12)			Lab File ID: 3AV019.D		Analyzed: 01/28/12 12:41			
Dibromofluoromethane	50.0	110	85 - 115	11.1	11.112	-0.0120	+/-0.5	
Toluene-d8	50.0	100	85 - 120	13.37	13.366	0.0040	+/-0.5	
4-Bromofluorobenzene	50.0	89	75 - 120	15.93	15.916	0.0140	+/-0.5	
DRAFT: IR86-GW71IW-12A (A200224-13)			Lab File ID: 3AV020.D		Analyzed: 01/28/12 13:11			
Dibromofluoromethane	50.0	104	85 - 115	11.09	11.112	-0.0220	+/-0.5	
Toluene-d8	50.0	99	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	84	75 - 120	15.91	15.916	-0.0060	+/-0.5	
DRAFT: IR86-GW58IW-12A (A200224-14)			Lab File ID: 3AV021.D		Analyzed: 01/28/12 13:41			
Dibromofluoromethane	50.0	104	85 - 115	11.09	11.112	-0.0220	+/-0.5	
Toluene-d8	50.0	101	85 - 120	13.36	13.366	-0.0060	+/-0.5	
4-Bromofluorobenzene	50.0	85	75 - 120	15.91	15.916	-0.0060	+/-0.5	
DRAFT: IR86-GW58IWD-12A (A200224-15)			Lab File ID: 3AV022.D		Analyzed: 01/28/12 14:11			
Dibromofluoromethane	50.0	105	85 - 115	11.09	11.112	-0.0220	+/-0.5	
Toluene-d8	50.0	98	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	84	75 - 120	15.91	15.916	-0.0060	+/-0.5	
DRAFT: IR86-GW59IW-12A (A200224-16)			Lab File ID: 3AV023.D		Analyzed: 01/28/12 14:41			
Dibromofluoromethane	50.0	100	85 - 115	11.08	11.112	-0.0320	+/-0.5	
Toluene-d8	50.0	93	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	79	75 - 120	15.91	15.916	-0.0060	+/-0.5	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA18060	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
DRAFT: IR86-GW74IW-12A (A200224-17)			Lab File ID: 3AV024.D		Analyzed: 01/28/12 15:11			
Dibromofluoromethane	50.0	103	85 - 115	11.09	11.112	-0.0220	+/-0.5	
Toluene-d8	50.0	102	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	85	75 - 120	15.91	15.916	-0.0060	+/-0.5	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA18061	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
Calibration Check (AA18061-CCV1)			Lab File ID: 3AV026.D		Analyzed: 01/28/12 16:11			
Dibromofluoromethane	50.0	98	80 - 120	11.09	11.112	-0.0220	+/-0.5	
Toluene-d8	50.0	101	80 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	85	80 - 120	15.91	15.916	-0.0060	+/-0.5	
LCS (2A27017-BS1)			Lab File ID: 3AV027.D		Analyzed: 01/28/12 16:42			
Dibromofluoromethane	50.0	94	85 - 115	11.09	11.112	-0.0220	+/-0.5	
Toluene-d8	50.0	94	85 - 120	13.36	13.366	-0.0060	+/-0.5	
4-Bromofluorobenzene	50.0	81	75 - 120	15.91	15.916	-0.0060	+/-0.5	
LCS Dup (2A27017-BSD1)			Lab File ID: 3AV028.D		Analyzed: 01/28/12 17:12			
Dibromofluoromethane	50.0	99	85 - 115	11.09	11.112	-0.0220	+/-0.5	
Toluene-d8	50.0	95	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	83	75 - 120	15.91	15.916	-0.0060	+/-0.5	
Blank (2A27017-BLK1)			Lab File ID: 3AV029.D		Analyzed: 01/28/12 17:42			
Dibromofluoromethane	50.0	101	85 - 115	11.08	11.112	-0.0320	+/-0.5	
Toluene-d8	50.0	93	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	83	75 - 120	15.91	15.916	-0.0060	+/-0.5	
DRAFT: IR86-GW72IW-12A (A200224-19)			Lab File ID: 3AV030.D		Analyzed: 01/28/12 18:13			
Dibromofluoromethane	50.0	95	85 - 115	11.08	11.112	-0.0320	+/-0.5	
Toluene-d8	50.0	94	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	83	75 - 120	15.91	15.916	-0.0060	+/-0.5	
DRAFT: EB-012512 (A200224-20)			Lab File ID: 3AV031.D		Analyzed: 01/28/12 18:42			
Dibromofluoromethane	50.0	98	85 - 115	11.08	11.112	-0.0320	+/-0.5	
Toluene-d8	50.0	92	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	83	75 - 120	15.91	15.916	-0.0060	+/-0.5	
DRAFT: EB-012312 (A200224-21)			Lab File ID: 3AV032.D		Analyzed: 01/28/12 19:12			
Dibromofluoromethane	50.0	96	85 - 115	11.09	11.112	-0.0220	+/-0.5	
Toluene-d8	50.0	92	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	78	75 - 120	15.9	15.916	-0.0160	+/-0.5	
DRAFT: EB-012412 (A200224-22)			Lab File ID: 3AV033.D		Analyzed: 01/28/12 19:42			
Dibromofluoromethane	50.0	103	85 - 115	11.09	11.112	-0.0220	+/-0.5	
Toluene-d8	50.0	93	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	80	75 - 120	15.91	15.916	-0.0060	+/-0.5	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA18061	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
DRAFT: IR86-GW55IW-12A (A200224-09RE1)			Lab File ID: 3AV034.D		Analyzed: 01/28/12 20:13			
Dibromofluoromethane	50.0	110	85 - 115	11.08	11.112	-0.0320	+/-0.5	
Toluene-d8	50.0	117	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	101	75 - 120	15.91	15.916	-0.0060	+/-0.5	
DRAFT: IR86-GW58IW-12A (A200224-14RE1)			Lab File ID: 3AV035.D		Analyzed: 01/28/12 20:43			
Dibromofluoromethane	50.0	114	85 - 115	11.08	11.112	-0.0320	+/-0.5	
Toluene-d8	50.0	115	85 - 120	13.35	13.366	-0.0160	+/-0.5	
4-Bromofluorobenzene	50.0	112	75 - 120	15.91	15.916	-0.0060	+/-0.5	
DRAFT: IR86-GW58IWD-12A (A200224-15RE1)			Lab File ID: 3AV036.D		Analyzed: 01/28/12 21:13			
Dibromofluoromethane	50.0	112	85 - 115	11.08	11.112	-0.0320	+/-0.5	
Toluene-d8	50.0	100	85 - 120	13.34	13.366	-0.0260	+/-0.5	
4-Bromofluorobenzene	50.0	90	75 - 120	15.91	15.916	-0.0060	+/-0.5	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA17439	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Initial Cal Blank (AA17439-ICB1)			Lab File ID: 3LA002.D			Analyzed: 12/06/11 10:49			
Pentafluorobenzene	1845013	11.51	1684111	11.52	110	50 - 200	-0.0100	+/-0.50	
1,4-Difluorobenzene	2871797	12.09	2430484	12.09	118	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	2329278	14.77	2040661	14.77	114	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1112610	17.17	1021309	17.17	109	50 - 200	0.0000	+/-0.50	
Cal Standard (AA17439-CAL1)			Lab File ID: 3LA003.D			Analyzed: 12/06/11 11:19			
Pentafluorobenzene	1769276	11.51	1684111	11.52	105	50 - 200	-0.0100	+/-0.50	
1,4-Difluorobenzene	2775146	12.09	2430484	12.09	114	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	2279211	14.77	2040661	14.77	112	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1070452	17.17	1021309	17.17	105	50 - 200	0.0000	+/-0.50	
Cal Standard (AA17439-CAL2)			Lab File ID: 3LA004.D			Analyzed: 12/06/11 11:49			
Pentafluorobenzene	1844751	11.51	1684111	11.52	110	50 - 200	-0.0100	+/-0.50	
1,4-Difluorobenzene	2902083	12.09	2430484	12.09	119	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	2553032	14.77	2040661	14.77	125	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1081141	17.16	1021309	17.17	106	50 - 200	-0.0100	+/-0.50	
Cal Standard (AA17439-CAL4)			Lab File ID: 3LA006.D			Analyzed: 12/06/11 12:50			
Pentafluorobenzene	1723947	11.51	1684111	11.52	102	50 - 200	-0.0100	+/-0.50	
1,4-Difluorobenzene	2577792	12.09	2430484	12.09	106	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	2123191	14.78	2040661	14.77	104	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1052420	17.17	1021309	17.17	103	50 - 200	0.0000	+/-0.50	
Cal Standard (AA17439-CAL5)			Lab File ID: 3LA007.D			Analyzed: 12/06/11 13:20			
Pentafluorobenzene	1684111	11.52	1684111	11.52	100	50 - 200	0.0000	+/-0.50	
1,4-Difluorobenzene	2430484	12.09	2430484	12.09	100	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	2040661	14.77	2040661	14.77	100	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1021309	17.17	1021309	17.17	100	50 - 200	0.0000	+/-0.50	
Cal Standard (AA17439-CAL6)			Lab File ID: 3LA008.D			Analyzed: 12/06/11 13:50			
Pentafluorobenzene	1666608	11.52	1684111	11.52	99	50 - 200	0.0000	+/-0.50	
1,4-Difluorobenzene	2244294	12.09	2430484	12.09	92	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	1875816	14.78	2040661	14.77	92	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	967021	17.17	1021309	17.17	95	50 - 200	0.0000	+/-0.50	
Cal Standard (AA17439-CAL7)			Lab File ID: 3LA009.D			Analyzed: 12/06/11 14:20			
Pentafluorobenzene	1681358	11.52	1684111	11.52	100	50 - 200	0.0000	+/-0.50	
1,4-Difluorobenzene	2567867	12.09	2430484	12.09	106	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	2218115	14.78	2040661	14.77	109	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1060717	17.17	1021309	17.17	104	50 - 200	0.0000	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA17439	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Cal Standard (AA17439-CAL3)			Lab File ID: 3LA012.D			Analyzed: 12/06/11 15:51			
Pentafluorobenzene	1704116	11.52	1684111	11.52	101	50 - 200	0.0000	+/-0.50	
1,4-Difluorobenzene	2516148	12.09	2430484	12.09	104	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	2142380	14.78	2040661	14.77	105	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1027274	17.17	1021309	17.17	101	50 - 200	0.0000	+/-0.50	
Secondary Cal Check (AA17439-SCV1)			Lab File ID: 3LA014.D			Analyzed: 12/06/11 16:52			
Pentafluorobenzene	1673953	11.52	1684111	11.52	99	50 - 200	0.0000	+/-0.50	
1,4-Difluorobenzene	2470128	12.09	2430484	12.09	102	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	2069502	14.77	2040661	14.77	101	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1013157	17.17	1021309	17.17	99	50 - 200	0.0000	+/-0.50	
Secondary Cal Check (AA17439-SCV2)			Lab File ID: 3LA015.D			Analyzed: 12/06/11 17:23			
Pentafluorobenzene	1675126	11.51	1684111	11.52	99	50 - 200	-0.0100	+/-0.50	
1,4-Difluorobenzene	2353315	12.09	2430484	12.09	97	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	1964944	14.78	2040661	14.77	96	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	990705	17.17	1021309	17.17	97	50 - 200	0.0000	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA18060	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Calibration Check (AA18060-CCV1)			Lab File ID: 3AV002.D			Analyzed: 01/27/12 12:25			
Pentafluorobenzene	2308558	11.5	1684111	11.52	137	50 - 200	-0.0200	+/-0.50	
1,4-Difluorobenzene	3282082	12.08	2430484	12.09	135	50 - 200	-0.0100	+/-0.50	
Chlorobenzene-d5	2959674	14.78	2040661	14.77	145	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1451585	17.17	1021309	17.17	142	50 - 200	0.0000	+/-0.50	
LCS (2A27016-BS1)			Lab File ID: 3AV003.D			Analyzed: 01/27/12 12:54			
Pentafluorobenzene	2181331	11.51	1684111	11.52	130	50 - 200	-0.0100	+/-0.50	
1,4-Difluorobenzene	3185017	12.08	2430484	12.09	131	50 - 200	-0.0100	+/-0.50	
Chlorobenzene-d5	2729349	14.78	2040661	14.77	134	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1340509	17.18	1021309	17.17	131	50 - 200	0.0100	+/-0.50	
Blank (2A27016-BLK1)			Lab File ID: 3AV004.D			Analyzed: 01/27/12 13:24			
Pentafluorobenzene	2151513	11.51	1684111	11.52	128	50 - 200	-0.0100	+/-0.50	
1,4-Difluorobenzene	3233798	12.08	2430484	12.09	133	50 - 200	-0.0100	+/-0.50	
Chlorobenzene-d5	2627917	14.78	2040661	14.77	129	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1221804	17.18	1021309	17.17	120	50 - 200	0.0100	+/-0.50	
Matrix Spike (2A27016-MS1)			Lab File ID: 3AV005.D			Analyzed: 01/27/12 13:55			
Pentafluorobenzene	2271219	11.51	1684111	11.52	135	50 - 200	-0.0100	+/-0.50	
1,4-Difluorobenzene	3329337	12.08	2430484	12.09	137	50 - 200	-0.0100	+/-0.50	
Chlorobenzene-d5	2847206	14.78	2040661	14.77	140	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1420957	17.18	1021309	17.17	139	50 - 200	0.0100	+/-0.50	
Matrix Spike Dup (2A27016-MSD1)			Lab File ID: 3AV006.D			Analyzed: 01/27/12 14:25			
Pentafluorobenzene	2351029	11.5	1684111	11.52	140	50 - 200	-0.0200	+/-0.50	
1,4-Difluorobenzene	3410309	12.08	2430484	12.09	140	50 - 200	-0.0100	+/-0.50	
Chlorobenzene-d5	2964777	14.78	2040661	14.77	145	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1453339	17.18	1021309	17.17	142	50 - 200	0.0100	+/-0.50	
DRAFT: IR86-GW70IW-12A (A200224-18)			Lab File ID: 3AV007.D			Analyzed: 01/27/12 14:55			
Pentafluorobenzene	2272100	11.5	1684111	11.52	135	50 - 200	-0.0200	+/-0.50	
1,4-Difluorobenzene	3343997	12.08	2430484	12.09	138	50 - 200	-0.0100	+/-0.50	
Chlorobenzene-d5	2770070	14.78	2040661	14.77	136	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1276294	17.18	1021309	17.17	125	50 - 200	0.0100	+/-0.50	
DRAFT: IR86-GW68-12A (A200224-01)			Lab File ID: 3AV008.D			Analyzed: 01/27/12 15:25			
Pentafluorobenzene	2112658	11.51	1684111	11.52	125	50 - 200	-0.0100	+/-0.50	
1,4-Difluorobenzene	3091194	12.08	2430484	12.09	127	50 - 200	-0.0100	+/-0.50	
Chlorobenzene-d5	2577687	14.78	2040661	14.77	126	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1199819	17.18	1021309	17.17	117	50 - 200	0.0100	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA18060	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
DRAFT: IR86-GW66-12A (A200224-02)			Lab File ID: 3AV009.D			Analyzed: 01/27/12 15:55			
Pentafluorobenzene	2034091	11.51	1684111	11.52	121	50 - 200	-0.0100	+/-0.50	
1,4-Difluorobenzene	3142945	12.09	2430484	12.09	129	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	2509179	14.78	2040661	14.77	123	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1169535	17.18	1021309	17.17	115	50 - 200	0.0100	+/-0.50	
DRAFT: IR86-GW67-12A (A200224-03)			Lab File ID: 3AV010.D			Analyzed: 01/27/12 16:25			
Pentafluorobenzene	2079795	11.5	1684111	11.52	123	50 - 200	-0.0200	+/-0.50	
1,4-Difluorobenzene	3216943	12.08	2430484	12.09	132	50 - 200	-0.0100	+/-0.50	
Chlorobenzene-d5	2618167	14.78	2040661	14.77	128	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1226006	17.17	1021309	17.17	120	50 - 200	0.0000	+/-0.50	
DRAFT: IR86-GW61-12A (A200224-04)			Lab File ID: 3AV011.D			Analyzed: 01/27/12 16:55			
Pentafluorobenzene	1817381	11.51	1684111	11.52	108	50 - 200	-0.0100	+/-0.50	
1,4-Difluorobenzene	2732782	12.08	2430484	12.09	112	50 - 200	-0.0100	+/-0.50	
Chlorobenzene-d5	2300136	14.78	2040661	14.77	113	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1054148	17.18	1021309	17.17	103	50 - 200	0.0100	+/-0.50	
DRAFT: IR86-GW69-12A (A200224-05)			Lab File ID: 3AV012.D			Analyzed: 01/27/12 17:25			
Pentafluorobenzene	2036651	11.5	1684111	11.52	121	50 - 200	-0.0200	+/-0.50	
1,4-Difluorobenzene	3125160	12.08	2430484	12.09	129	50 - 200	-0.0100	+/-0.50	
Chlorobenzene-d5	2557916	14.77	2040661	14.77	125	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1174626	17.17	1021309	17.17	115	50 - 200	0.0000	+/-0.50	
DRAFT: IR86-GW61IW-12A (A200224-06)			Lab File ID: 3AV013.D			Analyzed: 01/27/12 17:55			
Pentafluorobenzene	1865612	11.5	1684111	11.52	111	50 - 200	-0.0200	+/-0.50	
1,4-Difluorobenzene	2865979	12.08	2430484	12.09	118	50 - 200	-0.0100	+/-0.50	
Chlorobenzene-d5	2326053	14.78	2040661	14.77	114	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1091180	17.17	1021309	17.17	107	50 - 200	0.0000	+/-0.50	
DRAFT: IR86-GW63-12A (A200224-07)			Lab File ID: 3AV014.D			Analyzed: 01/27/12 18:26			
Pentafluorobenzene	1997099	11.5	1684111	11.52	119	50 - 200	-0.0200	+/-0.50	
1,4-Difluorobenzene	3154202	12.08	2430484	12.09	130	50 - 200	-0.0100	+/-0.50	
Chlorobenzene-d5	2538466	14.78	2040661	14.77	124	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1213028	17.17	1021309	17.17	119	50 - 200	0.0000	+/-0.50	
Calibration Check (AA18060-CCV2)			Lab File ID: 3AV101.D			Analyzed: 01/28/12 09:28			
Pentafluorobenzene	2120378	11.48	1684111	11.52	126	50 - 200	-0.0400	+/-0.50	
1,4-Difluorobenzene	3115145	12.07	2430484	12.09	128	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2779448	14.76	2040661	14.77	136	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1349064	17.16	1021309	17.17	132	50 - 200	-0.0100	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA18060	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Blank (2A27016-BLK2)			Lab File ID: 3AV102.D			Analyzed: 01/28/12 10:10			
Pentafluorobenzene	2035158	11.49	1684111	11.52	121	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3110228	12.07	2430484	12.09	128	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2416504	14.76	2040661	14.77	118	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1130166	17.17	1021309	17.17	111	50 - 200	0.0000	+/-0.50	
DRAFT: IR86-GW63D-12A (A200224-08)			Lab File ID: 3AV015.D			Analyzed: 01/28/12 10:40			
Pentafluorobenzene	2078803	11.49	1684111	11.52	123	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3153384	12.06	2430484	12.09	130	50 - 200	-0.0300	+/-0.50	
Chlorobenzene-d5	2486946	14.76	2040661	14.77	122	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1163200	17.16	1021309	17.17	114	50 - 200	-0.0100	+/-0.50	
DRAFT: IR86-GW55IW-12A (A200224-09)			Lab File ID: 3AV016.D			Analyzed: 01/28/12 11:11			
Pentafluorobenzene	2010568	11.49	1684111	11.52	119	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3066657	12.07	2430484	12.09	126	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2416266	14.76	2040661	14.77	118	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1137400	17.17	1021309	17.17	111	50 - 200	0.0000	+/-0.50	
DRAFT: IR86-GW75IW-12A (A200224-10)			Lab File ID: 3AV017.D			Analyzed: 01/28/12 11:41			
Pentafluorobenzene	2088918	11.49	1684111	11.52	124	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3150459	12.07	2430484	12.09	130	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2540108	14.76	2040661	14.77	124	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1221329	17.16	1021309	17.17	120	50 - 200	-0.0100	+/-0.50	
DRAFT: IR86-GW73IW-12A (A200224-11)			Lab File ID: 3AV018.D			Analyzed: 01/28/12 12:11			
Pentafluorobenzene	2288366	11.49	1684111	11.52	136	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3449053	12.07	2430484	12.09	142	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2865511	14.77	2040661	14.77	140	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1314882	17.16	1021309	17.17	129	50 - 200	-0.0100	+/-0.50	
DRAFT: TB01-012512 (A200224-12)			Lab File ID: 3AV019.D			Analyzed: 01/28/12 12:41			
Pentafluorobenzene	1968350	11.51	1684111	11.52	117	50 - 200	-0.0100	+/-0.50	
1,4-Difluorobenzene	3124544	12.09	2430484	12.09	129	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	2503678	14.78	2040661	14.77	123	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1170903	17.18	1021309	17.17	115	50 - 200	0.0100	+/-0.50	
DRAFT: IR86-GW71IW-12A (A200224-13)			Lab File ID: 3AV020.D			Analyzed: 01/28/12 13:11			
Pentafluorobenzene	2075584	11.49	1684111	11.52	123	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3058881	12.07	2430484	12.09	126	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2578320	14.76	2040661	14.77	126	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1182375	17.17	1021309	17.17	116	50 - 200	0.0000	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA18060	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
DRAFT: IR86-GW58IW-12A (A200224-14)			Lab File ID: 3AV021.D			Analyzed: 01/28/12 13:41			
Pentafluorobenzene	2171001	11.49	1684111	11.52	129	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3222219	12.07	2430484	12.09	133	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2727648	14.77	2040661	14.77	134	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1257228	17.16	1021309	17.17	123	50 - 200	-0.0100	+/-0.50	
DRAFT: IR86-GW58IWD-12A (A200224-15)			Lab File ID: 3AV022.D			Analyzed: 01/28/12 14:11			
Pentafluorobenzene	2157258	11.49	1684111	11.52	128	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3230744	12.07	2430484	12.09	133	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2641724	14.77	2040661	14.77	129	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1252591	17.17	1021309	17.17	123	50 - 200	0.0000	+/-0.50	
DRAFT: IR86-GW59IW-12A (A200224-16)			Lab File ID: 3AV023.D			Analyzed: 01/28/12 14:41			
Pentafluorobenzene	2101876	11.49	1684111	11.52	125	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3299735	12.07	2430484	12.09	136	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2681189	14.77	2040661	14.77	131	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1224341	17.17	1021309	17.17	120	50 - 200	0.0000	+/-0.50	
DRAFT: IR86-GW74IW-12A (A200224-17)			Lab File ID: 3AV024.D			Analyzed: 01/28/12 15:11			
Pentafluorobenzene	2152297	11.49	1684111	11.52	128	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3093085	12.07	2430484	12.09	127	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2638405	14.76	2040661	14.77	129	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1226383	17.17	1021309	17.17	120	50 - 200	0.0000	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA18061	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Calibration Check (AA18061-CCV1)			Lab File ID: 3AV026.D			Analyzed: 01/28/12 16:11			
Pentafluorobenzene	2261160	11.49	1684111	11.52	134	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3340430	12.07	2430484	12.09	137	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2997908	14.76	2040661	14.77	147	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1476258	17.17	1021309	17.17	145	50 - 200	0.0000	+/-0.50	
LCS (2A27017-BS1)			Lab File ID: 3AV027.D			Analyzed: 01/28/12 16:42			
Pentafluorobenzene	2272110	11.49	1684111	11.52	135	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3343872	12.07	2430484	12.09	138	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2839823	14.77	2040661	14.77	139	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1421274	17.17	1021309	17.17	139	50 - 200	0.0000	+/-0.50	
LCS Dup (2A27017-BSD1)			Lab File ID: 3AV028.D			Analyzed: 01/28/12 17:12			
Pentafluorobenzene	2225043	11.49	1684111	11.52	132	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3326184	12.07	2430484	12.09	137	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2899814	14.76	2040661	14.77	142	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1445199	17.17	1021309	17.17	142	50 - 200	0.0000	+/-0.50	
Blank (2A27017-BLK1)			Lab File ID: 3AV029.D			Analyzed: 01/28/12 17:42			
Pentafluorobenzene	2181093	11.49	1684111	11.52	130	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3378171	12.07	2430484	12.09	139	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2692924	14.77	2040661	14.77	132	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1280523	17.17	1021309	17.17	125	50 - 200	0.0000	+/-0.50	
DRAFT: IR86-GW72IW-12A (A200224-19)			Lab File ID: 3AV030.D			Analyzed: 01/28/12 18:13			
Pentafluorobenzene	2227323	11.49	1684111	11.52	132	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3201294	12.07	2430484	12.09	132	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2657407	14.76	2040661	14.77	130	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1307266	17.17	1021309	17.17	128	50 - 200	0.0000	+/-0.50	
DRAFT: EB-012512 (A200224-20)			Lab File ID: 3AV031.D			Analyzed: 01/28/12 18:42			
Pentafluorobenzene	2217332	11.49	1684111	11.52	132	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3399709	12.07	2430484	12.09	140	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2806864	14.76	2040661	14.77	138	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1306770	17.16	1021309	17.17	128	50 - 200	-0.0100	+/-0.50	
DRAFT: EB-012312 (A200224-21)			Lab File ID: 3AV032.D			Analyzed: 01/28/12 19:12			
Pentafluorobenzene	2195696	11.49	1684111	11.52	130	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3282548	12.07	2430484	12.09	135	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2803273	14.76	2040661	14.77	137	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1317575	17.16	1021309	17.17	129	50 - 200	-0.0100	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA18061	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1112016

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
DRAFT: EB-012412 (A200224-22)			Lab File ID: 3AV033.D			Analyzed: 01/28/12 19:42			
Pentafluorobenzene	2018024	11.49	1684111	11.52	120	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3224914	12.07	2430484	12.09	133	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2636529	14.77	2040661	14.77	129	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	1223719	17.16	1021309	17.17	120	50 - 200	-0.0100	+/-0.50	
DRAFT: IR86-GW55IW-12A (A200224-09RE1)			Lab File ID: 3AV034.D			Analyzed: 01/28/12 20:13			
Pentafluorobenzene	1700256	11.49	1684111	11.52	101	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	2651739	12.06	2430484	12.09	109	50 - 200	-0.0300	+/-0.50	
Chlorobenzene-d5	2175870	14.76	2040661	14.77	107	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1012396	17.16	1021309	17.17	99	50 - 200	-0.0100	+/-0.50	
DRAFT: IR86-GW58IW-12A (A200224-14RE1)			Lab File ID: 3AV035.D			Analyzed: 01/28/12 20:43			
Pentafluorobenzene	2446186	11.49	1684111	11.52	145	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3736098	12.06	2430484	12.09	154	50 - 200	-0.0300	+/-0.50	
Chlorobenzene-d5	3047783	14.76	2040661	14.77	149	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1473083	17.17	1021309	17.17	144	50 - 200	0.0000	+/-0.50	
DRAFT: IR86-GW58IWD-12A (A200224-15RE1)			Lab File ID: 3AV036.D			Analyzed: 01/28/12 21:13			
Pentafluorobenzene	2150961	11.49	1684111	11.52	128	50 - 200	-0.0300	+/-0.50	
1,4-Difluorobenzene	3305290	12.07	2430484	12.09	136	50 - 200	-0.0200	+/-0.50	
Chlorobenzene-d5	2658159	14.76	2040661	14.77	130	50 - 200	-0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	1256894	17.16	1021309	17.17	123	50 - 200	-0.0100	+/-0.50	

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA17439	Instrument:	OVGCMS3
		Calibration:	1112016

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
MS Tune	AA17439-TUN1	3LA001.D	12/06/11 10:19
Initial Cal Blank	AA17439-ICB1	3LA002.D	12/06/11 10:49
Cal Standard	AA17439-CAL1	3LA003.D	12/06/11 11:19
Cal Standard	AA17439-CAL2	3LA004.D	12/06/11 11:49
Cal Standard	AA17439-CAL4	3LA006.D	12/06/11 12:50
Cal Standard	AA17439-CAL5	3LA007.D	12/06/11 13:20
Cal Standard	AA17439-CAL6	3LA008.D	12/06/11 13:50
Cal Standard	AA17439-CAL7	3LA009.D	12/06/11 14:20
Cal Standard	AA17439-CAL3	3LA012.D	12/06/11 15:51
Secondary Cal Check	AA17439-SCV1	3LA014.D	12/06/11 16:52
Secondary Cal Check	AA17439-SCV2	3LA015.D	12/06/11 17:23

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 8260B

Laboratory: ENCO Orlando

Client: CH2M Hill, Inc. (CH025)

Sequence: AA18060

SDG: DRAFT CH025-064

Project: MCB Camp Lejeune, Site 86 CTO-WE09

Instrument: OVGCMS3

Calibration: 1112016

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
MS Tune	AA18060-TUN1	3AV001.D	01/27/12 11:54
Calibration Check	AA18060-CCV1	3AV002.D	01/27/12 12:25
LCS	2A27016-BS1	3AV003.D	01/27/12 12:54
Blank	2A27016-BLK1	3AV004.D	01/27/12 13:24
IR86-GW70IW-12A	2A27016-MS1	3AV005.D	01/27/12 13:55
IR86-GW70IW-12A	2A27016-MSD1	3AV006.D	01/27/12 14:25
DRAFT: IR86-GW70IW-12A	A200224-18	3AV007.D	01/27/12 14:55
DRAFT: IR86-GW68-12A	A200224-01	3AV008.D	01/27/12 15:25
DRAFT: IR86-GW66-12A	A200224-02	3AV009.D	01/27/12 15:55
DRAFT: IR86-GW67-12A	A200224-03	3AV010.D	01/27/12 16:25
DRAFT: IR86-GW61-12A	A200224-04	3AV011.D	01/27/12 16:55
DRAFT: IR86-GW69-12A	A200224-05	3AV012.D	01/27/12 17:25
DRAFT: IR86-GW61IW-12A	A200224-06	3AV013.D	01/27/12 17:55
DRAFT: IR86-GW63-12A	A200224-07	3AV014.D	01/27/12 18:26
MS Tune	AA18060-TUN2	3AV100.D	01/28/12 08:58
Calibration Check	AA18060-CCV2	3AV101.D	01/28/12 09:28
Blank	2A27016-BLK2	3AV102.D	01/28/12 10:10
DRAFT: IR86-GW63D-12A	A200224-08	3AV015.D	01/28/12 10:40
DRAFT: IR86-GW55IW-12A	A200224-09	3AV016.D	01/28/12 11:11
DRAFT: IR86-GW75IW-12A	A200224-10	3AV017.D	01/28/12 11:41
DRAFT: IR86-GW73IW-12A	A200224-11	3AV018.D	01/28/12 12:11
DRAFT: TB01-012512	A200224-12	3AV019.D	01/28/12 12:41
DRAFT: IR86-GW71IW-12A	A200224-13	3AV020.D	01/28/12 13:11
DRAFT: IR86-GW58IW-12A	A200224-14	3AV021.D	01/28/12 13:41
DRAFT: IR86-GW58IWD-12A	A200224-15	3AV022.D	01/28/12 14:11
DRAFT: IR86-GW59IW-12A	A200224-16	3AV023.D	01/28/12 14:41
DRAFT: IR86-GW74IW-12A	A200224-17	3AV024.D	01/28/12 15:11

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 8260B

Laboratory: ENCO Orlando

Client: CH2M Hill, Inc. (CH025)

Sequence: AA18061

SDG: DRAFT CH025-064

Project: MCB Camp Lejeune, Site 86 CTO-WE09

Instrument: OVGCMS3

Calibration: 1112016

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
MS Tune	AA18061-TUN1	3AV025.D	01/28/12 15:41
Calibration Check	AA18061-CCV1	3AV026.D	01/28/12 16:11
LCS	2A27017-BS1	3AV027.D	01/28/12 16:42
LCS Dup	2A27017-BSD1	3AV028.D	01/28/12 17:12
Blank	2A27017-BLK1	3AV029.D	01/28/12 17:42
DRAFT: IR86-GW72IW-12A	A200224-19	3AV030.D	01/28/12 18:13
DRAFT: EB-012512	A200224-20	3AV031.D	01/28/12 18:42
DRAFT: EB-012312	A200224-21	3AV032.D	01/28/12 19:12
DRAFT: EB-012412	A200224-22	3AV033.D	01/28/12 19:42
DRAFT: IR86-GW55IW-12A	A200224-09RE1	3AV034.D	01/28/12 20:13
DRAFT: IR86-GW58IW-12A	A200224-14RE1	3AV035.D	01/28/12 20:43
DRAFT: IR86-GW58IWD-12A	A200224-15RE1	3AV036.D	01/28/12 21:13

MASS SPECTROMETER INSTRUMENT PERFORMANCE CHECK

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Lab File ID:	3LA001.D	Injection Date:	12/06/11
Instrument ID:	OVGCMS3	Injection Time:	10:19
Sequence:	AA17439	Lab Sample ID:	AA17439-TUN1

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
50	15 - 40% of 95	20.8	PASS
75	30 - 60% of 95	46	PASS
95	Base peak, 100% relative abundance	100	PASS
96	5 - 9% of 95	6.59	PASS
173	Less than 2% of 174	0	PASS
174	50 - 200% of 95	75.1	PASS
175	5 - 9% of 174	8.58	PASS
176	95 - 101% of 174	97.9	PASS
177	5 - 9% of 176	6.92	PASS

MASS SPECTROMETER INSTRUMENT PERFORMANCE CHECK

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Lab File ID:	3AV001.D	Injection Date:	01/27/12
Instrument ID:	OVGCMS3	Injection Time:	11:54
Sequence:	AA18060	Lab Sample ID:	AA18060-TUN1

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
50	15 - 40% of 95	19	PASS
75	30 - 60% of 95	39.5	PASS
95	Base peak, 100% relative abundance	100	PASS
96	5 - 9% of 95	6.14	PASS
173	Less than 2% of 174	0	PASS
174	50 - 200% of 95	98	PASS
175	5 - 9% of 174	6.51	PASS
176	95 - 101% of 174	98.5	PASS
177	5 - 9% of 176	6.72	PASS

MASS SPECTROMETER INSTRUMENT PERFORMANCE CHECK

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Lab File ID:	3AV100.D	Injection Date:	01/28/12
Instrument ID:	OVGCMS3	Injection Time:	08:58
Sequence:	AA18060	Lab Sample ID:	AA18060-TUN2

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
50	15 - 40% of 95	17.3	PASS
75	30 - 60% of 95	40.2	PASS
95	Base peak, 100% relative abundance	100	PASS
96	5 - 9% of 95	6.38	PASS
173	Less than 2% of 174	0	PASS
174	50 - 200% of 95	91.7	PASS
175	5 - 9% of 174	7.4	PASS
176	95 - 101% of 174	96.4	PASS
177	5 - 9% of 176	6.67	PASS

MASS SPECTROMETER INSTRUMENT PERFORMANCE CHECK

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Lab File ID:	3AV025.D	Injection Date:	01/28/12
Instrument ID:	OVGCMS3	Injection Time:	15:41
Sequence:	AA18061	Lab Sample ID:	AA18061-TUN1

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
50	15 - 40% of 95	18.5	PASS
75	30 - 60% of 95	42.6	PASS
95	Base peak, 100% relative abundance	100	PASS
96	5 - 9% of 95	7.27	PASS
173	Less than 2% of 174	0	PASS
174	50 - 200% of 95	93.6	PASS
175	5 - 9% of 174	7.21	PASS
176	95 - 101% of 174	98.7	PASS
177	5 - 9% of 176	6.45	PASS

CONTINUING CALIBRATION CHECK

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Instrument ID:	OVGCMS3	Calibration:	1112016
Lab File ID:	3AV002.D	Calibration Date:	12/06/11 13:21
Sequence:	AA18060	Injection Date:	01/27/12
Lab Sample ID:	AA18060-CCV1	Injection Time:	12:25

		CONC. (ug/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Vinyl chloride	A	50.0	51	0.909554	0.9324115		2.5	20
1,1-Dichloroethene	A	50.0	59	0.3550561	0.4208233		18.5	20
cis-1,2-Dichloroethene	A	50.0	50	0.6472435	0.6427346		-0.7	20
Trichloroethene	A	50.0	55	0.3918101	0.4271734		9.0	20
Tetrachloroethene	A	50.0	55	0.3666694	0.4028616		9.9	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

CONTINUING CALIBRATION CHECK

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Instrument ID:	OVGCMS3	Calibration:	1112016
Lab File ID:	3AV101.D	Calibration Date:	12/06/11 13:21
Sequence:	AA18060	Injection Date:	01/28/12
Lab Sample ID:	AA18060-CCV2	Injection Time:	09:28

		CONC. (ug/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Vinyl chloride	A	50.0	52	0.909554	0.9431677		3.7	20
1,1-Dichloroethene	A	50.0	60	0.3550561	0.4260292		20.0	20
cis-1,2-Dichloroethene	A	50.0	51	0.6472435	0.6605931		2.1	20
Trichloroethene	A	50.0	56	0.3918101	0.4413856		12.7	20
Tetrachloroethene	A	50.0	56	0.3666694	0.4109154		12.1	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

CONTINUING CALIBRATION CHECK

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Instrument ID:	OVGCMS3	Calibration:	1112016
Lab File ID:	3AV026.D	Calibration Date:	12/06/11 13:21
Sequence:	AA18061	Injection Date:	01/28/12
Lab Sample ID:	AA18061-CCV1	Injection Time:	16:11

		CONC. (ug/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Vinyl chloride	A	50.0	42	0.909554	0.7621668		-16.2	20
1,1-Dichloroethene	A	50.0	59	0.3550561	0.4163115		17.3	20
cis-1,2-Dichloroethene	A	50.0	50	0.6472435	0.6523382		0.8	20
Trichloroethene	A	50.0	55	0.3918101	0.4288807		9.5	20
Tetrachloroethene	A	50.0	54	0.3666694	0.3941322		7.5	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

INITIAL CALIBRATION STANDARDS

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Sequence:	AA17439	Instrument:	OVGCMS3
Calibration:	1112016		

Standard ID	Description	Lab Sample ID	Lab File ID	Analysis Date/Time
A1I0569	8260 BFB Tuning solution	AA17439-TUN1	3LA001.D	12/06/11 10:19
A1L0101	8260 Calibration 1 ppb	AA17439-CAL1	3LA003.D	12/06/11 11:19
A1L0102	8260 Calibration 5 ppb	AA17439-CAL2	3LA004.D	12/06/11 11:49
A1L0104	8260 Calibration 50ppb	AA17439-CAL4	3LA006.D	12/06/11 12:50
A1L0105	8260 Calibration 100ppb	AA17439-CAL5	3LA007.D	12/06/11 13:20
A1L0106	8260 Calibration 200ppb	AA17439-CAL6	3LA008.D	12/06/11 13:50
A1L0103	8260 Calibration 20 ppb	AA17439-CAL3	3LA012.D	12/06/11 15:51
A1L0108	8260 scv working 50 ppb	AA17439-SCV1	3LA014.D	12/06/11 16:52
A1L0109	8260 scv working 100 ppb	AA17439-SCV2	3LA015.D	12/06/11 17:23

INITIAL CALIBRATION DATA

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Calibration:	1112016	Instrument:	OVGCMS3
Matrix:	Water	Calibration Date:	12/06/11 13:21

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
	ug/L	RF	ug/L	RF	ug/L	RF	ug/L	RF	ug/L	RF	ug/L	RF
Vinyl chloride	1	0.9071225	5	1.016229	20	0.8949215	50	0.9205851	100	0.9349877	200	0.7834782
1,1-Dichloroethene	1	0.3678058	5	0.3928498	20	0.3980157	50	0.3737133	100	0.3335819	200	0.2643699
cis-1,2-Dichloroethene	1	0.6803065	5	0.7860465	20	0.654417	50	0.6491313	100	0.599141	200	0.5144188
Trichloroethene	1	0.3931505	5	0.443702	20	0.4063414	50	0.40958	100	0.3734762	200	0.3246104
Tetrachloroethene	1	0.3934037	5	0.3891765	20	0.3985614	50	0.3730362	100	0.3478287	200	0.2980102
Dibromofluoromethane	1	~~1.696344~~	5	0.7877377	20	0.6295009	50	0.5915043	100	0.6428623	200	0.5785648
Toluene-d8	1	~~2.744396~~	5	1.441926	20	1.26734	50	1.129838	100	1.200649	200	1.078241
4-Bromofluorobenzene	1	~~1.578002~~	5	0.7718117	20	0.6276057	50	0.5457672	100	0.5986656	200	0.5571287

INITIAL CALIBRATION DATA (Continued)

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Calibration:	1112016	Instrument:	OVGCMS3
Matrix:	Water	Calibration Date:	12/06/11 13:21

Compound	Level 07		Level 08		Level 09		Level 10		Level 11		Level 12	
	ug/L	RF	ug/L	RF	ug/L	RF	ug/L	RF	ug/L	RF	ug/L	RF
Vinyl chloride												
1,1-Dichloroethene												
cis-1,2-Dichloroethene												
Trichloroethene												
Tetrachloroethene												
Dibromofluoromethane												
Toluene-d8												
4-Bromofluorobenzene												

INITIAL CALIBRATION DATA (Continued)

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	DRAFT CH025-064
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Calibration:	1112016	Instrument:	OVGCMS3
Matrix:	Water	Calibration Date:	12/06/11 13:21

Compound	Mean RF	RF RSD	Mean RT	RT RSD	Linear r	Quad COD	LIMIT	Q
Vinyl chloride	0.909554	8.266036	5.848333	7.198914E-02			CCC (30)	
1,1-Dichloroethene	0.3550561	14.06519	8.126667	6.104302E-02			CCC (30)	
cis-1,2-Dichloroethene	0.6472435	13.8829	10.65	6.049991E-02			15	
Trichloroethene	0.3918101	10.25576	12.095	4.382242E-02			15	
Tetrachloroethene	0.3666694	10.45501	13.77	1.240683E-02			15	
Dibromofluoromethane	0.646034	12.92499	11.112	3.822247E-02			15	
Toluene-d8	1.223599	11.55975	13.366	4.190116E-02			15	
4-Bromofluorobenzene	0.6201958	14.65038	15.916	3.220896E-02			15	

SECOND-SOURCE CALIBRATION VERIFICATION

EPA 8260B

Laboratory: ENCO Orlando

SDG: DRAFT CH025-064

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, Site 86 CTO-WE09

Calibration: 1112016

Laboratory ID: AA17439-SCV1

Sequence: AA17439

Standard ID: A1L0108

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Trichloroethene	50.0	51	2.3	20.00
cis-1,2-Dichloroethene	50.0	48	-4.7	20.00
Dibromofluoromethane	50.0	43	-13.6	20.00
Toluene-d8	50.0	46	-8.9	20.00
4-Bromofluorobenzene	50.0	42	-15.1	20.00
Vinyl chloride	50.0	42	-16.2	20.00
Tetrachloroethene	50.0	50	-0.7	20.00
1,1-Dichloroethene	50.0	53	6.7	20.00

* Values outside of QC limits

SECOND-SOURCE CALIBRATION VERIFICATION

EPA 8260B

Laboratory: ENCO Orlando

SDG: DRAFT CH025-064

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, Site 86 CTO-WE09

Calibration: 1112016

Laboratory ID: AA17439-SCV2

Sequence: AA17439

Standard ID: A1L0109

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Trichloroethene	100	100	-0.2	20.00
cis-1,2-Dichloroethene	100	90	-10.1	20.00
Dibromofluoromethane	50.0	41	-18.0	20.00
Toluene-d8	50.0	46	-7.7	20.00
4-Bromofluorobenzene	50.0	43	-13.3	20.00
Vinyl chloride	100	92	-7.8	20.00
1,1-Dichloroethene	100	95	-4.6	20.00
Tetrachloroethene	100	99	-0.9	20.00

* Values outside of QC limits

Flags, Notes and Definitions

B	The analyte was detected in the associated method blank.
D	The sample was analyzed at dilution.
J	The reported result is an estimated value.
U	Analyte was not detected and is reported as less than the LOD or as defined by the client. The LOD has been adjusted for any dilution or concentration of the sample.
E	The concentration indicated for this analyte is an estimated value above the calibration range of the instrument. This value is considered an estimate.
N	Non-target analyte.
Q	One or more quality control criteria failed.

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Email: info@microbe.com

Client: Troy Horn
CH2M HILL
5700 Cleveland Street
Suite 101
Virginia Beach, VA 23462

Phone: 751-671-6288

Fax: 751-497-6885

Identifier: 044JA **Date Rec:** 01/25/2012 **Report Date:** 02/07/2012

Client Project #: 423849.PT.PT **Client Project Name:** Site 86- 3 Month Sampling

Purchase Order #: 945859

Analysis Requested: mRNA

Reviewed By:

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MICROBIAL INSIGHTS, INC.

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mRNA

Client: **CH2M HILL**
Project: Site 86- 3 Month Sampling

MI Project Number: **044JA**
Date Received: 01/25/2012

Sample Information

Client Sample ID:		**IR86-GW72IW-1 2A**	**IR86-GW71IW-1 2A**	**IR86-GW58IW-1 2A**	**IR86-GW74IW-1 2A**	**IR86-GW70IW-1 2A**
Sample Date:		01/24/2012	01/24/2012	01/24/2012	01/24/2012	01/24/2012
Units:		gene copies/mL	gene copies/mL	gene copies/mL	gene copies/mL	gene copies/mL
Analyst:		RW	RW	RW	RW	RW
Dechlorinating Bacteria						
Dehalococcoides spp.	*DHC*	**2.10E+06**	**1.36E+06**	**6.78E+05**	**9.04E+04**	**2.32E+06**
Dehalobacter spp.	*DHBt*	**4.46E+04**	**4.90E+04**	**2.39E+05**	**3.99E+04**	**1.05E+05**
Desulfuromonas spp.	*DSM*	**1.83E+03**	**2.91E+03**	**1.00E+04**	**2.54E+03**	**2.31E+04**
Desulfitobacterium spp.	*DSB*	**6.32E+08**	**6.37E+08**	**2.41E+08**	**4.81E+08**	**5.01E+08**
Functional Genes						
tceA Reductase	TCE	**7.33E+04**	**5.37E+04**	**7.30E+00**	**1.91E+02**	**2.28E+04**
bvcA Reductase	BVC	**1.70E+00**	**1.02E+03**	**1.11E+04**	**3.36E+02**	**1.89E+02**
Vinyl Chloride Reductase	VCR	**3.85E+03**	**2.67E+03**	**1.20E+00**	**2.46E+01**	**2.04E+03**
Toluene Dioxygenase	TOD	<1.00E+00	<1.00E+00	**1.51E+04**	<1.00E+00	**1.07E+05**
Phylogenetic Group						
Methane Oxidizing Bacteria	MOB	**4.12E+06**	**4.25E+07**	**3.12E+08**	**5.37E+08**	**1.39E+08**

Legend:
NA = Not Analyzed NS = Not Sampled J = Estimated gene copies below PQL but above LQL I = Inhibited
< = Result not detected

ENCO Orlando

SDG: CH025-106

CLASS: 01_VOA_MS

METHOD: EPA 8260B

ANALYSES DATA PACKAGE COVER PAGE

EPA 8260B

Laboratory: ENCO Orlando

SDG: CH025-106

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, CTO-WE09

Client Sample Id:	Lab Sample Id:
IR86-GW59IW-12B	A202228-01
IR86-GW61-12B	A202228-02
IR86-GW67-12B	A202228-03
IR86-GW61IW-12B	A202228-04
IR86-EB050212	A202228-05
IR86-GW66-12B	A202228-06
IR86-GW68-12B	A202228-07
IR86-GW69-12B	A202228-08
IR86-TB01-050212	A202228-09
IR86-GW73IW-12B	A202228-10
IR86-GW63-12B	A202228-11
IR86-GW63D-12B	A202228-12
IR86-GW74IW-12B	A202228-13
IR86-EB043012	A202228-14
IR86-EB050112	A202228-15
IR86-GW70IW-12B	A202228-16
IR86-GW72IW-12B	A202228-17
IR86-GW75IW-12B	A202228-18
IR86-GW58IW-12B	A202228-19
IR86-GW58IWD-12B	A202228-20
IR86-GW71IW-12B	A202228-21
IR86-TB01-043012	A202228-22

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signatures.

Signature: _____ Name: _____

Date: _____ Title: _____

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW59IW-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-01	File ID:	3EB008.D
Sampled:	05/02/12 10:40	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 16:21
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.53	1.0	2.0
79-01-6	Trichloroethene	1	<1.0	U	0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	51	102	85 - 115	
Toluene-d8	50.0	51	102	85 - 120	
4-Bromofluorobenzene	50.0	53	105	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1155816	11.51	1271040	11.48	
1,4-Difluorobenzene	1876944	12.09	1870916	12.06	
Chlorobenzene-d5	1445496	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	634617	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW61-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-02	File ID:	3EB009.D
Sampled:	05/02/12 12:50	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 16:50
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	3.4		0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	64		0.53	1.0	2.0
79-01-6	Trichloroethene	1	170		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	51	103	85 - 115	
Toluene-d8	50.0	50	100	85 - 120	
4-Bromofluorobenzene	50.0	53	105	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1127002	11.51	1271040	11.48	
1,4-Difluorobenzene	1872044	12.09	1870916	12.06	
Chlorobenzene-d5	1444650	14.79	1654965	14.76	
1,4-Dichlorobenzene-d4	626691	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW67-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-03	File ID:	3EB010.D
Sampled:	05/02/12 12:00	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 17:20
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	0.94	J	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	19		0.53	1.0	2.0
79-01-6	Trichloroethene	1	34		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	50	100	85 - 115	
Toluene-d8	50.0	49	99	85 - 120	
4-Bromofluorobenzene	50.0	51	101	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1151428	11.51	1271040	11.48	
1,4-Difluorobenzene	1901394	12.09	1870916	12.06	
Chlorobenzene-d5	1480907	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	631592	17.19	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW61IW-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-04	File ID:	3EB011.D
Sampled:	05/02/12 11:05	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 17:51
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	2.3		0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	45		0.53	1.0	2.0
79-01-6	Trichloroethene	1	51		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	53	106	85 - 115	
Toluene-d8	50.0	52	104	85 - 120	
4-Bromofluorobenzene	50.0	52	103	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1092438	11.51	1271040	11.48	
1,4-Difluorobenzene	1834192	12.09	1870916	12.06	
Chlorobenzene-d5	1450080	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	636721	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-EB050212

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-05	File ID:	3EB012.D
Sampled:	05/02/12 11:30	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 18:21
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.53	1.0	2.0
79-01-6	Trichloroethene	1	<1.0	U	0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	103	85 - 115	
Toluene-d8	50.0	52	103	85 - 120	
4-Bromofluorobenzene	50.0	54	107	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1123702	11.51	1271040	11.48	
1,4-Difluorobenzene	1825976	12.09	1870916	12.06	
Chlorobenzene-d5	1410353	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	612603	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW66-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-06	File ID:	3EB013.D
Sampled:	04/30/12 16:45	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 18:51
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	1.1	J	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	21		0.53	1.0	2.0
79-01-6	Trichloroethene	1	44		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	51	103	85 - 115	
Toluene-d8	50.0	51	102	85 - 120	
4-Bromofluorobenzene	50.0	52	105	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1142032	11.51	1271040	11.48	
1,4-Difluorobenzene	1870325	12.09	1870916	12.06	
Chlorobenzene-d5	1481536	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	648809	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW68-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-07	File ID:	3EB014.D
Sampled:	04/30/12 15:25	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 19:21
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	1.1	J	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	22		0.53	1.0	2.0
79-01-6	Trichloroethene	1	39		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	104	85 - 115	
Toluene-d8	50.0	51	101	85 - 120	
4-Bromofluorobenzene	50.0	52	104	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1111990	11.51	1271040	11.48	
1,4-Difluorobenzene	1847455	12.09	1870916	12.06	
Chlorobenzene-d5	1460299	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	644146	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW69-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-08	File ID:	3EB015.D
Sampled:	04/30/12 15:30	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 19:51
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	1.9	J	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	38		0.53	1.0	2.0
79-01-6	Trichloroethene	1	46		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	103	85 - 115	
Toluene-d8	50.0	50	101	85 - 120	
4-Bromofluorobenzene	50.0	52	105	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1111111	11.51	1271040	11.48	
1,4-Difluorobenzene	1844696	12.08	1870916	12.06	
Chlorobenzene-d5	1439470	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	641981	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-TB01-050212

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water	Laboratory ID:	A202228-09	File ID:	3EB016.D
Sampled:	05/02/12 00:00	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 20:22
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.53	1.0	2.0
79-01-6	Trichloroethene	1	<1.0	U	0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	51	102	85 - 115	
Toluene-d8	50.0	50	100	85 - 120	
4-Bromofluorobenzene	50.0	53	105	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1111634	11.51	1271040	11.48	
1,4-Difluorobenzene	1842406	12.09	1870916	12.06	
Chlorobenzene-d5	1417070	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	623045	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW73IW-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-10	File ID:	3EB017.D
Sampled:	05/02/12 15:20	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 20:52
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	15		0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	1.4	J	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	40		0.53	1.0	2.0
79-01-6	Trichloroethene	1	5.4		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	53	107	85 - 115	
Toluene-d8	50.0	51	103	85 - 120	
4-Bromofluorobenzene	50.0	54	108	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1105576	11.51	1271040	11.48	
1,4-Difluorobenzene	1821033	12.09	1870916	12.06	
Chlorobenzene-d5	1449697	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	642717	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW63-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-11	File ID:	3EB018.D
Sampled:	05/02/12 15:20	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 21:22
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	5.9		0.53	1.0	2.0
79-01-6	Trichloroethene	1	6.1		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	51	101	85 - 115	
Toluene-d8	50.0	51	102	85 - 120	
4-Bromofluorobenzene	50.0	52	104	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1125269	11.51	1271040	11.48	
1,4-Difluorobenzene	1847627	12.09	1870916	12.06	
Chlorobenzene-d5	1449243	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	644324	17.19	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW63D-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-12	File ID:	3EB019.D
Sampled:	05/02/12 15:25	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 21:52
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	6.0		0.53	1.0	2.0
79-01-6	Trichloroethene	1	5.6		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	50	100	85 - 115	
Toluene-d8	50.0	55	110	85 - 120	
4-Bromofluorobenzene	50.0	56	112	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	893980	11.51	1271040	11.48	
1,4-Difluorobenzene	1464475	12.09	1870916	12.06	
Chlorobenzene-d5	1334647	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	641399	17.19	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW74IW-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-13	File ID:	3EB020.D
Sampled:	05/01/12 09:55	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 22:22
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	9.2		0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	16		0.53	1.0	2.0
79-01-6	Trichloroethene	1	5.5		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	53	105	85 - 115	
Toluene-d8	50.0	51	103	85 - 120	
4-Bromofluorobenzene	50.0	53	105	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1125035	11.51	1271040	11.48	
1,4-Difluorobenzene	1822215	12.09	1870916	12.06	
Chlorobenzene-d5	1457257	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	648657	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-EB043012

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-14	File ID:	3EB021.D
Sampled:	04/30/12 17:00	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 22:52
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.53	1.0	2.0
79-01-6	Trichloroethene	1	<1.0	U	0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	104	85 - 115	
Toluene-d8	50.0	51	102	85 - 120	
4-Bromofluorobenzene	50.0	52	103	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1079289	11.51	1271040	11.48	
1,4-Difluorobenzene	1800302	12.09	1870916	12.06	
Chlorobenzene-d5	1430766	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	611705	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-EB050112

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-15	File ID:	3EB022.D
Sampled:	05/01/12 07:30	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 23:23
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.53	1.0	2.0
79-01-6	Trichloroethene	1	<1.0	U	0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	51	103	85 - 115	
Toluene-d8	50.0	50	101	85 - 120	
4-Bromofluorobenzene	50.0	53	105	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1086397	11.51	1271040	11.48	
1,4-Difluorobenzene	1787869	12.09	1870916	12.06	
Chlorobenzene-d5	1403171	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	616089	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW70IW-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-16	File ID:	3EB007.D
Sampled:	05/01/12 14:00	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 15:51
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.53	1.0	2.0
79-01-6	Trichloroethene	1	<1.0	U	0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	105	85 - 115	
Toluene-d8	50.0	50	101	85 - 120	
4-Bromofluorobenzene	50.0	54	107	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1172526	11.51	1271040	11.48	
1,4-Difluorobenzene	1929114	12.09	1870916	12.06	
Chlorobenzene-d5	1506539	14.79	1654965	14.76	
1,4-Dichlorobenzene-d4	659056	17.19	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW72IW-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-17	File ID:	3EB023.D
Sampled:	05/01/12 13:15	Prepared:	05/07/12 13:59	Analyzed:	05/07/12 23:53
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	1.2	J	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.53	1.0	2.0
79-01-6	Trichloroethene	1	<1.0	U	0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	104	85 - 115	
Toluene-d8	50.0	51	103	85 - 120	
4-Bromofluorobenzene	50.0	53	106	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1079717	11.51	1271040	11.48	
1,4-Difluorobenzene	1801755	12.09	1870916	12.06	
Chlorobenzene-d5	1429375	14.79	1654965	14.76	
1,4-Dichlorobenzene-d4	639803	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW75IW-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-18	File ID:	3EB024.D
Sampled:	05/01/12 15:40	Prepared:	05/07/12 13:59	Analyzed:	05/08/12 00:23
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E07022 Sequence: AA19350 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	12		0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	20		0.53	1.0	2.0
79-01-6	Trichloroethene	1	6.1		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	51	103	85 - 115	
Toluene-d8	50.0	50	100	85 - 120	
4-Bromofluorobenzene	50.0	53	105	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1134819	11.51	1271040	11.48	
1,4-Difluorobenzene	1885102	12.09	1870916	12.06	
Chlorobenzene-d5	1465612	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	659078	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW58IW-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-19	File ID:	3EC006.D
Sampled:	05/01/12 10:25	Prepared:	05/08/12 10:02	Analyzed:	05/08/12 14:35
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E08017 Sequence: AA19359 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	76		0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	9.9		0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	96		0.53	1.0	2.0
79-01-6	Trichloroethene	1	31		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	50	101	85 - 115	
Toluene-d8	50.0	50	100	85 - 120	
4-Bromofluorobenzene	50.0	52	104	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1147802	11.51	1271040	11.48	
1,4-Difluorobenzene	1870268	12.09	1870916	12.06	
Chlorobenzene-d5	1486845	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	654031	17.18	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW58IWD-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-20	File ID:	3EC007.D
Sampled:	05/01/12 10:30	Prepared:	05/08/12 10:02	Analyzed:	05/08/12 15:05
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E08017 Sequence: AA19359 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	75		0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	10		0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	100		0.53	1.0	2.0
79-01-6	Trichloroethene	1	32		0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	51	102	85 - 115	
Toluene-d8	50.0	50	100	85 - 120	
4-Bromofluorobenzene	50.0	52	103	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1120741	11.51	1271040	11.48	
1,4-Difluorobenzene	1825707	12.09	1870916	12.06	
Chlorobenzene-d5	1467224	14.79	1654965	14.76	
1,4-Dichlorobenzene-d4	649720	17.19	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-GW71IW-12B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-21	File ID:	3EC008.D
Sampled:	05/01/12 11:55	Prepared:	05/08/12 10:02	Analyzed:	05/08/12 15:36
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E08017 Sequence: AA19359 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.53	1.0	2.0
79-01-6	Trichloroethene	1	<1.0	U	0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	103	85 - 115	
Toluene-d8	50.0	51	102	85 - 120	
4-Bromofluorobenzene	50.0	53	107	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1092776	11.51	1271040	11.48	
1,4-Difluorobenzene	1776395	12.09	1870916	12.06	
Chlorobenzene-d5	1410721	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	631193	17.19	798316	17.16	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

EPA 8260B

IR86-TB01-043012

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water	Laboratory ID:	A202228-22	File ID:	3EC009.D
Sampled:	05/02/12 00:00	Prepared:	05/08/12 10:02	Analyzed:	05/08/12 16:06
Solids:		Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Batch: 2E08017 Sequence: AA19359 Calibration: 1203063 Instrument: OVGCMS3

CAS NO.	COMPOUND	DILUTION	CONC. (ug/L)	Q	DL	LOD	LOQ
75-01-4	Vinyl chloride	1	<1.0	U	0.71	1.0	2.0
75-35-4	1,1-Dichloroethene	1	<1.0	U	0.94	1.0	2.0
156-59-2	cis-1,2-Dichloroethene	1	<1.0	U	0.53	1.0	2.0
79-01-6	Trichloroethene	1	<1.0	U	0.89	1.0	2.0
127-18-4	Tetrachloroethene	1	<1.0	U	0.76	1.0	2.0

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	52	103	85 - 115	
Toluene-d8	50.0	50	101	85 - 120	
4-Bromofluorobenzene	50.0	52	104	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1073902	11.51	1271040	11.48	
1,4-Difluorobenzene	1773542	12.09	1870916	12.06	
Chlorobenzene-d5	1396535	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	601110	17.18	798316	17.16	

* Values outside of QC limits

HOLDING TIME SUMMARY

EPA 8260B

Laboratory: ENCO Orlando SDG: CH025-106

Client: CH2M Hill, Inc. (CH025) Project: MCB Camp Lejeune, CTO-WE09

Sample Name	Date Collected	Date Received	Date Prepared	Days to Prep	Max Days to Prep	Date Analyzed	Days to Analysis	Max Days to Analysis	Q
IR86-GW59IW-12B	05/02/12 10:40	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 16:21	5.00	14.00	
IR86-GW61-12B	05/02/12 12:50	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 16:50	5.00	14.00	
IR86-GW67-12B	05/02/12 12:00	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 17:20	5.00	14.00	
IR86-GW61IW-12B	05/02/12 11:05	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 17:51	5.00	14.00	
IR86-EB050212	05/02/12 11:30	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 18:21	5.00	14.00	
IR86-GW66-12B	04/30/12 16:45	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 18:51	7.00	14.00	
IR86-GW68-12B	04/30/12 15:25	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 19:21	7.00	14.00	
IR86-GW69-12B	04/30/12 15:30	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 19:51	7.00	14.00	
IR86-TB01-050212	05/02/12 00:00	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 20:22	5.00	14.00	
IR86-GW73IW-12B	05/02/12 15:20	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 20:52	5.00	14.00	
IR86-GW63-12B	05/02/12 15:20	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 21:22	5.00	14.00	
IR86-GW63D-12B	05/02/12 15:25	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 21:52	5.00	14.00	
IR86-GW74IW-12B	05/01/12 09:55	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 22:22	6.00	14.00	
IR86-EB043012	04/30/12 17:00	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 22:52	7.00	14.00	
IR86-EB050112	05/01/12 07:30	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 23:23	6.00	14.00	
IR86-GW70IW-12B	05/01/12 14:00	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 15:51	6.00	14.00	
IR86-GW72IW-12B	05/01/12 13:15	05/04/12 10:20	05/07/12 13:59	NA	NA	05/07/12 23:53	6.00	14.00	
IR86-GW75IW-12B	05/01/12 15:40	05/04/12 10:20	05/07/12 13:59	NA	NA	05/08/12 00:23	6.00	14.00	
IR86-GW58IW-12B	05/01/12 10:25	05/04/12 10:20	05/08/12 10:02	NA	NA	05/08/12 14:35	7.00	14.00	
IR86-GW58IWD-12B	05/01/12 10:30	05/04/12 10:20	05/08/12 10:02	NA	NA	05/08/12 15:05	7.00	14.00	
IR86-GW71IW-12B	05/01/12 11:55	05/04/12 10:20	05/08/12 10:02	NA	NA	05/08/12 15:36	7.00	14.00	
IR86-TB01-043012	05/02/12 00:00	05/04/12 10:20	05/08/12 10:02	NA	NA	05/08/12 16:06	6.00	14.00	

PREPARATION BATCH SUMMARY

EPA 8260B

Laboratory: ENCO Orlando SDG: CH025-106

Client: CH2M Hill, Inc. (CH025) Project: MCB Camp Lejeune, CTO-WE09

Batch: 2E07022 Batch Matrix: Water Preparation: EPA 5030B_MS

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
Blank	2E07022-BLK1	3EB004.D	05/07/12 11:00	
LCS	2E07022-BS1	3EB003.D	05/07/12 11:00	
IR86-GW70IW-12B	2E07022-MS1	3EB005.D	05/07/12 13:59	
IR86-GW70IW-12B	2E07022-MSD1	3EB006.D	05/07/12 13:59	
IR86-GW59IW-12B	A202228-01	3EB008.D	05/07/12 13:59	*custom list*
IR86-GW61-12B	A202228-02	3EB009.D	05/07/12 13:59	*custom list*
IR86-GW67-12B	A202228-03	3EB010.D	05/07/12 13:59	*custom list*
IR86-GW61IW-12B	A202228-04	3EB011.D	05/07/12 13:59	*custom list*
IR86-EB050212	A202228-05	3EB012.D	05/07/12 13:59	*custom list*
IR86-GW66-12B	A202228-06	3EB013.D	05/07/12 13:59	*custom list*
IR86-GW68-12B	A202228-07	3EB014.D	05/07/12 13:59	*custom list*
IR86-GW69-12B	A202228-08	3EB015.D	05/07/12 13:59	*custom list*
IR86-TB01-050212	A202228-09	3EB016.D	05/07/12 13:59	*custom list*
IR86-GW73IW-12B	A202228-10	3EB017.D	05/07/12 13:59	*custom list*
IR86-GW63-12B	A202228-11	3EB018.D	05/07/12 13:59	*custom list*
IR86-GW63D-12B	A202228-12	3EB019.D	05/07/12 13:59	*custom list*
IR86-GW74IW-12B	A202228-13	3EB020.D	05/07/12 13:59	*custom list*
IR86-EB043012	A202228-14	3EB021.D	05/07/12 13:59	*custom list*
IR86-EB050112	A202228-15	3EB022.D	05/07/12 13:59	*custom list*
IR86-GW70IW-12B	A202228-16	3EB007.D	05/07/12 13:59	*custom list*. Use as MS/MSD. LSB 05/04/12
IR86-GW72IW-12B	A202228-17	3EB023.D	05/07/12 13:59	*custom list*. 1 vial has large headspace. LSB 05/04/12
IR86-GW75IW-12B	A202228-18	3EB024.D	05/07/12 13:59	*custom list*

PREPARATION BATCH SUMMARY

EPA 8260B

Laboratory: ENCO Orlando SDG: CH025-106

Client: CH2M Hill, Inc. (CH025) Project: MCB Camp Lejeune, CTO-WE09

Batch: 2E08017 Batch Matrix: Water Preparation: EPA 5030B_MS

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
Blank	2E08017-BLK1	3EC005.D	05/08/12 10:02	
LCS	2E08017-BS1	3EC003.D	05/08/12 10:02	
LCS Dup	2E08017-BSD1	3EC004.D	05/08/12 10:02	
IR86-GW58IW-12B	A202228-19	3EC006.D	05/08/12 10:02	*custom list*
IR86-GW58IWD-12B	A202228-20	3EC007.D	05/08/12 10:02	*custom list*
IR86-GW71IW-12B	A202228-21	3EC008.D	05/08/12 10:02	*custom list*
IR86-TB01-043012	A202228-22	3EC009.D	05/08/12 10:02	*custom list*

METHOD BLANK DATA SHEET
EPA 8260B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water	Laboratory ID:	2E07022-BLK1	File ID:	3EB004.D
Prepared:	05/07/12 11:00	Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL
Analyzed:	05/07/12 14:21	Instrument:	OVGCMS3		
Batch:	2E07022	Sequence:	AA19350	Calibration:	1203063

CAS NO.	COMPOUND	CONC. (ug/L)	Q
75-01-4	Vinyl chloride	<1.0	U
75-35-4	1,1-Dichloroethene	<1.0	U
156-59-2	cis-1,2-Dichloroethene	<1.0	U
79-01-6	Trichloroethene	<1.0	U
127-18-4	Tetrachloroethene	<1.0	U

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	51	103	85 - 115	
Toluene-d8	50.0	52	103	85 - 120	
4-Bromofluorobenzene	50.0	53	106	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1175211	11.51	1271040	11.48	
1,4-Difluorobenzene	1900184	12.09	1870916	12.06	
Chlorobenzene-d5	1500628	14.79	1654965	14.76	
1,4-Dichlorobenzene-d4	645923	17.19	798316	17.16	

METHOD BLANK DATA SHEET
EPA 8260B

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water	Laboratory ID:	2E08017-BLK1	File ID:	3EC005.D
Prepared:	05/08/12 10:02	Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL
Analyzed:	05/08/12 14:04	Instrument:	OVGCMS3		
Batch:	2E08017	Sequence:	AA19359	Calibration:	1203063

CAS NO.	COMPOUND	CONC. (ug/L)	Q
75-01-4	Vinyl chloride	<1.0	U
75-35-4	1,1-Dichloroethene	<1.0	U
156-59-2	cis-1,2-Dichloroethene	<1.0	U
79-01-6	Trichloroethene	<1.0	U
127-18-4	Tetrachloroethene	<1.0	U

SYSTEM MONITORING COMPOUND	ADDED (ug/L)	CONC (ug/L)	% REC	QC LIMITS	Q
Dibromofluoromethane	50.0	51	102	85 - 115	
Toluene-d8	50.0	51	101	85 - 120	
4-Bromofluorobenzene	50.0	52	103	75 - 120	

INTERNAL STANDARD	AREA	RT	REF AREA	REF RT	Q
Pentafluorobenzene	1122510	11.5	1271040	11.48	
1,4-Difluorobenzene	1844823	12.08	1870916	12.06	
Chlorobenzene-d5	1471684	14.78	1654965	14.76	
1,4-Dichlorobenzene-d4	641464	17.18	798316	17.16	

LCS / LCS DUPLICATE RECOVERY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water		
Batch:	2E07022	Laboratory ID:	2E07022-BS1
Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

COMPOUND	SPIKE ADDED (ug/L)	LCS CONCENTRATION (ug/L)	LCS % REC. #	QC LIMITS REC.
Vinyl chloride	20.0	21	105	50 - 145
1,1-Dichloroethene	20.0	24	119	70 - 130
cis-1,2-Dichloroethene	20.0	22	109	70 - 125
Trichloroethene	20.0	19	93	70 - 125
Tetrachloroethene	20.0	18	90	45 - 150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

LCS / LCS DUPLICATE RECOVERY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water		
Batch:	2E08017	Laboratory ID:	2E08017-BS1
Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

COMPOUND	SPIKE ADDED (ug/L)	LCS CONCENTRATION (ug/L)	LCS % REC. #	QC LIMITS REC.
Vinyl chloride	20.0	18	92	50 - 145
1,1-Dichloroethene	20.0	22	111	70 - 130
cis-1,2-Dichloroethene	20.0	18	90	70 - 125
Trichloroethene	20.0	16	82	70 - 125
Tetrachloroethene	20.0	16	78	45 - 150

COMPOUND	SPIKE ADDED (ug/L)	LCSD CONCENTRATION (ug/L)	LCSD % REC. #	% RPD #	QC LIMITS	
					RPD	REC.
Vinyl chloride	20.0	19	93	2	30	50 - 145
1,1-Dichloroethene	20.0	21	107	3	30	70 - 130
cis-1,2-Dichloroethene	20.0	18	91	2	30	70 - 125
Trichloroethene	20.0	16	81	2	30	70 - 125
Tetrachloroethene	20.0	16	80	3	30	45 - 150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY

IR86-GW70IW-12B

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water		
Batch:	2E07022	Laboratory ID:	2E07022-MS1
Preparation:	EPA 5030B_MS	Initial/Final:	5 mL / 5 mL

Source Sample Name: IR86-GW70IW-12B

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	MS CONCENTRATION (ug/L)	MS % REC. #	QC LIMITS REC.
Vinyl chloride	20.0	0.28	21	102	50 - 145
1,1-Dichloroethene	20.0	ND	24	121	70 - 130
cis-1,2-Dichloroethene	20.0	ND	21	106	70 - 125
Trichloroethene	20.0	ND	19	94	70 - 125
Tetrachloroethene	20.0	ND	17	85	45 - 150

COMPOUND	SPIKE ADDED (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC. #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
Vinyl chloride	20.0	21	104	2	30	50 - 145
1,1-Dichloroethene	20.0	24	121	0.5	30	70 - 130
cis-1,2-Dichloroethene	20.0	21	103	2	30	70 - 125
Trichloroethene	20.0	18	92	3	30	70 - 125
Tetrachloroethene	20.0	17	86	2	30	45 - 150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

SURROGATE STANDARD RECOVERY AND RT SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA18681	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
Initial Cal Blank (AA18681-ICB1)			Lab File ID: 3CJ002.D		Analyzed: 03/15/12 09:40			
Dibromofluoromethane			85 - 115	11.08	11.078	0.0020	+/-0.5	
Toluene-d8			85 - 120	13.34	13.345	-0.0050	+/-0.5	
4-Bromofluorobenzene			75 - 120	15.9	15.905	-0.0050	+/-0.5	
Secondary Cal Check (AA18681-SCV1)			Lab File ID: 3CJ013.D		Analyzed: 03/15/12 15:12			
Dibromofluoromethane	50.0	98	80 - 120	11.09	11.078	0.0120	+/-0.5	
Toluene-d8	50.0	107	80 - 120	13.35	13.345	0.0050	+/-0.5	
4-Bromofluorobenzene	50.0	100	80 - 120	15.91	15.905	0.0050	+/-0.5	
Secondary Cal Check (AA18681-SCV2)			Lab File ID: 3CJ014.D		Analyzed: 03/15/12 15:42			
Dibromofluoromethane	50.0	94	80 - 120	11.09	11.078	0.0120	+/-0.5	
Toluene-d8	50.0	112	80 - 120	13.35	13.345	0.0050	+/-0.5	
4-Bromofluorobenzene	50.0	102	80 - 120	15.91	15.905	0.0050	+/-0.5	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19350	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
Calibration Check (AA19350-CCV1)			Lab File ID: 3EB002.D		Analyzed: 05/07/12 13:21			
Dibromofluoromethane	50.0	103	80 - 120	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	97	80 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	99	80 - 120	15.92	15.905	0.0150	+/-0.5	
LCS (2E07022-BS1)			Lab File ID: 3EB003.D		Analyzed: 05/07/12 13:51			
Dibromofluoromethane	50.0	102	85 - 115	11.11	11.078	0.0320	+/-0.5	
Toluene-d8	50.0	97	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	105	75 - 120	15.93	15.905	0.0250	+/-0.5	
Blank (2E07022-BLK1)			Lab File ID: 3EB004.D		Analyzed: 05/07/12 14:21			
Dibromofluoromethane	50.0	103	85 - 115	11.11	11.078	0.0320	+/-0.5	
Toluene-d8	50.0	103	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	106	75 - 120	15.93	15.905	0.0250	+/-0.5	
Matrix Spike (2E07022-MS1)			Lab File ID: 3EB005.D		Analyzed: 05/07/12 14:51			
Dibromofluoromethane	50.0	103	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	100	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	106	75 - 120	15.93	15.905	0.0250	+/-0.5	
Matrix Spike Dup (2E07022-MSD1)			Lab File ID: 3EB006.D		Analyzed: 05/07/12 15:21			
Dibromofluoromethane	50.0	103	85 - 115	11.11	11.078	0.0320	+/-0.5	
Toluene-d8	50.0	101	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	105	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW70IW-12B (A202228-16)			Lab File ID: 3EB007.D		Analyzed: 05/07/12 15:51			
Dibromofluoromethane	50.0	105	85 - 115	11.11	11.078	0.0320	+/-0.5	
Toluene-d8	50.0	101	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	107	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW59IW-12B (A202228-01)			Lab File ID: 3EB008.D		Analyzed: 05/07/12 16:21			
Dibromofluoromethane	50.0	102	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	102	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	105	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW61-12B (A202228-02)			Lab File ID: 3EB009.D		Analyzed: 05/07/12 16:50			
Dibromofluoromethane	50.0	103	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	100	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	105	75 - 120	15.93	15.905	0.0250	+/-0.5	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19350	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
IR86-GW67-12B (A202228-03)			Lab File ID: 3EB010.D		Analyzed: 05/07/12 17:20			
Dibromofluoromethane	50.0	100	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	99	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	101	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW61IW-12B (A202228-04)			Lab File ID: 3EB011.D		Analyzed: 05/07/12 17:51			
Dibromofluoromethane	50.0	106	85 - 115	11.11	11.078	0.0320	+/-0.5	
Toluene-d8	50.0	104	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	103	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-EB050212 (A202228-05)			Lab File ID: 3EB012.D		Analyzed: 05/07/12 18:21			
Dibromofluoromethane	50.0	103	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	103	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	107	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW66-12B (A202228-06)			Lab File ID: 3EB013.D		Analyzed: 05/07/12 18:51			
Dibromofluoromethane	50.0	103	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	102	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	105	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW68-12B (A202228-07)			Lab File ID: 3EB014.D		Analyzed: 05/07/12 19:21			
Dibromofluoromethane	50.0	104	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	101	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	104	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW69-12B (A202228-08)			Lab File ID: 3EB015.D		Analyzed: 05/07/12 19:51			
Dibromofluoromethane	50.0	103	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	101	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	105	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-TB01-050212 (A202228-09)			Lab File ID: 3EB016.D		Analyzed: 05/07/12 20:22			
Dibromofluoromethane	50.0	102	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	100	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	105	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW73IW-12B (A202228-10)			Lab File ID: 3EB017.D		Analyzed: 05/07/12 20:52			
Dibromofluoromethane	50.0	107	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	103	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	108	75 - 120	15.92	15.905	0.0150	+/-0.5	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19350	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
IR86-GW63-12B (A202228-11)			Lab File ID: 3EB018.D		Analyzed: 05/07/12 21:22			
Dibromofluoromethane	50.0	101	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	102	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	104	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW63D-12B (A202228-12)			Lab File ID: 3EB019.D		Analyzed: 05/07/12 21:52			
Dibromofluoromethane	50.0	100	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	110	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	112	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW74IW-12B (A202228-13)			Lab File ID: 3EB020.D		Analyzed: 05/07/12 22:22			
Dibromofluoromethane	50.0	105	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	103	85 - 120	13.36	13.345	0.0150	+/-0.5	
4-Bromofluorobenzene	50.0	105	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-EB043012 (A202228-14)			Lab File ID: 3EB021.D		Analyzed: 05/07/12 22:52			
Dibromofluoromethane	50.0	104	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	102	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	103	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-EB050112 (A202228-15)			Lab File ID: 3EB022.D		Analyzed: 05/07/12 23:23			
Dibromofluoromethane	50.0	103	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	101	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	105	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW72IW-12B (A202228-17)			Lab File ID: 3EB023.D		Analyzed: 05/07/12 23:53			
Dibromofluoromethane	50.0	104	85 - 115	11.11	11.078	0.0320	+/-0.5	
Toluene-d8	50.0	103	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	106	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW75IW-12B (A202228-18)			Lab File ID: 3EB024.D		Analyzed: 05/08/12 00:23			
Dibromofluoromethane	50.0	103	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	100	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	105	75 - 120	15.93	15.905	0.0250	+/-0.5	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19359	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
Calibration Check (AA19359-CCV1)			Lab File ID: 3EC002.D		Analyzed: 05/08/12 12:34			
Dibromofluoromethane	50.0	98	80 - 120	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	99	80 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	101	80 - 120	15.93	15.905	0.0250	+/-0.5	
LCS (2E08017-BS1)			Lab File ID: 3EC003.D		Analyzed: 05/08/12 13:04			
Dibromofluoromethane	50.0	99	85 - 115	11.11	11.078	0.0320	+/-0.5	
Toluene-d8	50.0	97	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	99	75 - 120	15.93	15.905	0.0250	+/-0.5	
LCS Dup (2E08017-BSD1)			Lab File ID: 3EC004.D		Analyzed: 05/08/12 13:34			
Dibromofluoromethane	50.0	101	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	100	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	106	75 - 120	15.93	15.905	0.0250	+/-0.5	
Blank (2E08017-BLK1)			Lab File ID: 3EC005.D		Analyzed: 05/08/12 14:04			
Dibromofluoromethane	50.0	102	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	101	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	103	75 - 120	15.92	15.905	0.0150	+/-0.5	
IR86-GW58IW-12B (A202228-19)			Lab File ID: 3EC006.D		Analyzed: 05/08/12 14:35			
Dibromofluoromethane	50.0	101	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	100	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	104	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW58IWD-12B (A202228-20)			Lab File ID: 3EC007.D		Analyzed: 05/08/12 15:05			
Dibromofluoromethane	50.0	102	85 - 115	11.11	11.078	0.0320	+/-0.5	
Toluene-d8	50.0	100	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	103	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-GW71IW-12B (A202228-21)			Lab File ID: 3EC008.D		Analyzed: 05/08/12 15:36			
Dibromofluoromethane	50.0	103	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	102	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	107	75 - 120	15.93	15.905	0.0250	+/-0.5	
IR86-TB01-043012 (A202228-22)			Lab File ID: 3EC009.D		Analyzed: 05/08/12 16:06			
Dibromofluoromethane	50.0	103	85 - 115	11.1	11.078	0.0220	+/-0.5	
Toluene-d8	50.0	101	85 - 120	13.37	13.345	0.0250	+/-0.5	
4-Bromofluorobenzene	50.0	104	75 - 120	15.93	15.905	0.0250	+/-0.5	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA18681	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Initial Cal Blank (AA18681-ICB1)			Lab File ID: 3CJ002.D			Analyzed: 03/15/12 09:40			
Pentafluorobenzene	842358	11.49	1271040	11.48	66	50 - 200	0.0100	+/-0.50	
1,4-Difluorobenzene	1565959	12.07	1870916	12.06	84	50 - 200	0.0100	+/-0.50	
Chlorobenzene-d5	1168872	14.76	1654965	14.76	71	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	534490	17.16	798316	17.16	67	50 - 200	0.0000	+/-0.50	
Cal Standard (AA18681-CAL1)			Lab File ID: 3CJ003.D			Analyzed: 03/15/12 10:11			
Pentafluorobenzene	1113439	11.48	1271040	11.48	88	50 - 200	0.0000	+/-0.50	
1,4-Difluorobenzene	1777594	12.06	1870916	12.06	95	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	1445361	14.76	1654965	14.76	87	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	601052	17.16	798316	17.16	75	50 - 200	0.0000	+/-0.50	
Cal Standard (AA18681-CAL2)			Lab File ID: 3CJ004.D			Analyzed: 03/15/12 10:41			
Pentafluorobenzene	1004469	11.49	1271040	11.48	79	50 - 200	0.0100	+/-0.50	
1,4-Difluorobenzene	1619346	12.06	1870916	12.06	87	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	1450555	14.76	1654965	14.76	88	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	668444	17.16	798316	17.16	84	50 - 200	0.0000	+/-0.50	
Cal Standard (AA18681-CAL3)			Lab File ID: 3CJ005.D			Analyzed: 03/15/12 11:11			
Pentafluorobenzene	1180346	11.48	1271040	11.48	93	50 - 200	0.0000	+/-0.50	
1,4-Difluorobenzene	1824383	12.06	1870916	12.06	98	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	1554015	14.76	1654965	14.76	94	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	726387	17.15	798316	17.16	91	50 - 200	-0.0100	+/-0.50	
Cal Standard (AA18681-CAL4)			Lab File ID: 3CJ006.D			Analyzed: 03/15/12 11:41			
Pentafluorobenzene	1215085	11.48	1271040	11.48	96	50 - 200	0.0000	+/-0.50	
1,4-Difluorobenzene	1932243	12.06	1870916	12.06	103	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	1715172	14.76	1654965	14.76	104	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	806488	17.16	798316	17.16	101	50 - 200	0.0000	+/-0.50	
Cal Standard (AA18681-CAL5)			Lab File ID: 3CJ007.D			Analyzed: 03/15/12 12:12			
Pentafluorobenzene	1271040	11.48	1271040	11.48	100	50 - 200	0.0000	+/-0.50	
1,4-Difluorobenzene	1870916	12.06	1870916	12.06	100	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	1654965	14.76	1654965	14.76	100	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	798316	17.16	798316	17.16	100	50 - 200	0.0000	+/-0.50	
Cal Standard (AA18681-CAL6)			Lab File ID: 3CJ008.D			Analyzed: 03/15/12 12:42			
Pentafluorobenzene	1252168	11.49	1271040	11.48	99	50 - 200	0.0100	+/-0.50	
1,4-Difluorobenzene	1679378	12.07	1870916	12.06	90	50 - 200	0.0100	+/-0.50	
Chlorobenzene-d5	1417462	14.76	1654965	14.76	86	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	712577	17.16	798316	17.16	89	50 - 200	0.0000	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA18681	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Cal Standard (AA18681-CAL7)			Lab File ID: 3CJ009.D			Analyzed: 03/15/12 13:12			
Pentafluorobenzene	1258428	11.49	1271040	11.48	99	50 - 200	0.0100	+/-0.50	
1,4-Difluorobenzene	1877870	12.06	1870916	12.06	100	50 - 200	0.0000	+/-0.50	
Chlorobenzene-d5	1602985	14.76	1654965	14.76	97	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	729486	17.16	798316	17.16	91	50 - 200	0.0000	+/-0.50	
Secondary Cal Check (AA18681-SCV1)			Lab File ID: 3CJ013.D			Analyzed: 03/15/12 15:12			
Pentafluorobenzene	1203664	11.49	1271040	11.48	95	50 - 200	0.0100	+/-0.50	
1,4-Difluorobenzene	1796778	12.07	1870916	12.06	96	50 - 200	0.0100	+/-0.50	
Chlorobenzene-d5	1590412	14.76	1654965	14.76	96	50 - 200	0.0000	+/-0.50	
1,4-Dichlorobenzene-d4	712645	17.16	798316	17.16	89	50 - 200	0.0000	+/-0.50	
Secondary Cal Check (AA18681-SCV2)			Lab File ID: 3CJ014.D			Analyzed: 03/15/12 15:42			
Pentafluorobenzene	1238202	11.49	1271040	11.48	97	50 - 200	0.0100	+/-0.50	
1,4-Difluorobenzene	1826701	12.07	1870916	12.06	98	50 - 200	0.0100	+/-0.50	
Chlorobenzene-d5	1613561	14.77	1654965	14.76	97	50 - 200	0.0100	+/-0.50	
1,4-Dichlorobenzene-d4	586304	17.16	798316	17.16	73	50 - 200	0.0000	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19350	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Calibration Check (AA19350-CCV1)			Lab File ID: 3EB002.D			Analyzed: 05/07/12 13:21			
Pentafluorobenzene	1310398	11.51	1271040	11.48	103	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	2207278	12.09	1870916	12.06	118	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1865716	14.79	1654965	14.76	113	50 - 200	0.0300	+/-0.50	
1,4-Dichlorobenzene-d4	825540	17.18	798316	17.16	103	50 - 200	0.0200	+/-0.50	
LCS (2E07022-BS1)			Lab File ID: 3EB003.D			Analyzed: 05/07/12 13:51			
Pentafluorobenzene	1245155	11.51	1271040	11.48	98	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	2063874	12.09	1870916	12.06	110	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1633000	14.78	1654965	14.76	99	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	752662	17.19	798316	17.16	94	50 - 200	0.0300	+/-0.50	
Blank (2E07022-BLK1)			Lab File ID: 3EB004.D			Analyzed: 05/07/12 14:21			
Pentafluorobenzene	1175211	11.51	1271040	11.48	92	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1900184	12.09	1870916	12.06	102	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1500628	14.79	1654965	14.76	91	50 - 200	0.0300	+/-0.50	
1,4-Dichlorobenzene-d4	645923	17.19	798316	17.16	81	50 - 200	0.0300	+/-0.50	
Matrix Spike (2E07022-MS1)			Lab File ID: 3EB005.D			Analyzed: 05/07/12 14:51			
Pentafluorobenzene	1215505	11.51	1271040	11.48	96	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1977093	12.09	1870916	12.06	106	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1639478	14.78	1654965	14.76	99	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	739098	17.19	798316	17.16	93	50 - 200	0.0300	+/-0.50	
Matrix Spike Dup (2E07022-MSD1)			Lab File ID: 3EB006.D			Analyzed: 05/07/12 15:21			
Pentafluorobenzene	1208449	11.5	1271040	11.48	95	50 - 200	0.0200	+/-0.50	
1,4-Difluorobenzene	1945570	12.08	1870916	12.06	104	50 - 200	0.0200	+/-0.50	
Chlorobenzene-d5	1640217	14.78	1654965	14.76	99	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	737203	17.18	798316	17.16	92	50 - 200	0.0200	+/-0.50	
IR86-GW70IW-12B (A202228-16)			Lab File ID: 3EB007.D			Analyzed: 05/07/12 15:51			
Pentafluorobenzene	1172526	11.51	1271040	11.48	92	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1929114	12.09	1870916	12.06	103	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1506539	14.79	1654965	14.76	91	50 - 200	0.0300	+/-0.50	
1,4-Dichlorobenzene-d4	659056	17.19	798316	17.16	83	50 - 200	0.0300	+/-0.50	
IR86-GW59IW-12B (A202228-01)			Lab File ID: 3EB008.D			Analyzed: 05/07/12 16:21			
Pentafluorobenzene	1155816	11.51	1271040	11.48	91	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1876944	12.09	1870916	12.06	100	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1445496	14.78	1654965	14.76	87	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	634617	17.18	798316	17.16	79	50 - 200	0.0200	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19350	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
IR86-GW61-12B (A202228-02)			Lab File ID: 3EB009.D			Analyzed: 05/07/12 16:50			
Pentafluorobenzene	1127002	11.51	1271040	11.48	89	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1872044	12.09	1870916	12.06	100	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1444650	14.79	1654965	14.76	87	50 - 200	0.0300	+/-0.50	
1,4-Dichlorobenzene-d4	626691	17.18	798316	17.16	79	50 - 200	0.0200	+/-0.50	
IR86-GW67-12B (A202228-03)			Lab File ID: 3EB010.D			Analyzed: 05/07/12 17:20			
Pentafluorobenzene	1151428	11.51	1271040	11.48	91	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1901394	12.09	1870916	12.06	102	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1480907	14.78	1654965	14.76	89	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	631592	17.19	798316	17.16	79	50 - 200	0.0300	+/-0.50	
IR86-GW61IW-12B (A202228-04)			Lab File ID: 3EB011.D			Analyzed: 05/07/12 17:51			
Pentafluorobenzene	1092438	11.51	1271040	11.48	86	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1834192	12.09	1870916	12.06	98	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1450080	14.78	1654965	14.76	88	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	636721	17.18	798316	17.16	80	50 - 200	0.0200	+/-0.50	
IR86-EB050212 (A202228-05)			Lab File ID: 3EB012.D			Analyzed: 05/07/12 18:21			
Pentafluorobenzene	1123702	11.51	1271040	11.48	88	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1825976	12.09	1870916	12.06	98	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1410353	14.78	1654965	14.76	85	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	612603	17.18	798316	17.16	77	50 - 200	0.0200	+/-0.50	
IR86-GW66-12B (A202228-06)			Lab File ID: 3EB013.D			Analyzed: 05/07/12 18:51			
Pentafluorobenzene	1142032	11.51	1271040	11.48	90	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1870325	12.09	1870916	12.06	100	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1481536	14.78	1654965	14.76	90	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	648809	17.18	798316	17.16	81	50 - 200	0.0200	+/-0.50	
IR86-GW68-12B (A202228-07)			Lab File ID: 3EB014.D			Analyzed: 05/07/12 19:21			
Pentafluorobenzene	1111990	11.51	1271040	11.48	87	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1847455	12.09	1870916	12.06	99	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1460299	14.78	1654965	14.76	88	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	644146	17.18	798316	17.16	81	50 - 200	0.0200	+/-0.50	
IR86-GW69-12B (A202228-08)			Lab File ID: 3EB015.D			Analyzed: 05/07/12 19:51			
Pentafluorobenzene	1111111	11.51	1271040	11.48	87	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1844696	12.08	1870916	12.06	99	50 - 200	0.0200	+/-0.50	
Chlorobenzene-d5	1439470	14.78	1654965	14.76	87	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	641981	17.18	798316	17.16	80	50 - 200	0.0200	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19350	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
IR86-TB01-050212 (A202228-09)			Lab File ID: 3EB016.D			Analyzed: 05/07/12 20:22			
Pentafluorobenzene	1111634	11.51	1271040	11.48	87	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1842406	12.09	1870916	12.06	98	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1417070	14.78	1654965	14.76	86	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	623045	17.18	798316	17.16	78	50 - 200	0.0200	+/-0.50	
IR86-GW73IW-12B (A202228-10)			Lab File ID: 3EB017.D			Analyzed: 05/07/12 20:52			
Pentafluorobenzene	1105576	11.51	1271040	11.48	87	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1821033	12.09	1870916	12.06	97	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1449697	14.78	1654965	14.76	88	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	642717	17.18	798316	17.16	81	50 - 200	0.0200	+/-0.50	
IR86-GW63-12B (A202228-11)			Lab File ID: 3EB018.D			Analyzed: 05/07/12 21:22			
Pentafluorobenzene	1125269	11.51	1271040	11.48	89	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1847627	12.09	1870916	12.06	99	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1449243	14.78	1654965	14.76	88	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	644324	17.19	798316	17.16	81	50 - 200	0.0300	+/-0.50	
IR86-GW63D-12B (A202228-12)			Lab File ID: 3EB019.D			Analyzed: 05/07/12 21:52			
Pentafluorobenzene	893980	11.51	1271040	11.48	70	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1464475	12.09	1870916	12.06	78	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1334647	14.78	1654965	14.76	81	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	641399	17.19	798316	17.16	80	50 - 200	0.0300	+/-0.50	
IR86-GW74IW-12B (A202228-13)			Lab File ID: 3EB020.D			Analyzed: 05/07/12 22:22			
Pentafluorobenzene	1125035	11.51	1271040	11.48	89	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1822215	12.09	1870916	12.06	97	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1457257	14.78	1654965	14.76	88	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	648657	17.18	798316	17.16	81	50 - 200	0.0200	+/-0.50	
IR86-EB043012 (A202228-14)			Lab File ID: 3EB021.D			Analyzed: 05/07/12 22:52			
Pentafluorobenzene	1079289	11.51	1271040	11.48	85	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1800302	12.09	1870916	12.06	96	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1430766	14.78	1654965	14.76	86	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	611705	17.18	798316	17.16	77	50 - 200	0.0200	+/-0.50	
IR86-EB050112 (A202228-15)			Lab File ID: 3EB022.D			Analyzed: 05/07/12 23:23			
Pentafluorobenzene	1086397	11.51	1271040	11.48	85	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1787869	12.09	1870916	12.06	96	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1403171	14.78	1654965	14.76	85	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	616089	17.18	798316	17.16	77	50 - 200	0.0200	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19350	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
IR86-GW72IW-12B (A202228-17)			Lab File ID: 3EB023.D			Analyzed: 05/07/12 23:53			
Pentafluorobenzene	1079717	11.51	1271040	11.48	85	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1801755	12.09	1870916	12.06	96	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1429375	14.79	1654965	14.76	86	50 - 200	0.0300	+/-0.50	
1,4-Dichlorobenzene-d4	639803	17.18	798316	17.16	80	50 - 200	0.0200	+/-0.50	
IR86-GW75IW-12B (A202228-18)			Lab File ID: 3EB024.D			Analyzed: 05/08/12 00:23			
Pentafluorobenzene	1134819	11.51	1271040	11.48	89	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1885102	12.09	1870916	12.06	101	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1465612	14.78	1654965	14.76	89	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	659078	17.18	798316	17.16	83	50 - 200	0.0200	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19359	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Calibration Check (AA19359-CCV1)			Lab File ID: 3EC002.D			Analyzed: 05/08/12 12:34			
Pentafluorobenzene	1317108	11.51	1271040	11.48	104	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	2122569	12.08	1870916	12.06	113	50 - 200	0.0200	+/-0.50	
Chlorobenzene-d5	1778555	14.78	1654965	14.76	107	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	844421	17.18	798316	17.16	106	50 - 200	0.0200	+/-0.50	
LCS (2E08017-BS1)			Lab File ID: 3EC003.D			Analyzed: 05/08/12 13:04			
Pentafluorobenzene	1253213	11.51	1271040	11.48	99	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	2061344	12.09	1870916	12.06	110	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1715620	14.79	1654965	14.76	104	50 - 200	0.0300	+/-0.50	
1,4-Dichlorobenzene-d4	749963	17.18	798316	17.16	94	50 - 200	0.0200	+/-0.50	
LCS Dup (2E08017-BSD1)			Lab File ID: 3EC004.D			Analyzed: 05/08/12 13:34			
Pentafluorobenzene	1193540	11.51	1271040	11.48	94	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1967789	12.09	1870916	12.06	105	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1571880	14.78	1654965	14.76	95	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	753378	17.19	798316	17.16	94	50 - 200	0.0300	+/-0.50	
Blank (2E08017-BLK1)			Lab File ID: 3EC005.D			Analyzed: 05/08/12 14:04			
Pentafluorobenzene	1122510	11.5	1271040	11.48	88	50 - 200	0.0200	+/-0.50	
1,4-Difluorobenzene	1844823	12.08	1870916	12.06	99	50 - 200	0.0200	+/-0.50	
Chlorobenzene-d5	1471684	14.78	1654965	14.76	89	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	641464	17.18	798316	17.16	80	50 - 200	0.0200	+/-0.50	
IR86-GW58IW-12B (A202228-19)			Lab File ID: 3EC006.D			Analyzed: 05/08/12 14:35			
Pentafluorobenzene	1147802	11.51	1271040	11.48	90	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1870268	12.09	1870916	12.06	100	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1486845	14.78	1654965	14.76	90	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	654031	17.18	798316	17.16	82	50 - 200	0.0200	+/-0.50	
IR86-GW58IWD-12B (A202228-20)			Lab File ID: 3EC007.D			Analyzed: 05/08/12 15:05			
Pentafluorobenzene	1120741	11.51	1271040	11.48	88	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1825707	12.09	1870916	12.06	98	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1467224	14.79	1654965	14.76	89	50 - 200	0.0300	+/-0.50	
1,4-Dichlorobenzene-d4	649720	17.19	798316	17.16	81	50 - 200	0.0300	+/-0.50	
IR86-GW71IW-12B (A202228-21)			Lab File ID: 3EC008.D			Analyzed: 05/08/12 15:36			
Pentafluorobenzene	1092776	11.51	1271040	11.48	86	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1776395	12.09	1870916	12.06	95	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1410721	14.78	1654965	14.76	85	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	631193	17.19	798316	17.16	79	50 - 200	0.0300	+/-0.50	

INTERNAL STANDARD AREA AND RT SUMMARY
EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19359	Instrument:	OVGCMS3
Matrix:	Water	Calibration:	1203063

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
IR86-TB01-043012 (A202228-22)			Lab File ID: 3EC009.D			Analyzed: 05/08/12 16:06			
Pentafluorobenzene	1073902	11.51	1271040	11.48	84	50 - 200	0.0300	+/-0.50	
1,4-Difluorobenzene	1773542	12.09	1870916	12.06	95	50 - 200	0.0300	+/-0.50	
Chlorobenzene-d5	1396535	14.78	1654965	14.76	84	50 - 200	0.0200	+/-0.50	
1,4-Dichlorobenzene-d4	601110	17.18	798316	17.16	75	50 - 200	0.0200	+/-0.50	

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA18681	Instrument:	OVGCMS3
		Calibration:	1203063

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
MS Tune	AA18681-TUN1	3CJ001.D	03/15/12 09:09
Initial Cal Blank	AA18681-ICB1	3CJ002.D	03/15/12 09:40
Cal Standard	AA18681-CAL1	3CJ003.D	03/15/12 10:11
Cal Standard	AA18681-CAL2	3CJ004.D	03/15/12 10:41
Cal Standard	AA18681-CAL3	3CJ005.D	03/15/12 11:11
Cal Standard	AA18681-CAL4	3CJ006.D	03/15/12 11:41
Cal Standard	AA18681-CAL5	3CJ007.D	03/15/12 12:12
Cal Standard	AA18681-CAL6	3CJ008.D	03/15/12 12:42
Cal Standard	AA18681-CAL7	3CJ009.D	03/15/12 13:12
Secondary Cal Check	AA18681-SCV1	3CJ013.D	03/15/12 15:12
Secondary Cal Check	AA18681-SCV2	3CJ014.D	03/15/12 15:42

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19350	Instrument:	OVGCMS3
		Calibration:	1203063

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
MS Tune	AA19350-TUN1	3EB001.D	05/07/12 12:51
Calibration Check	AA19350-CCV1	3EB002.D	05/07/12 13:21
LCS	2E07022-BS1	3EB003.D	05/07/12 13:51
Blank	2E07022-BLK1	3EB004.D	05/07/12 14:21
IR86-GW70IW-12B	2E07022-MS1	3EB005.D	05/07/12 14:51
IR86-GW70IW-12B	2E07022-MSD1	3EB006.D	05/07/12 15:21
IR86-GW70IW-12B	A202228-16	3EB007.D	05/07/12 15:51
IR86-GW59IW-12B	A202228-01	3EB008.D	05/07/12 16:21
IR86-GW61-12B	A202228-02	3EB009.D	05/07/12 16:50
IR86-GW67-12B	A202228-03	3EB010.D	05/07/12 17:20
IR86-GW61IW-12B	A202228-04	3EB011.D	05/07/12 17:51
IR86-EB050212	A202228-05	3EB012.D	05/07/12 18:21
IR86-GW66-12B	A202228-06	3EB013.D	05/07/12 18:51
IR86-GW68-12B	A202228-07	3EB014.D	05/07/12 19:21
IR86-GW69-12B	A202228-08	3EB015.D	05/07/12 19:51
IR86-TB01-050212	A202228-09	3EB016.D	05/07/12 20:22
IR86-GW73IW-12B	A202228-10	3EB017.D	05/07/12 20:52
IR86-GW63-12B	A202228-11	3EB018.D	05/07/12 21:22
IR86-GW63D-12B	A202228-12	3EB019.D	05/07/12 21:52
IR86-GW74IW-12B	A202228-13	3EB020.D	05/07/12 22:22
IR86-EB043012	A202228-14	3EB021.D	05/07/12 22:52
IR86-EB050112	A202228-15	3EB022.D	05/07/12 23:23
IR86-GW72IW-12B	A202228-17	3EB023.D	05/07/12 23:53
IR86-GW75IW-12B	A202228-18	3EB024.D	05/08/12 00:23

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19359	Instrument:	OVGCMS3
		Calibration:	1203063

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
MS Tune	AA19359-TUN1	3EC001.D	05/08/12 12:03
Calibration Check	AA19359-CCV1	3EC002.D	05/08/12 12:34
LCS	2E08017-BS1	3EC003.D	05/08/12 13:04
LCS Dup	2E08017-BSD1	3EC004.D	05/08/12 13:34
Blank	2E08017-BLK1	3EC005.D	05/08/12 14:04
IR86-GW58IW-12B	A202228-19	3EC006.D	05/08/12 14:35
IR86-GW58IWD-12B	A202228-20	3EC007.D	05/08/12 15:05
IR86-GW71IW-12B	A202228-21	3EC008.D	05/08/12 15:36
IR86-TB01-043012	A202228-22	3EC009.D	05/08/12 16:06

MASS SPECTROMETER INSTRUMENT PERFORMANCE CHECK

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Lab File ID:	3CJ001.D	Injection Date:	03/15/12
Instrument ID:	OVGCMS3	Injection Time:	09:09
Sequence:	AA18681	Lab Sample ID:	AA18681-TUN1

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
50	15 - 40% of 95	19	PASS
75	30 - 60% of 95	43.9	PASS
95	Base peak, 100% relative abundance	100	PASS
96	5 - 9% of 95	6.28	PASS
173	Less than 2% of 174	0	PASS
174	50 - 200% of 95	88.1	PASS
175	5 - 9% of 174	7.51	PASS
176	95 - 101% of 174	98.9	PASS
177	5 - 9% of 176	6.83	PASS

MASS SPECTROMETER INSTRUMENT PERFORMANCE CHECK

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Lab File ID:	3EB001.D	Injection Date:	05/07/12
Instrument ID:	OVGCMS3	Injection Time:	12:51
Sequence:	AA19350	Lab Sample ID:	AA19350-TUN1

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
50	15 - 40% of 95	25.7	PASS
75	30 - 60% of 95	50.6	PASS
95	Base peak, 100% relative abundance	100	PASS
96	5 - 9% of 95	6.73	PASS
173	Less than 2% of 174	0	PASS
174	50 - 200% of 95	73.6	PASS
175	5 - 9% of 174	7.87	PASS
176	95 - 101% of 174	98.3	PASS
177	5 - 9% of 176	6.12	PASS

MASS SPECTROMETER INSTRUMENT PERFORMANCE CHECK

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Lab File ID:	3EC001.D	Injection Date:	05/08/12
Instrument ID:	OVGCMS3	Injection Time:	12:03
Sequence:	AA19359	Lab Sample ID:	AA19359-TUN1

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
50	15 - 40% of 95	25.5	PASS
75	30 - 60% of 95	49.9	PASS
95	Base peak, 100% relative abundance	100	PASS
96	5 - 9% of 95	7.3	PASS
173	Less than 2% of 174	0	PASS
174	50 - 200% of 95	72.2	PASS
175	5 - 9% of 174	5.53	PASS
176	95 - 101% of 174	99.8	PASS
177	5 - 9% of 176	6.45	PASS

CONTINUING CALIBRATION CHECK

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Instrument ID:	OVGCMS3	Calibration:	1203063
Lab File ID:	3EB002.D	Calibration Date:	03/15/12 12:47
Sequence:	AA19350	Injection Date:	05/07/12
Lab Sample ID:	AA19350-CCV1	Injection Time:	13:21

		CONC. (ug/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Vinyl chloride	A	50.0	60	0.775225	0.9285736		19.8	20
1,1-Dichloroethene	A	50.0	59	0.469901	0.5553992		18.2	20
cis-1,2-Dichloroethene	A	50.0	57	0.5671131	0.6442562		13.6	20
Trichloroethene	A	50.0	48	0.3692314	0.3539985		-4.1	20
Tetrachloroethene	A	50.0	44	0.3574191	0.314945		-11.9	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

CONTINUING CALIBRATION CHECK

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Instrument ID:	OVGCMS3	Calibration:	1203063
Lab File ID:	3EC002.D	Calibration Date:	03/15/12 12:47
Sequence:	AA19359	Injection Date:	05/08/12
Lab Sample ID:	AA19359-CCV1	Injection Time:	12:34

		CONC. (ug/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Vinyl chloride	A	50.0	59	0.775225	0.9136214		17.9	20
1,1-Dichloroethene	A	50.0	59	0.469901	0.5575086		18.6	20
cis-1,2-Dichloroethene	A	50.0	56	0.5671131	0.6376835		12.4	20
Trichloroethene	A	50.0	49	0.3692314	0.3605211		-2.4	20
Tetrachloroethene	A	50.0	45	0.3574191	0.3204804		-10.3	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

INITIAL CALIBRATION STANDARDS

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA18681	Instrument:	OVGCMS3
Calibration:	1203063		

Standard ID	Description	Lab Sample ID	Lab File ID	Analysis Date/Time
A2B0558	8260 BFB Tuning solution	AA18681-TUN1	3CJ001.D	03/15/12 09:09
A2C0319	8260 Calibration 1 ppb	AA18681-CAL1	3CJ003.D	03/15/12 10:11
A2C0320	8260 Calibration 5 ppb	AA18681-CAL2	3CJ004.D	03/15/12 10:41
A2C0321	8260 Calibration 20 ppb	AA18681-CAL3	3CJ005.D	03/15/12 11:11
A2C0322	8260 Calibration 50 ppb	AA18681-CAL4	3CJ006.D	03/15/12 11:41
A2C0323	8260 Calibration 100 ppb	AA18681-CAL5	3CJ007.D	03/15/12 12:12
A2C0324	8260 Calibration 200 ppb	AA18681-CAL6	3CJ008.D	03/15/12 12:42
A2C0326	8260 scv working 50 ppb	AA18681-SCV1	3CJ013.D	03/15/12 15:12
A2C0327	8260 scv working 100 ppb	AA18681-SCV2	3CJ014.D	03/15/12 15:42

INITIAL CALIBRATION DATA

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Calibration:	1203063	Instrument:	OVGCMS3
Matrix:	Water	Calibration Date:	03/15/12 12:47

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
	ug/L	RF	ug/L	RF	ug/L	RF	ug/L	RF	ug/L	RF	ug/L	RF
Vinyl chloride	1	0.7284189	5	0.9968252	20	0.6789111	50	0.7810474	100	0.7486983	200	0.7174489
1,1-Dichloroethene	1	0.5500526	5	0.5530982	20	0.396657	50	0.484032	100	0.4290306	200	0.4065359
cis-1,2-Dichloroethene	1	0.5336619	5	0.5722227	20	0.5454735	50	0.5991918	100	0.5984898	200	0.5536386
Trichloroethene	1	0.4017509	5	0.4351448	20	0.3512475	50	0.3582919	100	0.3437378	200	0.3252156
Tetrachloroethene	1	0.3791094	5	0.3938355	20	0.3490555	50	0.3411395	100	0.3437786	200	0.337596
Dibromofluoromethane	1	~~0.8895413~~	5	0.7802232	20	0.6926211	50	0.6290301	100	0.5821976	200	0.5454272
Toluene-d8	1	0.9839142	5	1.231108	20	1.206056	50	1.196317	100	1.199314	200	1.155962
4-Bromofluorobenzene	1	0.5104261	5	0.4874824	20	0.5280612	50	0.5034929	100	0.5461158	200	0.5488962

INITIAL CALIBRATION DATA (Continued)

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Calibration:	1203063	Instrument:	OVGCMS3
Matrix:	Water	Calibration Date:	03/15/12 12:47

Compound	Level 07		Level 08		Level 09		Level 10		Level 11		Level 12	
	ug/L	RF	ug/L	RF	ug/L	RF	ug/L	RF	ug/L	RF	ug/L	RF
Vinyl chloride												
1,1-Dichloroethene												
cis-1,2-Dichloroethene												
Trichloroethene												
Tetrachloroethene												
Dibromofluoromethane												
Toluene-d8												
4-Bromofluorobenzene												

INITIAL CALIBRATION DATA (Continued)

EPA 8260B

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Calibration:	1203063	Instrument:	OVGCMS3
Matrix:	Water	Calibration Date:	03/15/12 12:47

Compound	Mean RF	RF RSD	Mean RT	RT RSD	Linear r	Quad COD	LIMIT	Q
Vinyl chloride	0.775225	14.66796	5.75	0			CCC (30)	
1,1-Dichloroethene	0.469901	14.9259	8.058334	5.290552E-02			CCC (30)	
cis-1,2-Dichloroethene	0.5671131	4.866513	10.60833	3.543307E-02			15	
Trichloroethene	0.3692314	11.1223	12.07	1.246386E-02			15	
Tetrachloroethene	0.3574191	6.514356	13.75167	2.867474E-02			15	
Dibromofluoromethane	0.6458998	14.41245	11.078	0.0369871			15	
Toluene-d8	1.162112	7.795772	13.345	3.498657E-02			15	
4-Bromofluorobenzene	0.5207458	4.703948	15.905	5.057864E-02			15	

SECOND-SOURCE CALIBRATION VERIFICATION

EPA 8260B

Laboratory: ENCO Orlando

SDG: CH025-106

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, CTO-WE09

Calibration: 1203063

Laboratory ID: AA18681-SCV1

Sequence: AA18681

Standard ID: A2C0326

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Trichloroethene	50.0	48	-3.8	20.00
cis-1,2-Dichloroethene	50.0	51	2.2	20.00
Dibromofluoromethane	50.0	49	-2.5	20.00
Toluene-d8	50.0	54	7.2	20.00
4-Bromofluorobenzene	50.0	50	0.06	20.00
Vinyl chloride	50.0	44	-12.1	20.00
Tetrachloroethene	50.0	48	-3.6	20.00
1,1-Dichloroethene	50.0	51	1.7	20.00

* Values outside of QC limits

SECOND-SOURCE CALIBRATION VERIFICATION

EPA 8260B

Laboratory: ENCO Orlando

SDG: CH025-106

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, CTO-WE09

Calibration: 1203063

Laboratory ID: AA18681-SCV2

Sequence: AA18681

Standard ID: A2C0327

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Trichloroethene	100	91	-9.4	20.00
cis-1,2-Dichloroethene	100	99	-1.3	20.00
Dibromofluoromethane	50.0	47	-5.9	20.00
Toluene-d8	50.0	56	12.0	20.00
4-Bromofluorobenzene	50.0	51	2.4	20.00
Vinyl chloride	100	90	-9.6	20.00
1,1-Dichloroethene	100	94	-6.1	20.00
Tetrachloroethene	100	87	-12.7	20.00

* Values outside of QC limits

ENCO Orlando

SDG: CH025-106

CLASS: 31_WET

METHOD: EPA 9060A

ANALYSES DATA PACKAGE COVER PAGE

EPA 9060A

Laboratory: ENCO Orlando

SDG: CH025-106

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, CTO-WE09

Client Sample Id:	Lab Sample Id:
IR86-GW59IW-12B	A202228-01
IR86-GW61IW-12B	A202228-04
IR86-GW73IW-12B	A202228-10
IR86-GW74IW-12B	A202228-13
IR86-GW70IW-12B	A202228-16
IR86-GW72IW-12B	A202228-17
IR86-GW75IW-12B	A202228-18
IR86-GW58IW-12B	A202228-19
IR86-GW71IW-12B	A202228-21

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signatures.

Signature: _____ Name: _____

Date: _____ Title: _____

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW59IW-12B

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A202228-01
File ID:
Sampled: 05/02/12 10:40
Prepared: 05/08/12 10:00
Analyzed: 05/08/12 10:33
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2E07003
Sequence: AA19335
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	0.81	1	J	0.22	0.66	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW61IW-12B

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A202228-04
File ID:
Sampled: 05/02/12 11:05
Prepared: 05/08/12 10:00
Analyzed: 05/08/12 10:33
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2E07003
Sequence: AA19335
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	2.2	1		0.22	0.66	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW73IW-12B

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A202228-10
File ID:
Sampled: 05/02/12 15:20
Prepared: 05/08/12 10:00
Analyzed: 05/08/12 10:33
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2E07003
Sequence: AA19335
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	140	2	D	0.44	1.3	2.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW74IW-12B

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A202228-13
File ID:
Sampled: 05/01/12 09:55
Prepared: 05/08/12 10:00
Analyzed: 05/08/12 10:33
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2E07003
Sequence: AA19335
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	670	10	D	2.2	6.6	10	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW70IW-12B

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A202228-16
File ID:
Sampled: 05/01/12 14:00
Prepared: 05/08/12 10:00
Analyzed: 05/08/12 10:33
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2E07003
Sequence: AA19335
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	790	10	D	2.2	6.6	10	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW72IW-12B

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A202228-17
File ID:
Sampled: 05/01/12 13:15
Prepared: 05/08/12 10:00
Analyzed: 05/08/12 10:33
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2E07003
Sequence: AA19335
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	820	10	D	2.2	6.6	10	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW75IW-12B

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A202228-18
File ID:
Sampled: 05/01/12 15:40
Prepared: 05/08/12 10:00
Analyzed: 05/08/12 10:33
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2E07003
Sequence: AA19335
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	160	2	D	0.44	1.3	2.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW58IW-12B

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A202228-19
File ID:
Sampled: 05/01/12 10:25
Prepared: 05/08/12 10:00
Analyzed: 05/08/12 10:33
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2E07003
Sequence: AA19335
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	580	10	D	2.2	6.6	10	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW71IW-12B

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A202228-21
File ID:
Sampled: 05/01/12 11:55
Prepared: 05/08/12 10:00
Analyzed: 05/08/12 10:33
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2E07003
Sequence: AA19335
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	650	10	D	2.2	6.6	10	EPA 9060A

PREPARATION BATCH SUMMARY

EPA 9060A

Laboratory: ENCO Orlando SDG: CH025-106

Client: CH2M Hill, Inc. (CH025) Project: MCB Camp Lejeune, CTO-WE09

Batch: 2E07003 Batch Matrix: Water Preparation: NO PREP

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
Blank	2E07003-BLK1		05/08/12 10:00	
LCS	2E07003-BS1		05/08/12 10:00	
IR86-GW70IW-12B	2E07003-MS1		05/08/12 10:00	
IR86-GW70IW-12B	2E07003-MSD1		05/08/12 10:00	
IR86-GW59IW-12B	A202228-01		05/08/12 10:00	
IR86-GW61IW-12B	A202228-04		05/08/12 10:00	
IR86-GW73IW-12B	A202228-10		05/08/12 10:00	
IR86-GW74IW-12B	A202228-13		05/08/12 10:00	
IR86-GW70IW-12B	A202228-16		05/08/12 10:00	MS/MSD not needed. LSB 05/04/12
IR86-GW72IW-12B	A202228-17		05/08/12 10:00	
IR86-GW75IW-12B	A202228-18		05/08/12 10:00	
IR86-GW58IW-12B	A202228-19		05/08/12 10:00	
IR86-GW71IW-12B	A202228-21		05/08/12 10:00	

METHOD BLANK DATA SHEET
EPA 9060A

Laboratory:	ENCO Orlando			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water	Laboratory ID:	2E07003-BLK1	File ID:	
Prepared:	05/08/12 10:00	Preparation:	NO PREP	Initial/Final:	20 mL / 20 mL
Analyzed:	05/08/12 10:33	Instrument:	OWETSTOC1		
Batch:	2E07003	Sequence:	AA19335	Calibration:	1204018

CAS NO.	COMPOUND	CONC. (mg/L)	Q
ECL-0165	Total Organic Carbon	<0.66	U

LCS / LCS DUPLICATE RECOVERY

EPA 9060A

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water		
Batch:	2E07003	Laboratory ID:	2E07003-BS1
Preparation:	NO PREP	Initial/Final:	100 mL / 100 mL

COMPOUND	SPIKE ADDED (mg/L)	LCS CONCENTRATION (mg/L)	LCS % REC. #	QC LIMITS REC.
Total Organic Carbon	40.0	35	87	85 - 115

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY

IR86-GW70IW-12B

EPA 9060A

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water		
Batch:	2E07003	Laboratory ID:	2E07003-MS1
Preparation:	NO PREP	Initial/Final:	20 mL / 20 mL

Source Sample Name: IR86-GW70IW-12B

COMPOUND	SPIKE ADDED (mg/L)	SAMPLE CONCENTRATION (mg/L)	MS CONCENTRATION (mg/L)	MS % REC. #	QC LIMITS REC.
Total Organic Carbon	40.0	790	840	111	85 - 115

COMPOUND	SPIKE ADDED (mg/L)	MSD CONCENTRATION (mg/L)	MSD % REC. #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
Total Organic Carbon	40.0	830	91	1	21	85 - 115

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 9060A

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA18921	Instrument:	OWETSTOC1
		Calibration:	1204018

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
Cal Standard	AA18921-CAL1		04/04/12 15:06
Cal Standard	AA18921-CAL2		04/04/12 15:06
Cal Standard	AA18921-CAL3		04/04/12 15:06
Cal Standard	AA18921-CAL4		04/04/12 15:06
Cal Standard	AA18921-CAL5		04/04/12 15:06
Cal Standard	AA18921-CAL6		04/04/12 15:06
Cal Standard	AA18921-CAL7		04/04/12 15:06
Secondary Cal Check	AA18921-SCV1		04/04/12 15:06
Initial Cal Check	AA18921-ICV1		04/04/12 15:06
Initial Cal Blank	AA18921-ICB1		04/04/12 15:06

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 9060A

Laboratory:	ENCO Orlando	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	AA19335	Instrument:	OWETSTOC1
		Calibration:	1204018

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
Calibration Check	AA19335-CCV1		05/08/12 10:33
Calibration Blank	AA19335-CCB1		05/08/12 10:33
Blank	2E07003-BLK1		05/08/12 10:33
LCS	2E07003-BS1		05/08/12 10:33
IR86-GW59IW-12B	A202228-01		05/08/12 10:33
IR86-GW61IW-12B	A202228-04		05/08/12 10:33
IR86-GW73IW-12B	A202228-10		05/08/12 10:33
IR86-GW74IW-12B	A202228-13		05/08/12 10:33
IR86-GW72IW-12B	A202228-17		05/08/12 10:33
Calibration Check	AA19335-CCV2		05/08/12 10:33
Calibration Blank	AA19335-CCB2		05/08/12 10:33
IR86-GW75IW-12B	A202228-18		05/08/12 10:33
IR86-GW58IW-12B	A202228-19		05/08/12 10:33
IR86-GW71IW-12B	A202228-21		05/08/12 10:33
IR86-GW70IW-12B	A202228-16		05/08/12 10:33
IR86-GW70IW-12B	2E07003-MS1		05/08/12 10:33
IR86-GW70IW-12B	2E07003-MSD1		05/08/12 10:33
Calibration Check	AA19335-CCV3		05/08/12 11:10
Calibration Blank	AA19335-CCB3		05/08/12 11:10
Calibration Check	AA19335-CCV4		05/08/12 11:10
Calibration Blank	AA19335-CCB4		05/08/12 11:10

BLANKS
EPA 9060A

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Instrument ID: OWETSTOC1
Project: MCB Camp Lejeune, CTO-WE09
Sequence: AA18921
Calibration: 1204018

Lab Sample ID	Analyte	Found	LOQ	Units	C	Method
AA18921-ICB1	Total Organic Carbon	0.0	1.0	mg/L		EPA 9060A

BLANKS
EPA 9060A

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Instrument ID: OWETSTOC1
Project: MCB Camp Lejeune, CTO-WE09
Sequence: AA19335
Calibration: 1204018

Lab Sample ID	Analyte	Found	LOQ	Units	C	Method
2E07003-BLK1	Total Organic Carbon	-0.10	1.0	mg/L		EPA 9060A
AA19335-CCB1	Total Organic Carbon	0.03	1.0	mg/L		EPA 9060A
AA19335-CCB2	Total Organic Carbon	-0.05	1.0	mg/L		EPA 9060A
AA19335-CCB3	Total Organic Carbon	-0.04	1.0	mg/L		EPA 9060A
AA19335-CCB4	Total Organic Carbon	0.04	1.0	mg/L		EPA 9060A

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 9060A

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Instrument ID: OWETSTOC1
Calibration: 1204018
Control Limt: +/- 15.00%
Sequence: AA18921

Lab Sample ID	Analyte	True	Found	%R	Units	Method
AA18921-ICV1	Total Organic Carbon	40.0	0.0		mg/L	EPA 9060A

* Values outside of QC limits

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 9060A

Laboratory: ENCO Orlando
SDG: CH025-106
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Instrument ID: OWETSTOC1
Calibration: 1204018
Control Limt: +/- 15.00%
Sequence: AA19335

Lab Sample ID	Analyte	True	Found	%R	Units	Method
AA19335-CCV1	Total Organic Carbon	40.0	38	96	mg/L	EPA 9060A
AA19335-CCV2	Total Organic Carbon	40.0	38	96	mg/L	EPA 9060A
AA19335-CCV3	Total Organic Carbon	40.0	39	97	mg/L	EPA 9060A
AA19335-CCV4	Total Organic Carbon	40.0	38	96	mg/L	EPA 9060A

* Values outside of QC limits

SECOND-SOURCE CALIBRATION VERIFICATION

EPA 9060A

Laboratory: ENCO Orlando

SDG: CH025-106

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, CTO-WE09

Calibration: 1204018

Laboratory ID: AA18921-SCV1

Sequence: AA18921

Standard ID: A2C0615

ANALYTE	EXPECTED (mg/L)	FOUND (mg/L)	% DRIFT	QC LIMIT
Total Organic Carbon	40.0	0.0		15.00

* Values outside of QC limits

ENCO Jacksonville

SDG: CH025-106

CLASS: 33_HPLC

METHOD: VGC-13

ANALYSES DATA PACKAGE COVER PAGE

VGC-13

Laboratory: ENCO Jacksonville

SDG: CH025-106

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, CTO-WE09

Client Sample Id:	Lab Sample Id:
IR86-GW59IW-12B	A202228-01/B202263-01
IR86-GW61IW-12B	A202228-04/B202263-02
IR86-GW73IW-12B	A202228-10/B202263-03
IR86-GW74IW-12B	A202228-13/B202263-04
IR86-GW74IW-12B	A202228-13/B202263-04RE1
IR86-GW70IW-12B	A202228-16/B202263-05
IR86-GW70IW-12B	A202228-16/B202263-05RE1
IR86-GW72IW-12B	A202228-17/B202263-06
IR86-GW72IW-12B	A202228-17/B202263-06RE1
IR86-GW75IW-12B	A202228-18/B202263-07
IR86-GW58IW-12B	A202228-19/B202263-08
IR86-GW58IW-12B	A202228-19/B202263-08RE1
IR86-GW71IW-12B	A202228-21/B202263-09
IR86-GW71IW-12B	A202228-21/B202263-09RE1

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signatures.

Signature: _____ Name: _____

Date: _____ Title: _____

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW59IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-01/B202263-01	File ID:	1EC006.
Sampled:	05/02/12 10:40	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 15:27
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	<0.070	U	0.040	0.070	0.10
107-92-6	Butyric Acid	1	<0.070	U	0.024	0.070	0.10
79-09-4	Propionic Acid	1	<0.070	U	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	<0.14	U	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	103	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW61IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-04/B202263-02	File ID:	1EC007.
Sampled:	05/02/12 11:05	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 15:51
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	<0.070	U	0.040	0.070	0.10
107-92-6	Butyric Acid	1	<0.070	U	0.024	0.070	0.10
79-09-4	Propionic Acid	1	<0.070	U	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	<0.14	U	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	106	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW73IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-10/B202263-03	File ID:	1EC014.
Sampled:	05/02/12 15:20	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 18:52
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	130		0.040	0.070	0.10
107-92-6	Butyric Acid	1	2.1		0.024	0.070	0.10
79-09-4	Propionic Acid	1	150		0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	<0.14	U	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	22	112	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW74IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-13/B202263-04	File ID:	1EC011.
Sampled:	05/01/12 09:55	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 17:41
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	570	E	0.040	0.070	0.10
107-92-6	Butyric Acid	1	13		0.024	0.070	0.10
79-09-4	Propionic Acid	1	670	E	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	0.11	J	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	22	109	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW74IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-13/B202263-04RE1	File ID:	1EC023.
Sampled:	05/01/12 09:55	Prepared:	05/08/12 10:22	Analyzed:	05/09/12 11:12
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	5	570	D	0.20	0.35	0.50
79-09-4	Propionic Acid	5	670	D	0.28	0.35	0.50

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	103	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW70IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-16/B202263-05	File ID:	1EC008.
Sampled:	05/01/12 14:00	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 16:14
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	700	E	0.040	0.070	0.10
107-92-6	Butyric Acid	1	16		0.024	0.070	0.10
79-09-4	Propionic Acid	1	820	E	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	0.13	J	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	106	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW70IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-16/B202263-05RE1	File ID:	1EC009.
Sampled:	05/01/12 14:00	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 16:53
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	5	690	D	0.20	0.35	0.50
79-09-4	Propionic Acid	5	810	D	0.28	0.35	0.50

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	20	101	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW72IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-17/B202263-06	File ID:	1EC016.
Sampled:	05/01/12 13:15	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 19:39
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	710	E	0.040	0.070	0.10
107-92-6	Butyric Acid	1	15		0.024	0.070	0.10
79-09-4	Propionic Acid	1	840	E	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	0.099	J	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	20	99	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW72IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-17/B202263-06RE1	File ID:	1EC024.
Sampled:	05/01/12 13:15	Prepared:	05/08/12 10:22	Analyzed:	05/09/12 11:35
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	5	710	D	0.20	0.35	0.50
79-09-4	Propionic Acid	5	850	D	0.28	0.35	0.50

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	104	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW75IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-18/B202263-07	File ID:	1EC012.
Sampled:	05/01/12 15:40	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 18:04
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	130		0.040	0.070	0.10
107-92-6	Butyric Acid	1	3.1		0.024	0.070	0.10
79-09-4	Propionic Acid	1	190		0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	0.18	J	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	22	108	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW58IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-19/B202263-08	File ID:	1EC015.
Sampled:	05/01/12 10:25	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 19:15
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	450		0.040	0.070	0.10
107-92-6	Butyric Acid	1	14		0.024	0.070	0.10
79-09-4	Propionic Acid	1	650	E	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	<0.14	U	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	103	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW58IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-19/B202263-08RE1	File ID:	1EC025.
Sampled:	05/01/12 10:25	Prepared:	05/08/12 10:22	Analyzed:	05/09/12 11:59
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
79-09-4	Propionic Acid	5	660	D	0.28	0.35	0.50

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	104	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW71IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-21/B202263-09	File ID:	1EC013.
Sampled:	05/01/12 11:55	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 18:28
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	580	E	0.040	0.070	0.10
107-92-6	Butyric Acid	1	13		0.024	0.070	0.10
79-09-4	Propionic Acid	1	680	E	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	0.081	J	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	104	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW71IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-21/B202263-09RE1	File ID:	1EC026.
Sampled:	05/01/12 11:55	Prepared:	05/08/12 10:22	Analyzed:	05/09/12 12:23
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	5	580	D	0.20	0.35	0.50
79-09-4	Propionic Acid	5	690	D	0.28	0.35	0.50

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	106	80 - 124	

* Values outside of QC limits

HOLDING TIME SUMMARY
VGC-13

Laboratory: ENCO Jacksonville SDG: CH025-106

Client: CH2M Hill, Inc. (CH025) Project: MCB Camp Lejeune, CTO-WE09

Sample Name	Date Collected	Date Received	Date Prepared	Days to Prep	Max Days to Prep	Date Analyzed	Days to Analysis	Max Days to Analysis	Q
IR86-GW59IW-12B	05/02/12 10:40	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 15:27	6.00	14.00	
IR86-GW61IW-12B	05/02/12 11:05	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 15:51	6.00	14.00	
IR86-GW73IW-12B	05/02/12 15:20	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 18:52	6.00	14.00	
IR86-GW74IW-12B	05/01/12 09:55	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 17:41	7.00	14.00	
IR86-GW74IW-12B	05/01/12 09:55	05/05/12 08:00	05/08/12 10:22	NA	NA	05/09/12 11:12	8.00	14.00	
IR86-GW70IW-12B	05/01/12 14:00	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 16:14	7.00	14.00	
IR86-GW70IW-12B	05/01/12 14:00	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 16:53	7.00	14.00	
IR86-GW72IW-12B	05/01/12 13:15	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 19:39	7.00	14.00	
IR86-GW72IW-12B	05/01/12 13:15	05/05/12 08:00	05/08/12 10:22	NA	NA	05/09/12 11:35	7.00	14.00	
IR86-GW75IW-12B	05/01/12 15:40	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 18:04	7.00	14.00	
IR86-GW58IW-12B	05/01/12 10:25	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 19:15	7.00	14.00	
IR86-GW58IW-12B	05/01/12 10:25	05/05/12 08:00	05/08/12 10:22	NA	NA	05/09/12 11:59	8.00	14.00	
IR86-GW71IW-12B	05/01/12 11:55	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 18:28	7.00	14.00	
IR86-GW71IW-12B	05/01/12 11:55	05/05/12 08:00	05/08/12 10:22	NA	NA	05/09/12 12:23	8.00	14.00	

PREPARATION BATCH SUMMARY

VGC-13

Laboratory: ENCO Jacksonville SDG: CH025-106

Client: CH2M Hill, Inc. (CH025) Project: MCB Camp Lejeune, CTO-WE09

Batch: 2E07027 Batch Matrix: Water Preparation: NO PREP

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
Blank	2E07027-BLK1	1EC003.	05/08/12 10:22	
LCS	2E07027-BS1	1EC004.	05/08/12 10:22	
LCS Dup	2E07027-BSD1	1EC005.	05/08/12 10:22	
IR86-GW59IW-12B	A202228-01/B202263-01	1EC006.	05/08/12 10:22	
IR86-GW61IW-12B	A202228-04/B202263-02	1EC007.	05/08/12 10:22	
IR86-GW73IW-12B	A202228-10/B202263-03	1EC014.	05/08/12 10:22	
IR86-GW74IW-12B	A202228-13/B202263-04	1EC011.	05/08/12 10:22	
IR86-GW74IW-12B	A202228-13/B202263-04RE1	1EC023.	05/08/12 10:22	
IR86-GW70IW-12B	A202228-16/B202263-05	1EC008.	05/08/12 10:22	
IR86-GW70IW-12B	A202228-16/B202263-05RE1	1EC009.	05/08/12 10:22	
IR86-GW72IW-12B	A202228-17/B202263-06	1EC016.	05/08/12 10:22	
IR86-GW72IW-12B	A202228-17/B202263-06RE1	1EC024.	05/08/12 10:22	
IR86-GW75IW-12B	A202228-18/B202263-07	1EC012.	05/08/12 10:22	
IR86-GW58IW-12B	A202228-19/B202263-08	1EC015.	05/08/12 10:22	
IR86-GW58IW-12B	A202228-19/B202263-08RE1	1EC025.	05/08/12 10:22	
IR86-GW71IW-12B	A202228-21/B202263-09	1EC013.	05/08/12 10:22	
IR86-GW71IW-12B	A202228-21/B202263-09RE1	1EC026.	05/08/12 10:22	

METHOD BLANK DATA SHEET
VGC-13

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water	Laboratory ID:	2E07027-BLK1	File ID:	1EC003.
Prepared:	05/08/12 10:22	Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL
Analyzed:	05/08/12 14:04	Instrument:	JSVHPLC1		
Batch:	2E07027	Sequence:	BA11671	Calibration:	1112014

CAS NO.	COMPOUND	CONC. (mg/L)	Q
64-19-7	Acetic Acid	<0.070	U
107-92-6	Butyric Acid	<0.070	U
79-09-4	Propionic Acid	<0.070	U
127-17-3	Pyruvic Acid	<0.070	U
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric Acid)	<0.14	U

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	105	80 - 124	

LCS / LCS DUPLICATE RECOVERY

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water		
Batch:	2E07027	Laboratory ID:	2E07027-BS1
Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

COMPOUND	SPIKE ADDED (mg/L)	LCS CONCENTRATION (mg/L)	LCS % REC. #	QC LIMITS REC.
Acetic Acid	20.0	20	100	73 - 125
Butyric Acid	20.0	20	98	80 - 120
Propionic Acid	20.0	19	94	80 - 120
Pyruvic Acid	20.0	19	96	37 - 142
Lactic Acid/HIBA (2-Hydroxyisobutyric Acid)	40.0	40	101	70 - 130

COMPOUND	SPIKE ADDED (mg/L)	LCSD CONCENTRATION (mg/L)	LCSD % REC. #	% RPD #	QC LIMITS	
					RPD	REC.
Acetic Acid	20.0	20	100	0.1	10	73 - 125
Butyric Acid	20.0	20	98	0.03	10	80 - 120
Propionic Acid	20.0	19	94	0.4	10	80 - 120
Pyruvic Acid	20.0	19	96	0.07	10	37 - 142
Lactic Acid/HIBA	40.0	40	101	0.05	30	70 - 130

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

SURROGATE STANDARD RECOVERY AND RT SUMMARY

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	BA10757	Instrument:	JSVHPLC1
Matrix:	Water	Calibration:	1112014

Surrogate Compound	Spike Level mg/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
Secondary Cal Check (BA10757-SCV1)			Lab File ID: 1LN019.		Analyzed: 12/19/11 19:45			
Trimethylacetic acid	20.0	109	75 - 125	8.593	8.5867	0.0063	+/-1.0	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	BA11671	Instrument:	JSVHPLC1
Matrix:	Water	Calibration:	1112014

Surrogate Compound	Spike Level mg/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
Calibration Check (BA11671-CCV1)			Lab File ID: 1EC002.		Analyzed: 05/08/12 13:12			
Trimethylacetic acid	20.0	107	80 - 120	8.591	8.5867	0.0043	+/-1.0	
Blank (2E07027-BLK1)			Lab File ID: 1EC003.		Analyzed: 05/08/12 14:04			
Trimethylacetic acid	20.0	105	80 - 124	8.591	8.5867	0.0043	+/-1.0	
LCS (2E07027-BS1)			Lab File ID: 1EC004.		Analyzed: 05/08/12 14:27			
Trimethylacetic acid	20.0	106	80 - 124	8.591	8.5867	0.0043	+/-1.0	
LCS Dup (2E07027-BSD1)			Lab File ID: 1EC005.		Analyzed: 05/08/12 14:51			
Trimethylacetic acid	20.0	106	80 - 124	8.584	8.5867	-0.0027	+/-1.0	
IR86-GW59IW-12B (A202228-01/B202263-01)			Lab File ID: 1EC006.		Analyzed: 05/08/12 15:27			
Trimethylacetic acid	20.0	103	80 - 124	8.585	8.5867	-0.0017	+/-1.0	
IR86-GW61IW-12B (A202228-04/B202263-02)			Lab File ID: 1EC007.		Analyzed: 05/08/12 15:51			
Trimethylacetic acid	20.0	106	80 - 124	8.591	8.5867	0.0043	+/-1.0	
IR86-GW70IW-12B (A202228-16/B202263-05)			Lab File ID: 1EC008.		Analyzed: 05/08/12 16:14			
Trimethylacetic acid	20.0	106	80 - 124	8.591	8.5867	0.0043	+/-1.0	
IR86-GW70IW-12B (A202228-16/B202263-05RE1)			Lab File ID: 1EC009.		Analyzed: 05/08/12 16:53			
Trimethylacetic acid	20.0	101	80 - 124	8.587	8.5867	0.0003	+/-1.0	
Calibration Check (BA11671-CCV2)			Lab File ID: 1EC010.		Analyzed: 05/08/12 17:17			
Trimethylacetic acid	20.0	105	80 - 120	8.592	8.5867	0.0053	+/-1.0	
IR86-GW74IW-12B (A202228-13/B202263-04)			Lab File ID: 1EC011.		Analyzed: 05/08/12 17:41			
Trimethylacetic acid	20.0	109	80 - 124	8.597	8.5867	0.0103	+/-1.0	
IR86-GW75IW-12B (A202228-18/B202263-07)			Lab File ID: 1EC012.		Analyzed: 05/08/12 18:04			
Trimethylacetic acid	20.0	108	80 - 124	8.603	8.5867	0.0163	+/-1.0	
IR86-GW71IW-12B (A202228-21/B202263-09)			Lab File ID: 1EC013.		Analyzed: 05/08/12 18:28			
Trimethylacetic acid	20.0	104	80 - 124	8.601	8.5867	0.0143	+/-1.0	
IR86-GW73IW-12B (A202228-10/B202263-03)			Lab File ID: 1EC014.		Analyzed: 05/08/12 18:52			
Trimethylacetic acid	20.0	112	80 - 124	8.614	8.5867	0.0273	+/-1.0	
IR86-GW58IW-12B (A202228-19/B202263-08)			Lab File ID: 1EC015.		Analyzed: 05/08/12 19:15			
Trimethylacetic acid	20.0	103	80 - 124	8.596	8.5867	0.0093	+/-1.0	
IR86-GW72IW-12B (A202228-17/B202263-06)			Lab File ID: 1EC016.		Analyzed: 05/08/12 19:39			
Trimethylacetic acid	20.0	99	80 - 124	8.601	8.5867	0.0143	+/-1.0	
Calibration Check (BA11671-CCV3)			Lab File ID: 1EC018.		Analyzed: 05/08/12 20:56			
Trimethylacetic acid	20.0	107	80 - 120	8.595	8.5867	0.0083	+/-1.0	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	BA11671	Instrument:	JSVHPLC1
Matrix:	Water	Calibration:	1112014

Surrogate Compound	Spike Level mg/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
Calibration Check (BA11671-CCV4)			Lab File ID: 1EC021.		Analyzed: 05/09/12 09:54			
Trimethylacetic acid	20.0	107	80 - 120	8.597	8.5867	0.0103	+/-1.0	
Instrument Blank (BA11671-IBL1)			Lab File ID: 1EC022.		Analyzed: 05/09/12 10:43			
Trimethylacetic acid			80 - 124	8.6	8.5867	0.0133	+/-1.0	
IR86-GW74IW-12B (A202228-13/B202263-04RE1)			Lab File ID: 1EC023.		Analyzed: 05/09/12 11:12			
Trimethylacetic acid	20.0	103	80 - 124	8.6	8.5867	0.0133	+/-1.0	
IR86-GW72IW-12B (A202228-17/B202263-06RE1)			Lab File ID: 1EC024.		Analyzed: 05/09/12 11:35			
Trimethylacetic acid	20.0	104	80 - 124	8.594	8.5867	0.0073	+/-1.0	
IR86-GW58IW-12B (A202228-19/B202263-08RE1)			Lab File ID: 1EC025.		Analyzed: 05/09/12 11:59			
Trimethylacetic acid	20.0	104	80 - 124	8.599	8.5867	0.0123	+/-1.0	
IR86-GW71IW-12B (A202228-21/B202263-09RE1)			Lab File ID: 1EC026.		Analyzed: 05/09/12 12:23			
Trimethylacetic acid	20.0	106	80 - 124	8.596	8.5867	0.0093	+/-1.0	
Calibration Check (BA11671-CCV5)			Lab File ID: 1EC027.		Analyzed: 05/09/12 12:46			
Trimethylacetic acid	20.0	106	80 - 120	8.591	8.5867	0.0043	+/-1.0	

ANALYSIS BATCH (SEQUENCE) SUMMARY
VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	BA10757	Instrument:	JSVHPLC1
		Calibration:	1112014

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
Cal Standard	BA10757-CAL1	1LN007.	12/19/11 14:49
Cal Standard	BA10757-CAL2	1LN009.	12/19/11 15:49
Cal Standard	BA10757-CAL3	1LN010.	12/19/11 16:13
Cal Standard	BA10757-CAL4	1LN011.	12/19/11 16:37
Cal Standard	BA10757-CAL5	1LN012.	12/19/11 17:00
Cal Standard	BA10757-CAL6	1LN013.	12/19/11 17:24
Cal Standard	BA10757-CAL7	1LN014.	12/19/11 17:47
Cal Standard	BA10757-CAL8	1LN015.	12/19/11 18:11
Cal Standard	BA10757-CAL9	1LN016.	12/19/11 18:34
Cal Standard	BA10757-CALA	1LN017.	12/19/11 18:58
Secondary Cal Check	BA10757-SCV1	1LN019.	12/19/11 19:45

ANALYSIS BATCH (SEQUENCE) SUMMARY
VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	BA11671	Instrument:	JSVHPLC1
		Calibration:	1112014

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
Calibration Check	BA11671-CCV1	1EC002.	05/08/12 13:12
Blank	2E07027-BLK1	1EC003.	05/08/12 14:04
LCS	2E07027-BS1	1EC004.	05/08/12 14:27
LCS Dup	2E07027-BSD1	1EC005.	05/08/12 14:51
IR86-GW59IW-12B	A202228-01/B202263-01	1EC006.	05/08/12 15:27
IR86-GW61IW-12B	A202228-04/B202263-02	1EC007.	05/08/12 15:51
IR86-GW70IW-12B	A202228-16/B202263-05	1EC008.	05/08/12 16:14
IR86-GW70IW-12B	A202228-16/B202263-05RE1	1EC009.	05/08/12 16:53
Calibration Check	BA11671-CCV2	1EC010.	05/08/12 17:17
IR86-GW74IW-12B	A202228-13/B202263-04	1EC011.	05/08/12 17:41
IR86-GW75IW-12B	A202228-18/B202263-07	1EC012.	05/08/12 18:04
IR86-GW71IW-12B	A202228-21/B202263-09	1EC013.	05/08/12 18:28
IR86-GW73IW-12B	A202228-10/B202263-03	1EC014.	05/08/12 18:52
IR86-GW58IW-12B	A202228-19/B202263-08	1EC015.	05/08/12 19:15
IR86-GW72IW-12B	A202228-17/B202263-06	1EC016.	05/08/12 19:39
Calibration Check	BA11671-CCV3	1EC018.	05/08/12 20:56
Calibration Check	BA11671-CCV4	1EC021.	05/09/12 09:54
Instrument Blank	BA11671-IBL1	1EC022.	05/09/12 10:43
IR86-GW74IW-12B	A202228-13/B202263-04RE1	1EC023.	05/09/12 11:12
IR86-GW72IW-12B	A202228-17/B202263-06RE1	1EC024.	05/09/12 11:35
IR86-GW58IW-12B	A202228-19/B202263-08RE1	1EC025.	05/09/12 11:59
IR86-GW71IW-12B	A202228-21/B202263-09RE1	1EC026.	05/09/12 12:23
Calibration Check	BA11671-CCV5	1EC027.	05/09/12 12:46

CONTINUING CALIBRATION CHECK

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Instrument ID:	JSVHPLC1	Calibration:	1112014
Lab File ID:	1EC002.	Calibration Date:	12/20/11 13:47
Sequence:	BA11671	Injection Date:	05/08/12
Lab Sample ID:	BA11671-CCV1	Injection Time:	13:12

		CONC. (mg/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Acetic Acid	A	20.0	20	5.612801	5.681115		1.2	20
Butyric Acid	A	20.0	20	5.297898	5.26051		-0.7	20
Propionic Acid	A	20.0	18	6.297709	5.72695		-9.1	20
Pyruvic Acid	A	20.0	20	100.2014	102.8294		2.6	20
Lactic Acid/HIBA	A	40.0	41	7.532468	7.760165		3.0	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

CONTINUING CALIBRATION CHECK

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Instrument ID:	JSVHPLC1	Calibration:	1112014
Lab File ID:	1EC010.	Calibration Date:	12/20/11 13:47
Sequence:	BA11671	Injection Date:	05/08/12
Lab Sample ID:	BA11671-CCV2	Injection Time:	17:17

		CONC. (mg/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Acetic Acid	A	20.0	20	5.612801	5.546785		-1.2	20
Butyric Acid	A	20.0	20	5.297898	5.21554		-1.6	20
Propionic Acid	A	20.0	22	6.297709	6.816865		8.2	20
Pyruvic Acid	A	20.0	21	100.2014	103.3224		3.1	20
Lactic Acid/HIBA	A	40.0	41	7.532468	7.79119		3.4	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

CONTINUING CALIBRATION CHECK

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Instrument ID:	JSVHPLC1	Calibration:	1112014
Lab File ID:	1EC018.	Calibration Date:	12/20/11 13:47
Sequence:	BA11671	Injection Date:	05/08/12
Lab Sample ID:	BA11671-CCV3	Injection Time:	20:56

		CONC. (mg/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Acetic Acid	A	20.0	20	5.612801	5.67588		1.1	20
Butyric Acid	A	20.0	20	5.297898	5.257695		-0.8	20
Propionic Acid	A	20.0	18	6.297709	5.72037		-9.2	20
Pyruvic Acid	A	20.0	21	100.2014	103.0227		2.8	20
Lactic Acid/HIBA	A	40.0	41	7.532468	7.759123		3.0	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

CONTINUING CALIBRATION CHECK

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Instrument ID:	JSVHPLC1	Calibration:	1112014
Lab File ID:	1EC021.	Calibration Date:	12/20/11 13:47
Sequence:	BA11671	Injection Date:	05/09/12
Lab Sample ID:	BA11671-CCV4	Injection Time:	09:54

		CONC. (mg/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Acetic Acid	A	20.0	20	5.612801	5.689775		1.4	20
Butyric Acid	A	20.0	20	5.297898	5.25744		-0.8	20
Propionic Acid	A	20.0	18	6.297709	5.688605		-9.7	20
Pyruvic Acid	A	20.0	20	100.2014	102.1146		1.9	20
Lactic Acid/HIBA	A	40.0	41	7.532468	7.757475		3.0	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

CONTINUING CALIBRATION CHECK

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Instrument ID:	JSVHPLC1	Calibration:	1112014
Lab File ID:	1EC027.	Calibration Date:	12/20/11 13:47
Sequence:	BA11671	Injection Date:	05/09/12
Lab Sample ID:	BA11671-CCV5	Injection Time:	12:46

		CONC. (mg/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Acetic Acid	A	20.0	20	5.612801	5.595505		-0.3	20
Butyric Acid	A	20.0	20	5.297898	5.19576		-1.9	20
Propionic Acid	A	20.0	20	6.297709	6.406225		1.7	20
Pyruvic Acid	A	20.0	21	100.2014	103.1579		3.0	20
Lactic Acid/HIBA	A	40.0	41	7.532468	7.766973		3.1	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

INITIAL CALIBRATION STANDARDS

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	BA10757	Instrument:	JSVHPLC1
Calibration:	1112014		

Standard ID	Description	Lab Sample ID	Lab File ID	Analysis Date/Time
B1L0177	VFA - CAL1	BA10757-CAL1	1LN007.	12/19/11 14:49
B1L0176	VFA - CAL2	BA10757-CAL2	1LN009.	12/19/11 15:49
B1L0175	VFA - CAL3	BA10757-CAL3	1LN010.	12/19/11 16:13
B1L0174	VFA - CAL4	BA10757-CAL4	1LN011.	12/19/11 16:37
B1L0173	VFA - CAL5	BA10757-CAL5	1LN012.	12/19/11 17:00
B1L0172	VFA - CAL6	BA10757-CAL6	1LN013.	12/19/11 17:24
B1L0171	VFA - CAL7	BA10757-CAL7	1LN014.	12/19/11 17:47
B1L0170	VFA - CAL8	BA10757-CAL8	1LN015.	12/19/11 18:11
B1L0169	VFA - CAL9	BA10757-CAL9	1LN016.	12/19/11 18:34
B1L0168	VFA - CALA	BA10757-CALA	1LN017.	12/19/11 18:58
B1L0155	VFA - SCV (Accustandard)	BA10757-SCV1	1LN019.	12/19/11 19:45

INITIAL CALIBRATION DATA

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Calibration:	1112014	Instrument:	JSVHPLC1
Matrix:	Water	Calibration Date:	12/20/11 13:47

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
	mg/L	RF	mg/L	RF	mg/L	RF	mg/L	RF	mg/L	RF	mg/L	RF
Acetic Acid	0.07	5.397985	0.1	5.47376	0.5	5.78528	1	5.46305	2	5.753105	5	5.324408
Butyric Acid	0.07	6.823371	0.1	4.93044	0.5	4.72324	1	4.87341	2	5.308235	5	4.949552
Propionic Acid	0.07	8.592401	0.1	8.489141	0.5	5.92702	1	5.92982	2	5.79185	5	5.298854
Pyruvic Acid	0.07	108.3031	0.1	101.3726	0.5	100.9688	1	95.8215	2	106.5459	5	96.50582
Lactic Acid/HIBA	0.14	7.407286	0.2	7.18175	1	7.88111	2	7.15988	4	7.750785	10	7.140215
Trimethylacetic acid	0.07	6.2395	0.1	6.58307	0.5	7.04362	1	6.96155	2	7.70232	5	7.14116

INITIAL CALIBRATION DATA (Continued)

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Calibration:	1112014	Instrument:	JSVHPLC1
Matrix:	Water	Calibration Date:	12/20/11 13:47

Compound	Level 07		Level 08		Level 09		Level 10		Level 11		Level 12	
	mg/L	RF	mg/L	RF	mg/L	RF	mg/L	RF	mg/L	RF	mg/L	RF
Acetic Acid	20	5.976915	50	5.737642	100	5.659404	500	5.55646				
Butyric Acid	20	5.56718	50	5.374828	100	5.291839	500	5.13688				
Propionic Acid	20	5.95692	50	5.74775	100	5.64067	500	5.602666				
Pyruvic Acid	20	107.8465	50	~~102.9524~~	100	~~99.51758~~	500	84.2472				
Lactic Acid/HIBA	40	8.005842	100	7.710767	200	7.61176	1000	7.475286				
Trimethylacetic acid	20	8.063894	50	7.77333	100	7.695571	500	7.62455				

INITIAL CALIBRATION DATA (Continued)

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Calibration:	1112014	Instrument:	JSVHPLC1
Matrix:	Water	Calibration Date:	12/20/11 13:47

Compound	Mean RF	RF RSD	Mean RT	RT RSD	Linear r	Quad COD	LIMIT	Q
Acetic Acid	5.612801	3.632	5.7431	0.1061946			20	
Butyric Acid	5.297898	11.25224	8.1361	0.299458			20	
Propionic Acid	6.297709	19.0308	6.7074	0.2321973			20	
Pyruvic Acid	100.2014	8.034347	3.50825	1.997484			20	
Lactic Acid/HIBA (2-Hydroxyisobutyric Acid)	7.532468	4.118139	5.0246	8.408931E-02			20	
Trimethylacetic acid	7.282857	8.0227	8.5867	0.2663312			20	

SECOND-SOURCE CALIBRATION VERIFICATION

VGC-13

Laboratory: ENCO Jacksonville

SDG: CH025-106

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, CTO-WE09

Calibration: 1112014

Laboratory ID: BA10757-SCV1

Sequence: BA10757

Standard ID: B1L0155

ANALYTE	EXPECTED (mg/L)	FOUND (mg/L)	% DRIFT	QC LIMIT
Propionic Acid	20.0	18	-7.7	25.00
Trimethylacetic acid	20.0	22	8.6	25.00
Acetic Acid	20.0	21	3.1	25.00
Lactic Acid/HIBA (2-Hydroxyisobutyric Acid)	40.0	40	0.6	25.00
Pyruvic Acid	20.0	19	-2.9	25.00
Butyric Acid	20.0	20	0.6	25.00

* Values outside of QC limits

Flags, Notes and Definitions

B	The analyte was detected in the associated method blank.
D	The sample was analyzed at dilution.
J	The reported result is an estimated value.
U	Analyte was not detected and is reported as less than the LOD or as defined by the client. The LOD has been adjusted for any dilution or concentration of the sample.
E	The concentration indicated for this analyte is an estimated value above the calibration range of the instrument. This value is considered an estimate.
N	Non-target analyte.
Q	One or more quality control criteria failed.

ENCO Jacksonville

SDG: CH025-106

CLASS: 33_HPLC

METHOD: VGC-13

ANALYSES DATA PACKAGE COVER PAGE

VGC-13

Laboratory: ENCO Jacksonville

SDG: CH025-106

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, CTO-WE09

Client Sample Id:	Lab Sample Id:
IR86-GW59IW-12B	A202228-01/B202263-01
IR86-GW61IW-12B	A202228-04/B202263-02
IR86-GW73IW-12B	A202228-10/B202263-03
IR86-GW74IW-12B	A202228-13/B202263-04
IR86-GW74IW-12B	A202228-13/B202263-04RE1
IR86-GW70IW-12B	A202228-16/B202263-05
IR86-GW70IW-12B	A202228-16/B202263-05RE1
IR86-GW72IW-12B	A202228-17/B202263-06
IR86-GW72IW-12B	A202228-17/B202263-06RE1
IR86-GW75IW-12B	A202228-18/B202263-07
IR86-GW58IW-12B	A202228-19/B202263-08
IR86-GW58IW-12B	A202228-19/B202263-08RE1
IR86-GW71IW-12B	A202228-21/B202263-09
IR86-GW71IW-12B	A202228-21/B202263-09RE1

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signatures.

Signature: _____ Name: _____

Date: _____ Title: _____

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW59IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-01/B202263-01	File ID:	1EC006.
Sampled:	05/02/12 10:40	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 15:27
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	<0.070	U	0.040	0.070	0.10
107-92-6	Butyric Acid	1	<0.070	U	0.024	0.070	0.10
79-09-4	Propionic Acid	1	<0.070	U	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	<0.14	U	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	103	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW61IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-04/B202263-02	File ID:	1EC007.
Sampled:	05/02/12 11:05	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 15:51
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	<0.070	U	0.040	0.070	0.10
107-92-6	Butyric Acid	1	<0.070	U	0.024	0.070	0.10
79-09-4	Propionic Acid	1	<0.070	U	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	<0.14	U	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	106	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW73IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-10/B202263-03	File ID:	1EC014.
Sampled:	05/02/12 15:20	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 18:52
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	130		0.040	0.070	0.10
107-92-6	Butyric Acid	1	2.1		0.024	0.070	0.10
79-09-4	Propionic Acid	1	150		0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	<0.14	U	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	22	112	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW74IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-13/B202263-04	File ID:	1EC011.
Sampled:	05/01/12 09:55	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 17:41
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	570	E	0.040	0.070	0.10
107-92-6	Butyric Acid	1	13		0.024	0.070	0.10
79-09-4	Propionic Acid	1	670	E	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	0.11	J	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	22	109	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW74IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-13/B202263-04RE1	File ID:	1EC023.
Sampled:	05/01/12 09:55	Prepared:	05/08/12 10:22	Analyzed:	05/09/12 11:12
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	5	570	D	0.20	0.35	0.50
79-09-4	Propionic Acid	5	670	D	0.28	0.35	0.50

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	103	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW70IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-16/B202263-05	File ID:	1EC008.
Sampled:	05/01/12 14:00	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 16:14
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	700	E	0.040	0.070	0.10
107-92-6	Butyric Acid	1	16		0.024	0.070	0.10
79-09-4	Propionic Acid	1	820	E	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	0.13	J	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	106	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW70IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-16/B202263-05RE1	File ID:	1EC009.
Sampled:	05/01/12 14:00	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 16:53
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	5	690	D	0.20	0.35	0.50
79-09-4	Propionic Acid	5	810	D	0.28	0.35	0.50

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	20	101	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW72IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-17/B202263-06	File ID:	1EC016.
Sampled:	05/01/12 13:15	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 19:39
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	710	E	0.040	0.070	0.10
107-92-6	Butyric Acid	1	15		0.024	0.070	0.10
79-09-4	Propionic Acid	1	840	E	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	0.099	J	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	20	99	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW72IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-17/B202263-06RE1	File ID:	1EC024.
Sampled:	05/01/12 13:15	Prepared:	05/08/12 10:22	Analyzed:	05/09/12 11:35
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	5	710	D	0.20	0.35	0.50
79-09-4	Propionic Acid	5	850	D	0.28	0.35	0.50

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	104	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW75IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-18/B202263-07	File ID:	1EC012.
Sampled:	05/01/12 15:40	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 18:04
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	130		0.040	0.070	0.10
107-92-6	Butyric Acid	1	3.1		0.024	0.070	0.10
79-09-4	Propionic Acid	1	190		0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	0.18	J	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	22	108	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW58IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-19/B202263-08	File ID:	1EC015.
Sampled:	05/01/12 10:25	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 19:15
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	450		0.040	0.070	0.10
107-92-6	Butyric Acid	1	14		0.024	0.070	0.10
79-09-4	Propionic Acid	1	650	E	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	<0.14	U	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	103	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW58IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-19/B202263-08RE1	File ID:	1EC025.
Sampled:	05/01/12 10:25	Prepared:	05/08/12 10:22	Analyzed:	05/09/12 11:59
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
79-09-4	Propionic Acid	5	660	D	0.28	0.35	0.50

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	104	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW71IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-21/B202263-09	File ID:	1EC013.
Sampled:	05/01/12 11:55	Prepared:	05/08/12 10:22	Analyzed:	05/08/12 18:28
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	1	580	E	0.040	0.070	0.10
107-92-6	Butyric Acid	1	13		0.024	0.070	0.10
79-09-4	Propionic Acid	1	680	E	0.057	0.070	0.10
127-17-3	Pyruvic Acid	1	<0.070	U	0.061	0.070	0.10
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric	1	0.081	J	0.062	0.14	0.20

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	104	80 - 124	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET

VGC-13

IR86-GW71IW-12B

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A202228-21/B202263-09RE1	File ID:	1EC026.
Sampled:	05/01/12 11:55	Prepared:	05/08/12 10:22	Analyzed:	05/09/12 12:23
Solids:		Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

Batch: 2E07027 Sequence: BA11671 Calibration: 1112014 Instrument: JSVHPLC1

CAS NO.	COMPOUND	DILUTION	CONC. (mg/L)	Q	DL	LOD	LOQ
64-19-7	Acetic Acid	5	580	D	0.20	0.35	0.50
79-09-4	Propionic Acid	5	690	D	0.28	0.35	0.50

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	106	80 - 124	

* Values outside of QC limits

HOLDING TIME SUMMARY
VGC-13

Laboratory: ENCO Jacksonville SDG: CH025-106

Client: CH2M Hill, Inc. (CH025) Project: MCB Camp Lejeune, CTO-WE09

Sample Name	Date Collected	Date Received	Date Prepared	Days to Prep	Max Days to Prep	Date Analyzed	Days to Analysis	Max Days to Analysis	Q
IR86-GW59IW-12B	05/02/12 10:40	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 15:27	6.00	14.00	
IR86-GW61IW-12B	05/02/12 11:05	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 15:51	6.00	14.00	
IR86-GW73IW-12B	05/02/12 15:20	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 18:52	6.00	14.00	
IR86-GW74IW-12B	05/01/12 09:55	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 17:41	7.00	14.00	
IR86-GW74IW-12B	05/01/12 09:55	05/05/12 08:00	05/08/12 10:22	NA	NA	05/09/12 11:12	8.00	14.00	
IR86-GW70IW-12B	05/01/12 14:00	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 16:14	7.00	14.00	
IR86-GW70IW-12B	05/01/12 14:00	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 16:53	7.00	14.00	
IR86-GW72IW-12B	05/01/12 13:15	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 19:39	7.00	14.00	
IR86-GW72IW-12B	05/01/12 13:15	05/05/12 08:00	05/08/12 10:22	NA	NA	05/09/12 11:35	7.00	14.00	
IR86-GW75IW-12B	05/01/12 15:40	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 18:04	7.00	14.00	
IR86-GW58IW-12B	05/01/12 10:25	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 19:15	7.00	14.00	
IR86-GW58IW-12B	05/01/12 10:25	05/05/12 08:00	05/08/12 10:22	NA	NA	05/09/12 11:59	8.00	14.00	
IR86-GW71IW-12B	05/01/12 11:55	05/05/12 08:00	05/08/12 10:22	NA	NA	05/08/12 18:28	7.00	14.00	
IR86-GW71IW-12B	05/01/12 11:55	05/05/12 08:00	05/08/12 10:22	NA	NA	05/09/12 12:23	8.00	14.00	

PREPARATION BATCH SUMMARY

VGC-13

Laboratory: ENCO Jacksonville SDG: CH025-106

Client: CH2M Hill, Inc. (CH025) Project: MCB Camp Lejeune, CTO-WE09

Batch: 2E07027 Batch Matrix: Water Preparation: NO PREP

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
Blank	2E07027-BLK1	1EC003.	05/08/12 10:22	
LCS	2E07027-BS1	1EC004.	05/08/12 10:22	
LCS Dup	2E07027-BSD1	1EC005.	05/08/12 10:22	
IR86-GW59IW-12B	A202228-01/B202263-01	1EC006.	05/08/12 10:22	
IR86-GW61IW-12B	A202228-04/B202263-02	1EC007.	05/08/12 10:22	
IR86-GW73IW-12B	A202228-10/B202263-03	1EC014.	05/08/12 10:22	
IR86-GW74IW-12B	A202228-13/B202263-04	1EC011.	05/08/12 10:22	
IR86-GW74IW-12B	A202228-13/B202263-04RE1	1EC023.	05/08/12 10:22	
IR86-GW70IW-12B	A202228-16/B202263-05	1EC008.	05/08/12 10:22	
IR86-GW70IW-12B	A202228-16/B202263-05RE1	1EC009.	05/08/12 10:22	
IR86-GW72IW-12B	A202228-17/B202263-06	1EC016.	05/08/12 10:22	
IR86-GW72IW-12B	A202228-17/B202263-06RE1	1EC024.	05/08/12 10:22	
IR86-GW75IW-12B	A202228-18/B202263-07	1EC012.	05/08/12 10:22	
IR86-GW58IW-12B	A202228-19/B202263-08	1EC015.	05/08/12 10:22	
IR86-GW58IW-12B	A202228-19/B202263-08RE1	1EC025.	05/08/12 10:22	
IR86-GW71IW-12B	A202228-21/B202263-09	1EC013.	05/08/12 10:22	
IR86-GW71IW-12B	A202228-21/B202263-09RE1	1EC026.	05/08/12 10:22	

METHOD BLANK DATA SHEET
VGC-13

Laboratory:	ENCO Jacksonville			SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water	Laboratory ID:	2E07027-BLK1	File ID:	1EC003.
Prepared:	05/08/12 10:22	Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL
Analyzed:	05/08/12 14:04	Instrument:	JSVHPLC1		
Batch:	2E07027	Sequence:	BA11671	Calibration:	1112014

CAS NO.	COMPOUND	CONC. (mg/L)	Q
64-19-7	Acetic Acid	<0.070	U
107-92-6	Butyric Acid	<0.070	U
79-09-4	Propionic Acid	<0.070	U
127-17-3	Pyruvic Acid	<0.070	U
50-21-5/594-61-6	Lactic Acid/HIBA (2-Hydroxyisobutyric Acid)	<0.14	U

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Trimethylacetic acid	20.0	21	105	80 - 124	

LCS / LCS DUPLICATE RECOVERY

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Matrix:	Water		
Batch:	2E07027	Laboratory ID:	2E07027-BS1
Preparation:	NO PREP	Initial/Final:	1 mL / 1 mL

COMPOUND	SPIKE ADDED (mg/L)	LCS CONCENTRATION (mg/L)	LCS % REC. #	QC LIMITS REC.
Acetic Acid	20.0	20	100	73 - 125
Butyric Acid	20.0	20	98	80 - 120
Propionic Acid	20.0	19	94	80 - 120
Pyruvic Acid	20.0	19	96	37 - 142
Lactic Acid/HIBA (2-Hydroxyisobutyric Acid)	40.0	40	101	70 - 130

COMPOUND	SPIKE ADDED (mg/L)	LCSD CONCENTRATION (mg/L)	LCSD % REC. #	% RPD #	QC LIMITS	
					RPD	REC.
Acetic Acid	20.0	20	100	0.1	10	73 - 125
Butyric Acid	20.0	20	98	0.03	10	80 - 120
Propionic Acid	20.0	19	94	0.4	10	80 - 120
Pyruvic Acid	20.0	19	96	0.07	10	37 - 142
Lactic Acid/HIBA	40.0	40	101	0.05	30	70 - 130

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

SURROGATE STANDARD RECOVERY AND RT SUMMARY

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	BA10757	Instrument:	JSVHPLC1
Matrix:	Water	Calibration:	1112014

Surrogate Compound	Spike Level mg/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
Secondary Cal Check (BA10757-SCV1)			Lab File ID: 1LN019.		Analyzed: 12/19/11 19:45			
Trimethylacetic acid	20.0	109	75 - 125	8.593	8.5867	0.0063	+/-1.0	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	BA11671	Instrument:	JSVHPLC1
Matrix:	Water	Calibration:	1112014

Surrogate Compound	Spike Level mg/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
Calibration Check (BA11671-CCV1)			Lab File ID: 1EC002.		Analyzed: 05/08/12 13:12			
Trimethylacetic acid	20.0	107	80 - 120	8.591	8.5867	0.0043	+/-1.0	
Blank (2E07027-BLK1)			Lab File ID: 1EC003.		Analyzed: 05/08/12 14:04			
Trimethylacetic acid	20.0	105	80 - 124	8.591	8.5867	0.0043	+/-1.0	
LCS (2E07027-BS1)			Lab File ID: 1EC004.		Analyzed: 05/08/12 14:27			
Trimethylacetic acid	20.0	106	80 - 124	8.591	8.5867	0.0043	+/-1.0	
LCS Dup (2E07027-BSD1)			Lab File ID: 1EC005.		Analyzed: 05/08/12 14:51			
Trimethylacetic acid	20.0	106	80 - 124	8.584	8.5867	-0.0027	+/-1.0	
IR86-GW59IW-12B (A202228-01/B202263-01)			Lab File ID: 1EC006.		Analyzed: 05/08/12 15:27			
Trimethylacetic acid	20.0	103	80 - 124	8.585	8.5867	-0.0017	+/-1.0	
IR86-GW61IW-12B (A202228-04/B202263-02)			Lab File ID: 1EC007.		Analyzed: 05/08/12 15:51			
Trimethylacetic acid	20.0	106	80 - 124	8.591	8.5867	0.0043	+/-1.0	
IR86-GW70IW-12B (A202228-16/B202263-05)			Lab File ID: 1EC008.		Analyzed: 05/08/12 16:14			
Trimethylacetic acid	20.0	106	80 - 124	8.591	8.5867	0.0043	+/-1.0	
IR86-GW70IW-12B (A202228-16/B202263-05RE1)			Lab File ID: 1EC009.		Analyzed: 05/08/12 16:53			
Trimethylacetic acid	20.0	101	80 - 124	8.587	8.5867	0.0003	+/-1.0	
Calibration Check (BA11671-CCV2)			Lab File ID: 1EC010.		Analyzed: 05/08/12 17:17			
Trimethylacetic acid	20.0	105	80 - 120	8.592	8.5867	0.0053	+/-1.0	
IR86-GW74IW-12B (A202228-13/B202263-04)			Lab File ID: 1EC011.		Analyzed: 05/08/12 17:41			
Trimethylacetic acid	20.0	109	80 - 124	8.597	8.5867	0.0103	+/-1.0	
IR86-GW75IW-12B (A202228-18/B202263-07)			Lab File ID: 1EC012.		Analyzed: 05/08/12 18:04			
Trimethylacetic acid	20.0	108	80 - 124	8.603	8.5867	0.0163	+/-1.0	
IR86-GW71IW-12B (A202228-21/B202263-09)			Lab File ID: 1EC013.		Analyzed: 05/08/12 18:28			
Trimethylacetic acid	20.0	104	80 - 124	8.601	8.5867	0.0143	+/-1.0	
IR86-GW73IW-12B (A202228-10/B202263-03)			Lab File ID: 1EC014.		Analyzed: 05/08/12 18:52			
Trimethylacetic acid	20.0	112	80 - 124	8.614	8.5867	0.0273	+/-1.0	
IR86-GW58IW-12B (A202228-19/B202263-08)			Lab File ID: 1EC015.		Analyzed: 05/08/12 19:15			
Trimethylacetic acid	20.0	103	80 - 124	8.596	8.5867	0.0093	+/-1.0	
IR86-GW72IW-12B (A202228-17/B202263-06)			Lab File ID: 1EC016.		Analyzed: 05/08/12 19:39			
Trimethylacetic acid	20.0	99	80 - 124	8.601	8.5867	0.0143	+/-1.0	
Calibration Check (BA11671-CCV3)			Lab File ID: 1EC018.		Analyzed: 05/08/12 20:56			
Trimethylacetic acid	20.0	107	80 - 120	8.595	8.5867	0.0083	+/-1.0	

SURROGATE STANDARD RECOVERY AND RT SUMMARY

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	BA11671	Instrument:	JSVHPLC1
Matrix:	Water	Calibration:	1112014

Surrogate Compound	Spike Level mg/L	% Recovery	Recovery Limits	RT	Calibration RT	RT Diff	RT Diff Limit	Q
Calibration Check (BA11671-CCV4)			Lab File ID: 1EC021.		Analyzed: 05/09/12 09:54			
Trimethylacetic acid	20.0	107	80 - 120	8.597	8.5867	0.0103	+/-1.0	
Instrument Blank (BA11671-IBL1)			Lab File ID: 1EC022.		Analyzed: 05/09/12 10:43			
Trimethylacetic acid			80 - 124	8.6	8.5867	0.0133	+/-1.0	
IR86-GW74IW-12B (A202228-13/B202263-04RE1)			Lab File ID: 1EC023.		Analyzed: 05/09/12 11:12			
Trimethylacetic acid	20.0	103	80 - 124	8.6	8.5867	0.0133	+/-1.0	
IR86-GW72IW-12B (A202228-17/B202263-06RE1)			Lab File ID: 1EC024.		Analyzed: 05/09/12 11:35			
Trimethylacetic acid	20.0	104	80 - 124	8.594	8.5867	0.0073	+/-1.0	
IR86-GW58IW-12B (A202228-19/B202263-08RE1)			Lab File ID: 1EC025.		Analyzed: 05/09/12 11:59			
Trimethylacetic acid	20.0	104	80 - 124	8.599	8.5867	0.0123	+/-1.0	
IR86-GW71IW-12B (A202228-21/B202263-09RE1)			Lab File ID: 1EC026.		Analyzed: 05/09/12 12:23			
Trimethylacetic acid	20.0	106	80 - 124	8.596	8.5867	0.0093	+/-1.0	
Calibration Check (BA11671-CCV5)			Lab File ID: 1EC027.		Analyzed: 05/09/12 12:46			
Trimethylacetic acid	20.0	106	80 - 120	8.591	8.5867	0.0043	+/-1.0	

ANALYSIS BATCH (SEQUENCE) SUMMARY
VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	BA10757	Instrument:	JSVHPLC1
		Calibration:	1112014

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
Cal Standard	BA10757-CAL1	1LN007.	12/19/11 14:49
Cal Standard	BA10757-CAL2	1LN009.	12/19/11 15:49
Cal Standard	BA10757-CAL3	1LN010.	12/19/11 16:13
Cal Standard	BA10757-CAL4	1LN011.	12/19/11 16:37
Cal Standard	BA10757-CAL5	1LN012.	12/19/11 17:00
Cal Standard	BA10757-CAL6	1LN013.	12/19/11 17:24
Cal Standard	BA10757-CAL7	1LN014.	12/19/11 17:47
Cal Standard	BA10757-CAL8	1LN015.	12/19/11 18:11
Cal Standard	BA10757-CAL9	1LN016.	12/19/11 18:34
Cal Standard	BA10757-CALA	1LN017.	12/19/11 18:58
Secondary Cal Check	BA10757-SCV1	1LN019.	12/19/11 19:45

ANALYSIS BATCH (SEQUENCE) SUMMARY
VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	BA11671	Instrument:	JSVHPLC1
		Calibration:	1112014

Sample Name	Lab Sample ID	Lab File ID	Analysis Date/Time
Calibration Check	BA11671-CCV1	1EC002.	05/08/12 13:12
Blank	2E07027-BLK1	1EC003.	05/08/12 14:04
LCS	2E07027-BS1	1EC004.	05/08/12 14:27
LCS Dup	2E07027-BSD1	1EC005.	05/08/12 14:51
IR86-GW59IW-12B	A202228-01/B202263-01	1EC006.	05/08/12 15:27
IR86-GW61IW-12B	A202228-04/B202263-02	1EC007.	05/08/12 15:51
IR86-GW70IW-12B	A202228-16/B202263-05	1EC008.	05/08/12 16:14
IR86-GW70IW-12B	A202228-16/B202263-05RE1	1EC009.	05/08/12 16:53
Calibration Check	BA11671-CCV2	1EC010.	05/08/12 17:17
IR86-GW74IW-12B	A202228-13/B202263-04	1EC011.	05/08/12 17:41
IR86-GW75IW-12B	A202228-18/B202263-07	1EC012.	05/08/12 18:04
IR86-GW71IW-12B	A202228-21/B202263-09	1EC013.	05/08/12 18:28
IR86-GW73IW-12B	A202228-10/B202263-03	1EC014.	05/08/12 18:52
IR86-GW58IW-12B	A202228-19/B202263-08	1EC015.	05/08/12 19:15
IR86-GW72IW-12B	A202228-17/B202263-06	1EC016.	05/08/12 19:39
Calibration Check	BA11671-CCV3	1EC018.	05/08/12 20:56
Calibration Check	BA11671-CCV4	1EC021.	05/09/12 09:54
Instrument Blank	BA11671-IBL1	1EC022.	05/09/12 10:43
IR86-GW74IW-12B	A202228-13/B202263-04RE1	1EC023.	05/09/12 11:12
IR86-GW72IW-12B	A202228-17/B202263-06RE1	1EC024.	05/09/12 11:35
IR86-GW58IW-12B	A202228-19/B202263-08RE1	1EC025.	05/09/12 11:59
IR86-GW71IW-12B	A202228-21/B202263-09RE1	1EC026.	05/09/12 12:23
Calibration Check	BA11671-CCV5	1EC027.	05/09/12 12:46

CONTINUING CALIBRATION CHECK

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Instrument ID:	JSVHPLC1	Calibration:	1112014
Lab File ID:	1EC002.	Calibration Date:	12/20/11 13:47
Sequence:	BA11671	Injection Date:	05/08/12
Lab Sample ID:	BA11671-CCV1	Injection Time:	13:12

		CONC. (mg/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Acetic Acid	A	20.0	20	5.612801	5.681115		1.2	20
Butyric Acid	A	20.0	20	5.297898	5.26051		-0.7	20
Propionic Acid	A	20.0	18	6.297709	5.72695		-9.1	20
Pyruvic Acid	A	20.0	20	100.2014	102.8294		2.6	20
Lactic Acid/HIBA	A	40.0	41	7.532468	7.760165		3.0	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

CONTINUING CALIBRATION CHECK

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Instrument ID:	JSVHPLC1	Calibration:	1112014
Lab File ID:	1EC010.	Calibration Date:	12/20/11 13:47
Sequence:	BA11671	Injection Date:	05/08/12
Lab Sample ID:	BA11671-CCV2	Injection Time:	17:17

		CONC. (mg/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Acetic Acid	A	20.0	20	5.612801	5.546785		-1.2	20
Butyric Acid	A	20.0	20	5.297898	5.21554		-1.6	20
Propionic Acid	A	20.0	22	6.297709	6.816865		8.2	20
Pyruvic Acid	A	20.0	21	100.2014	103.3224		3.1	20
Lactic Acid/HIBA	A	40.0	41	7.532468	7.79119		3.4	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

CONTINUING CALIBRATION CHECK

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Instrument ID:	JSVHPLC1	Calibration:	1112014
Lab File ID:	1EC018.	Calibration Date:	12/20/11 13:47
Sequence:	BA11671	Injection Date:	05/08/12
Lab Sample ID:	BA11671-CCV3	Injection Time:	20:56

		CONC. (mg/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Acetic Acid	A	20.0	20	5.612801	5.67588		1.1	20
Butyric Acid	A	20.0	20	5.297898	5.257695		-0.8	20
Propionic Acid	A	20.0	18	6.297709	5.72037		-9.2	20
Pyruvic Acid	A	20.0	21	100.2014	103.0227		2.8	20
Lactic Acid/HIBA	A	40.0	41	7.532468	7.759123		3.0	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

CONTINUING CALIBRATION CHECK

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Instrument ID:	JSVHPLC1	Calibration:	1112014
Lab File ID:	1EC021.	Calibration Date:	12/20/11 13:47
Sequence:	BA11671	Injection Date:	05/09/12
Lab Sample ID:	BA11671-CCV4	Injection Time:	09:54

		CONC. (mg/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Acetic Acid	A	20.0	20	5.612801	5.689775		1.4	20
Butyric Acid	A	20.0	20	5.297898	5.25744		-0.8	20
Propionic Acid	A	20.0	18	6.297709	5.688605		-9.7	20
Pyruvic Acid	A	20.0	20	100.2014	102.1146		1.9	20
Lactic Acid/HIBA	A	40.0	41	7.532468	7.757475		3.0	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

CONTINUING CALIBRATION CHECK

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Instrument ID:	JSVHPLC1	Calibration:	1112014
Lab File ID:	1EC027.	Calibration Date:	12/20/11 13:47
Sequence:	BA11671	Injection Date:	05/09/12
Lab Sample ID:	BA11671-CCV5	Injection Time:	12:46

		CONC. (mg/L)		RESPONSE FACTOR			% DIFF / DRIFT	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN (#)	CCV	LIMIT (#)
Acetic Acid	A	20.0	20	5.612801	5.595505		-0.3	20
Butyric Acid	A	20.0	20	5.297898	5.19576		-1.9	20
Propionic Acid	A	20.0	20	6.297709	6.406225		1.7	20
Pyruvic Acid	A	20.0	21	100.2014	103.1579		3.0	20
Lactic Acid/HIBA	A	40.0	41	7.532468	7.766973		3.1	20

Column to be used to flag Response Factor and %Diff/Drift values with an asterisk

* Values outside of QC limits

INITIAL CALIBRATION STANDARDS

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Sequence:	BA10757	Instrument:	JSVHPLC1
Calibration:	1112014		

Standard ID	Description	Lab Sample ID	Lab File ID	Analysis Date/Time
B1L0177	VFA - CAL1	BA10757-CAL1	1LN007.	12/19/11 14:49
B1L0176	VFA - CAL2	BA10757-CAL2	1LN009.	12/19/11 15:49
B1L0175	VFA - CAL3	BA10757-CAL3	1LN010.	12/19/11 16:13
B1L0174	VFA - CAL4	BA10757-CAL4	1LN011.	12/19/11 16:37
B1L0173	VFA - CAL5	BA10757-CAL5	1LN012.	12/19/11 17:00
B1L0172	VFA - CAL6	BA10757-CAL6	1LN013.	12/19/11 17:24
B1L0171	VFA - CAL7	BA10757-CAL7	1LN014.	12/19/11 17:47
B1L0170	VFA - CAL8	BA10757-CAL8	1LN015.	12/19/11 18:11
B1L0169	VFA - CAL9	BA10757-CAL9	1LN016.	12/19/11 18:34
B1L0168	VFA - CALA	BA10757-CALA	1LN017.	12/19/11 18:58
B1L0155	VFA - SCV (Accustandard)	BA10757-SCV1	1LN019.	12/19/11 19:45

INITIAL CALIBRATION DATA

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Calibration:	1112014	Instrument:	JSVHPLC1
Matrix:	Water	Calibration Date:	12/20/11 13:47

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
	mg/L	RF	mg/L	RF	mg/L	RF	mg/L	RF	mg/L	RF	mg/L	RF
Acetic Acid	0.07	5.397985	0.1	5.47376	0.5	5.78528	1	5.46305	2	5.753105	5	5.324408
Butyric Acid	0.07	6.823371	0.1	4.93044	0.5	4.72324	1	4.87341	2	5.308235	5	4.949552
Propionic Acid	0.07	8.592401	0.1	8.489141	0.5	5.92702	1	5.92982	2	5.79185	5	5.298854
Pyruvic Acid	0.07	108.3031	0.1	101.3726	0.5	100.9688	1	95.8215	2	106.5459	5	96.50582
Lactic Acid/HIBA	0.14	7.407286	0.2	7.18175	1	7.88111	2	7.15988	4	7.750785	10	7.140215
Trimethylacetic acid	0.07	6.2395	0.1	6.58307	0.5	7.04362	1	6.96155	2	7.70232	5	7.14116

INITIAL CALIBRATION DATA (Continued)

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Calibration:	1112014	Instrument:	JSVHPLC1
Matrix:	Water	Calibration Date:	12/20/11 13:47

Compound	Level 07		Level 08		Level 09		Level 10		Level 11		Level 12	
	mg/L	RF	mg/L	RF	mg/L	RF	mg/L	RF	mg/L	RF	mg/L	RF
Acetic Acid	20	5.976915	50	5.737642	100	5.659404	500	5.55646				
Butyric Acid	20	5.56718	50	5.374828	100	5.291839	500	5.13688				
Propionic Acid	20	5.95692	50	5.74775	100	5.64067	500	5.602666				
Pyruvic Acid	20	107.8465	50	~~102.9524~~	100	~~99.51758~~	500	84.2472				
Lactic Acid/HIBA	40	8.005842	100	7.710767	200	7.61176	1000	7.475286				
Trimethylacetic acid	20	8.063894	50	7.77333	100	7.695571	500	7.62455				

INITIAL CALIBRATION DATA (Continued)

VGC-13

Laboratory:	ENCO Jacksonville	SDG:	CH025-106
Client:	CH2M Hill, Inc. (CH025)	Project:	MCB Camp Lejeune, CTO-WE09
Calibration:	1112014	Instrument:	JSVHPLC1
Matrix:	Water	Calibration Date:	12/20/11 13:47

Compound	Mean RF	RF RSD	Mean RT	RT RSD	Linear r	Quad COD	LIMIT	Q
Acetic Acid	5.612801	3.632	5.7431	0.1061946			20	
Butyric Acid	5.297898	11.25224	8.1361	0.299458			20	
Propionic Acid	6.297709	19.0308	6.7074	0.2321973			20	
Pyruvic Acid	100.2014	8.034347	3.50825	1.997484			20	
Lactic Acid/HIBA (2-Hydroxyisobutyric Acid)	7.532468	4.118139	5.0246	8.408931E-02			20	
Trimethylacetic acid	7.282857	8.0227	8.5867	0.2663312			20	

SECOND-SOURCE CALIBRATION VERIFICATION

VGC-13

Laboratory: ENCO Jacksonville

SDG: CH025-106

Client: CH2M Hill, Inc. (CH025)

Project: MCB Camp Lejeune, CTO-WE09

Calibration: 1112014

Laboratory ID: BA10757-SCV1

Sequence: BA10757

Standard ID: B1L0155

ANALYTE	EXPECTED (mg/L)	FOUND (mg/L)	% DRIFT	QC LIMIT
Propionic Acid	20.0	18	-7.7	25.00
Trimethylacetic acid	20.0	22	8.6	25.00
Acetic Acid	20.0	21	3.1	25.00
Lactic Acid/HIBA (2-Hydroxyisobutyric Acid)	40.0	40	0.6	25.00
Pyruvic Acid	20.0	19	-2.9	25.00
Butyric Acid	20.0	20	0.6	25.00

* Values outside of QC limits

Flags, Notes and Definitions

B	The analyte was detected in the associated method blank.
D	The sample was analyzed at dilution.
J	The reported result is an estimated value.
U	Analyte was not detected and is reported as less than the LOD or as defined by the client. The LOD has been adjusted for any dilution or concentration of the sample.
E	The concentration indicated for this analyte is an estimated value above the calibration range of the instrument. This value is considered an estimate.
N	Non-target analyte.
Q	One or more quality control criteria failed.

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW70IW-041012

Laboratory: ENCO Orlando
SDG: CH025-089
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A201992-01
File ID:
Sampled: 04/10/12 13:00
Prepared: 04/13/12 09:00
Analyzed: 04/13/12 09:46
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2D13001
Sequence: AA19010
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	1600	50	D	11	33	50	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW71IW-041012

Laboratory: ENCO Orlando
SDG: CH025-089
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A201992-02
File ID:
Sampled: 04/10/12 13:05
Prepared: 04/13/12 09:00
Analyzed: 04/13/12 09:46
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2D13001
Sequence: AA19010
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	3200	50	D	11	33	50	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW72IW-041012

Laboratory: ENCO Orlando
SDG: CH025-089
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A201992-03
File ID:
Sampled: 04/10/12 13:10
Prepared: 04/13/12 09:00
Analyzed: 04/13/12 09:46
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2D13001
Sequence: AA19010
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	330	5	D	1.1	3.3	5.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW73IW-041012

Laboratory: ENCO Orlando
SDG: CH025-089
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A201992-04
File ID:
Sampled: 04/10/12 13:15
Prepared: 04/13/12 09:00
Analyzed: 04/13/12 09:46
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2D13001
Sequence: AA19010
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	14	1		0.22	0.66	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW74IW-041012

Laboratory: ENCO Orlando
SDG: CH025-089
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A201992-05
File ID:
Sampled: 04/10/12 13:30
Prepared: 04/13/12 09:00
Analyzed: 04/13/12 09:46
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2D13001
Sequence: AA19010
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	800	10	D	2.2	6.6	10	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW75IW-041012

Laboratory: ENCO Orlando
SDG: CH025-089
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A201992-06
File ID:
Sampled: 04/10/12 13:35
Prepared: 04/13/12 09:00
Analyzed: 04/13/12 09:46
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2D13001
Sequence: AA19010
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	280	5	D	1.1	3.3	5.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-EW01-041012

Laboratory: ENCO Orlando
SDG: CH025-089
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A201992-07
File ID:
Sampled: 04/10/12 13:20
Prepared: 04/13/12 09:00
Analyzed: 04/13/12 09:46
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2D13001
Sequence: AA19010
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	60	1		0.22	0.66	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-EW02-041012

Laboratory: ENCO Orlando
SDG: CH025-089
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A201992-08
File ID:
Sampled: 04/10/12 13:25
Prepared: 04/13/12 09:00
Analyzed: 04/13/12 09:46
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2D13001
Sequence: AA19010
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	23	1		0.22	0.66	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-LACTATE-041012

Laboratory: ENCO Orlando
SDG: CH025-089
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A201992-09
File ID:
Sampled: 04/10/12 14:00
Prepared: 04/13/12 09:00
Analyzed: 04/13/12 09:46
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2D13001
Sequence: AA19010
Calibration: 1204018
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	240000	5000	D	1100	3300	5000	EPA 9060A

2340 Stock Creek Blvd.
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Client: Troy Horn
CH2M HILL
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Phone: 751-671-6288

Fax: 751-497-6885

Identifier: 045IJ **Date Rec:** 10/19/2011 **Report Date:** 10/25/2011

Client Project #: 423849.PT.PT **Client Project Name:** Site 86 Baseline Groundwater Sampling

Purchase Order #: 945859

Analysis Requested: mRNA

Reviewed By:

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MICROBIAL INSIGHTS, INC.

2340 Stock Creek Blvd. Rockford, TN 37853-3044
Tel. (865) 573-8188 Fax. (865) 573-8133

mRNA

Client: **CH2M HILL**
Project: Site 86 Baseline Groundwater Sampling

MI Project Number: **045IJ**
Date Received: 10/19/2011

Sample Information

Client Sample ID:		**IR86-GW58IW-1 106**	**IR86-GW70IW-1 106**	**IR86-GW74IW-1 106**	**IR86-GW72IW-1 106**	**IR86-GW75IW-1 106**
Sample Date:		10/18/2011	10/18/2011	10/18/2011	10/18/2011	10/18/2011
Units:		gene copies/mL	gene copies/mL	gene copies/mL	gene copies/mL	gene copies/mL
Analyst:		CT	CT	CT	CT	CT
Dechlorinating Bacteria						
Dehalococcoides spp.	*DHC*	**7.89E+01**	**5.77E+01**	**3.66E+01**	**1.80E+00**	**7.40E+00**
Dehalobacter spp.	*DHBt*	**2.71E+03**	**1.96E+02**	**2.89E+03**	**1.44E+03**	**7.54E+02**
Desulfuromonas spp.	*DSM*	**6.35E+02**	**1.89E+02**	**2.79E+03**	**6.08E+02**	**2.56E+02**
Desulfitobacterium spp.	*DSB*	**7.05E+04**	**4.94E+05**	**1.75E+07**	**2.59E+03**	**7.80E+05**
Functional Genes						
tceA Reductase	TCE	**9.60E+00**	**4.50E+00**	**8.90E+00**	**6.00E+00**	**1.09E+01**
bvcA Reductase	BVC	**8.42E+02**	**2.55E+01**	**1.26E+02**	**4.00E-01 (J)**	**1.37E+01**
Vinyl Chloride Reductase	VCR	**1.20E+00**	<5.00E-01	**4.00E-01 (J)**	<5.00E-01	<5.00E-01
Toluene Dioxygenase	TOD	**3.51E+03**	**1.70E+04**	**7.12E+03**	<1.00E+00	**4.92E+03**
Phylogenetic Group						
Methane Oxidizing Bacteria	MOB	**7.79E+05**	**3.86E+06**	**2.98E+06**	<1.00E+00	**1.31E+06**

Legend:
NA = Not Analyzed NS = Not Sampled J = Estimated gene copies below PQL but above LQL I = Inhibited
< = Result not detected

MICROBIAL INSIGHTS, INC.

2340 Stock Creek Blvd. Rockford, TN 37853-3044
Tel. (865) 573-8188 Fax. (865) 573-8133

mRNA

Client: **CH2M HILL**
Project: Site 86 Baseline Groundwater Sampling

MI Project Number: **045IJ**
Date Received: 10/19/2011

Sample Information

Client Sample ID:	**IR86-GW71IW-1 106**
Sample Date:	10/18/2011
Units:	gene copies/mL
Analyst:	CT

Dechlorinating Bacteria

Dehalococcoides spp.	*DHC*	**2.00E+00**
Dehalobacter spp.	*DHBt*	**1.37E+04**
Desulfuromonas spp.	*DSM*	**2.93E+03**
Desulfitobacterium spp.	*DSB*	**1.57E+04**

Functional Genes

tceA Reductase	TCE	**9.20E+00**
bvcA Reductase	BVC	**5.33E+01**
Vinyl Chloride Reductase	VCR	<5.00E-01
Toluene Dioxygenase	TOD	**1.59E+03**

Phylogenetic Group

Methane Oxidizing Bacteria	MOB	**3.22E+05**

Legend:
NA = Not Analyzed NS = Not Sampled J = Estimated gene copies below PQL but above LQL I = Inhibited
< = Result not detected

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-EW01-11D

Laboratory: ENCO Orlando
SDG: CH025-054
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106352-13
File ID:
Sampled: 12/01/11 08:30
Prepared: 12/05/11 15:41
Analyzed: 12/05/11 16:36
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L05025
Sequence: AA17424
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	270	5	D	1.1	4.5	5.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-EW02-11D

Laboratory: ENCO Orlando
SDG: CH025-054
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106352-14
File ID:
Sampled: 12/01/11 08:40
Prepared: 12/05/11 15:41
Analyzed: 12/05/11 16:36
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L05025
Sequence: AA17424
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	250	5	D	1.1	4.5	5.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW70IW-11D

Laboratory: ENCO Orlando
SDG: CH025-054
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106352-15
File ID:
Sampled: 12/01/11 09:00
Prepared: 12/05/11 15:41
Analyzed: 12/05/11 16:36
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L05025
Sequence: AA17424
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	23	1		0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW71IW-11D

Laboratory: ENCO Orlando
SDG: CH025-054
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106352-16
File ID:
Sampled: 12/01/11 09:20
Prepared: 12/05/11 15:41
Analyzed: 12/05/11 16:36
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L05025
Sequence: AA17424
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	200	5	D	1.1	4.5	5.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW72IW-11D

Laboratory:	ENCO Orlando			SDG:	CH025-054
Client:	CH2M Hill, Inc. (CH025)			Project:	MCB Camp Lejeune, Site 86 CTO-WE09
Matrix:	Ground Water	Laboratory ID:	A106352-17	File ID:	
Sampled:	12/01/11 09:40	Prepared:	12/05/11 15:41	Analyzed:	12/05/11 16:36
Solids:	0.00	Preparation:	NO PREP	Initial/Final:	20 mL / 20 mL
Batch:	1L05025	Sequence:	AA17424	Calibration:	1103065
Instrument:	OWETSTOC1				

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	2600	50	D	11	45	50	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW73IW-11D

Laboratory: ENCO Orlando
SDG: CH025-054
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106352-18
File ID:
Sampled: 12/01/11 09:50
Prepared: 12/05/11 15:41
Analyzed: 12/05/11 16:36
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L05025
Sequence: AA17424
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	7.5	1		0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW74IW-11D

Laboratory: ENCO Orlando
SDG: CH025-054
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106352-19
File ID:
Sampled: 12/01/11 10:10
Prepared: 12/05/11 15:41
Analyzed: 12/05/11 16:36
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L05025
Sequence: AA17424
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	35	1		0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-GW75IW-11D

Laboratory: ENCO Orlando
SDG: CH025-054
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, Site 86 CTO-WE09
Matrix: Ground Water
Laboratory ID: A106352-20
File ID:
Sampled: 12/01/11 10:30
Prepared: 12/05/11 15:41
Analyzed: 12/05/11 16:36
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 1L05025
Sequence: AA17424
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	3100	50	D	11	45	50	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-MW70IW-1512

Laboratory: ENCO Orlando
SDG: CH025-059
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A200104-01
File ID:
Sampled: 01/05/12 15:00
Prepared: 01/06/12 10:30
Analyzed: 01/06/12 11:12
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2A06007
Sequence: AA17783
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	17	1		0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-MW71IW-1512

Laboratory: ENCO Orlando
SDG: CH025-059
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A200104-02
File ID:
Sampled: 01/05/12 15:00
Prepared: 01/06/12 10:30
Analyzed: 01/06/12 11:12
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2A06007
Sequence: AA17783
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	38	1		0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-MW72IW-1512

Laboratory: ENCO Orlando
SDG: CH025-059
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A200104-03
File ID:
Sampled: 01/05/12 15:10
Prepared: 01/06/12 10:30
Analyzed: 01/06/12 11:12
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2A06007
Sequence: AA17783
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	100	1	E	0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-MW72IW-1512

Laboratory: ENCO Orlando
SDG: CH025-059
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A200104-03RE1
File ID:
Sampled: 01/05/12 15:10
Prepared: 01/06/12 10:30
Analyzed: 01/06/12 11:12
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2A06007
Sequence: AA17783
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	100	2	D	0.44	1.8	2.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-MW73IW-1512

Laboratory: ENCO Orlando
SDG: CH025-059
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A200104-04
File ID:
Sampled: 01/05/12 15:20
Prepared: 01/06/12 10:30
Analyzed: 01/06/12 11:12
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2A06007
Sequence: AA17783
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	5.6	1		0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-MW74IW-1512

Laboratory: ENCO Orlando
SDG: CH025-059
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A200104-05
File ID:
Sampled: 01/05/12 15:30
Prepared: 01/06/12 10:30
Analyzed: 01/06/12 11:12
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2A06007
Sequence: AA17783
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	14	1		0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-MW75IW-1512

Laboratory: ENCO Orlando
SDG: CH025-059
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A200104-06
File ID:
Sampled: 01/05/12 15:40
Prepared: 01/06/12 10:30
Analyzed: 01/06/12 11:12
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2A06007
Sequence: AA17783
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	160	1	E	0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-MW75IW-1512

Laboratory: ENCO Orlando
SDG: CH025-059
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A200104-06RE1
File ID:
Sampled: 01/05/12 15:40
Prepared: 01/06/12 10:30
Analyzed: 01/06/12 11:12
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2A06007
Sequence: AA17783
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	180	5	D	1.1	4.5	5.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-EW01-1512

Laboratory: ENCO Orlando
SDG: CH025-059
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A200104-07
File ID:
Sampled: 01/05/12 16:00
Prepared: 01/06/12 10:30
Analyzed: 01/06/12 11:12
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2A06007
Sequence: AA17783
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	38	1		0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-EW02-1512

Laboratory: ENCO Orlando
SDG: CH025-059
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A200104-08
File ID:
Sampled: 01/05/12 16:00
Prepared: 01/06/12 10:30
Analyzed: 01/06/12 11:12
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2A06007
Sequence: AA17783
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	190	1	E	0.22	0.90	1.0	EPA 9060A

INORGANIC ANALYSIS DATA SHEET

EPA 9060A

IR86-EW02-1512

Laboratory: ENCO Orlando
SDG: CH025-059
Client: CH2M Hill, Inc. (CH025)
Project: MCB Camp Lejeune, CTO-WE09
Matrix: Ground Water
Laboratory ID: A200104-08RE1
File ID:
Sampled: 01/05/12 16:00
Prepared: 01/06/12 10:30
Analyzed: 01/06/12 11:12
Solids: 0.00
Preparation: NO PREP
Initial/Final: 20 mL / 20 mL
Batch: 2A06007
Sequence: AA17783
Calibration: 1103065
Instrument: OWETSTOC1

CAS NO.	Analyte	Concentration (mg/L)	Dilution Factor	Q	DL	LOD	LOQ	Method
ECL-0165	Total Organic Carbon	240	5	D	1.1	4.5	5.0	EPA 9060A

Appendix B
Relevant Historical Documentation

Preliminary Site Investigation (Dewberry and Davis, 1990)

TABLE 9

NEW RIVER AIR STATION WASTE OIL TANKS
LABORATORY RESULTS OF SOIL SAMPLES

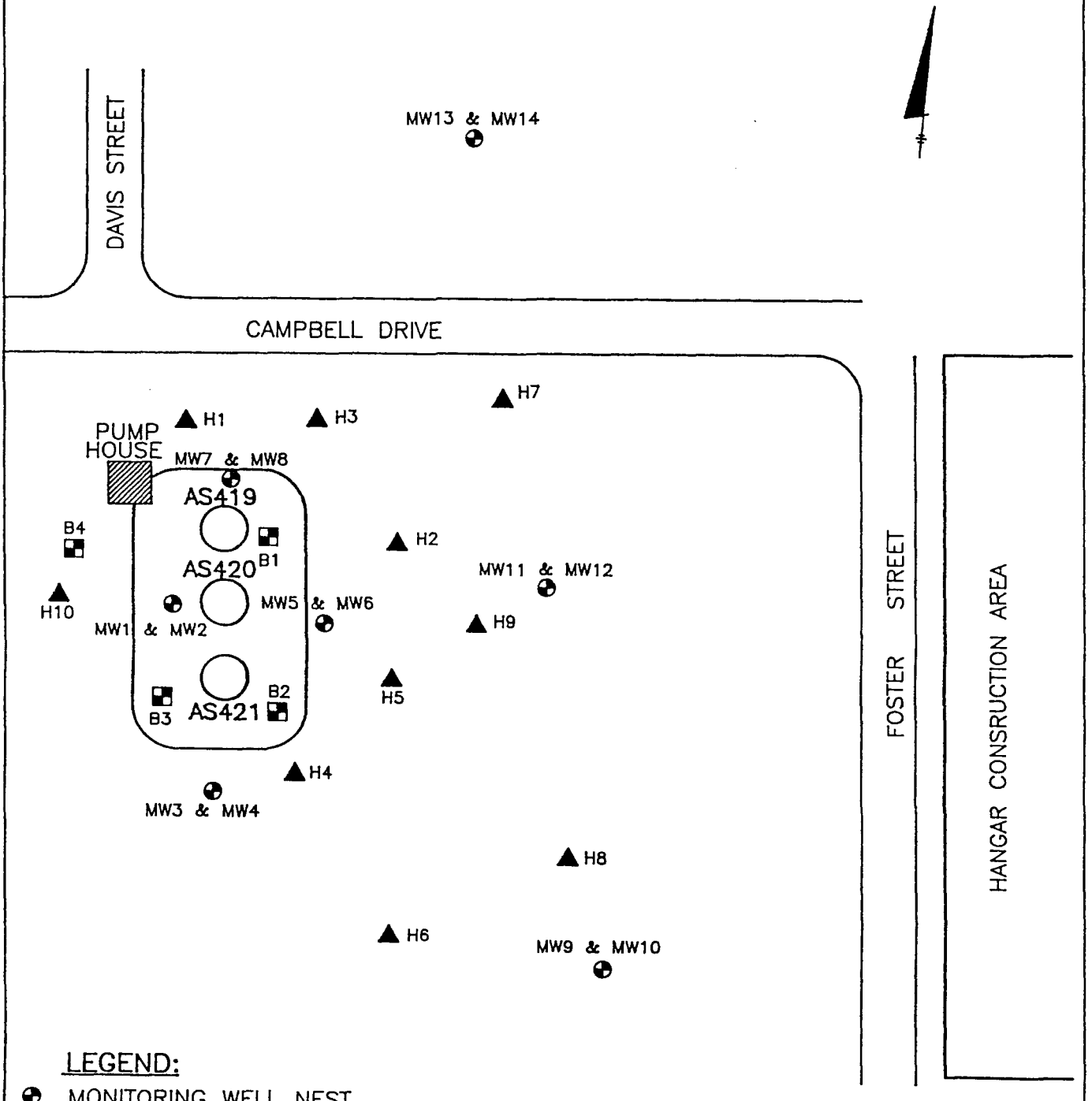
IPLE	DEPTH	TPH	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	V7	V17	V20	V25
SB-1	2'-4'	ND	--	--	--	--	--	--	--	--
SB-2	2'-4'	ND	--	--	--	--	--	--	--	--
B-3A	0'-1'	ND	--	--	--	--	--	--	--	--
B-3B	1'-5'	ND	--	--	--	--	--	--	--	--
SB-4	0'-4'	ND	ND	ND	ND	ND	0.006	0.030	0.035	0.061
SB-5	1'-2'	211 D 7000 IR 2750 IR*	--	--	--	--	--	--	--	--
B-6A	0.5'-2'	ND	--	--	--	--	--	--	--	--
B-6B	3.5'	ND	--	--	--	--	--	--	--	--
B-7A	0.5'-2'	70 D 7500 IR	--	--	--	--	--	--	--	--
B-7B	3.5'-4'	200 IR	--	--	--	--	--	--	--	--
SB-8	3'-5'	ND	--	--	--	--	--	--	--	--

ES:
1) ALL RESULTS ARE PRESENTED IN PARTS PER MILLION (PPM), WHICH IS ANALOGOUS TO MILLIGRAMS PER KILOGRAM.
2) TPH- TOTAL PETROLEUM HYDROCARBONS. TEST METHOD IS BY GAS CHROMATOGRAPH (GC); "D" - INDICATES DIESEL, "IR" - INDICATES INFRARED SPECTROPHOTOMETRY METHOD IN LIEU OF OR IN ADDITION TO GC METHOD. "*" - INDICATES TEST RESULTS FROM SECOND LABORATORY.
3) VOLATILE ORGANIC COMPOUNDS (VOC) ARE 34 COMMON PRIORITY POLLUTANTS. V7 - CHLOROFORM, V17 MEHYLENE CHLORIDE, V20 - 1,1,1 TRICHLOROETHANE, V25 - 1,1,2 TRICHLOROTRIFLUOROETHANE (FREON). INCLUDES BENZENE, TOLUENE, ETHYLBENZENE AND TOTAL XYLENES (BTEX). ALL OTHER COMPOUNDS WERE BELOW THEIR DETECTION LIMITS.
4) "ND" - NOT DETECTED. DETECTION LIMITS: TPH IN SOIL = 10 PPM, VOC AND BTEX IN SOIL = 0.005 PPM.

Site Assessment (O'Brien and Gere, 1992)

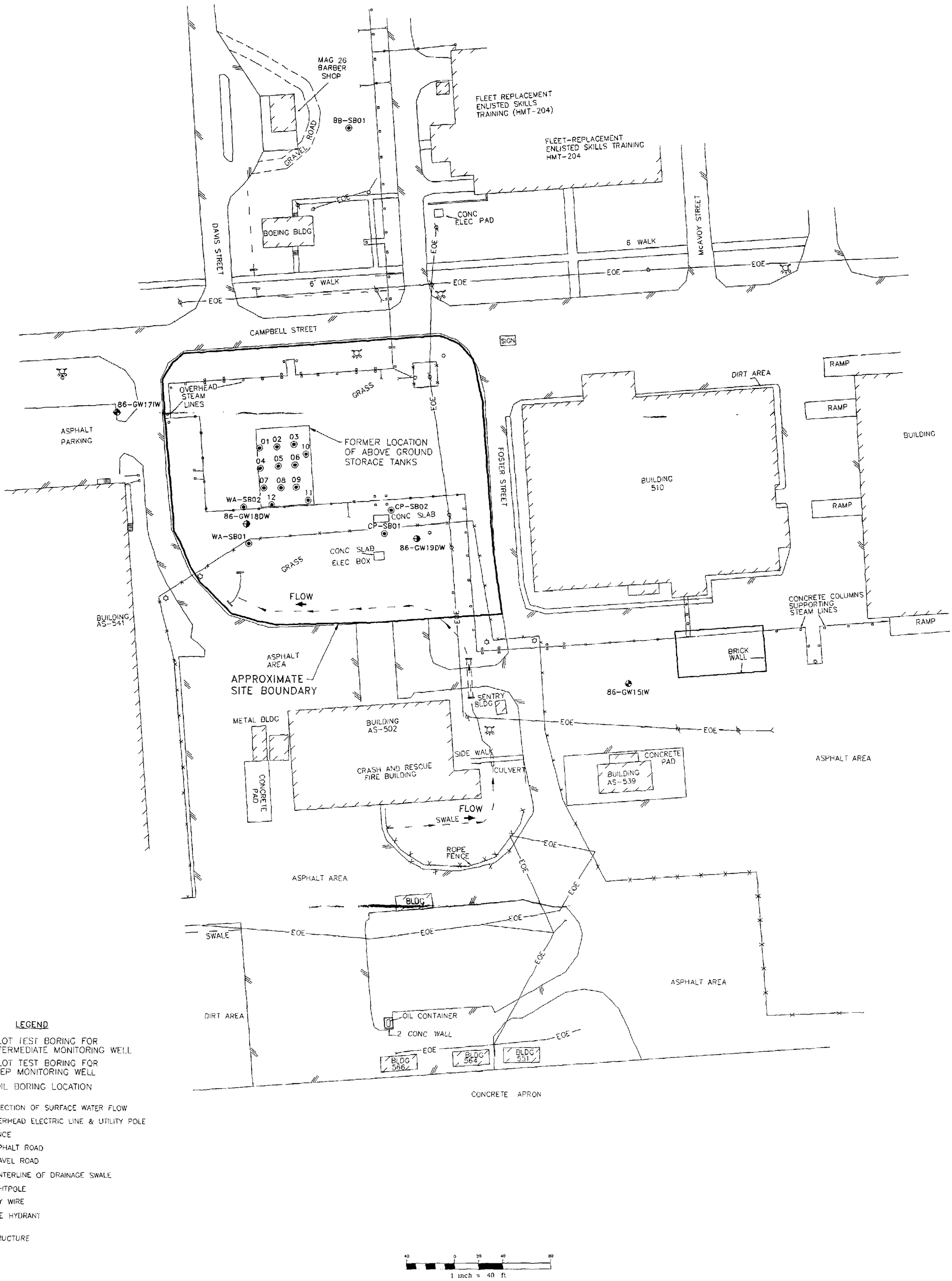
FIGURE 3

MARINE CORPS AIR STATION
NEW RIVER, NORTH CAROLINA
TANKS AS419 – AS421
SUBSURFACE INVESTIGATION LOCATIONS



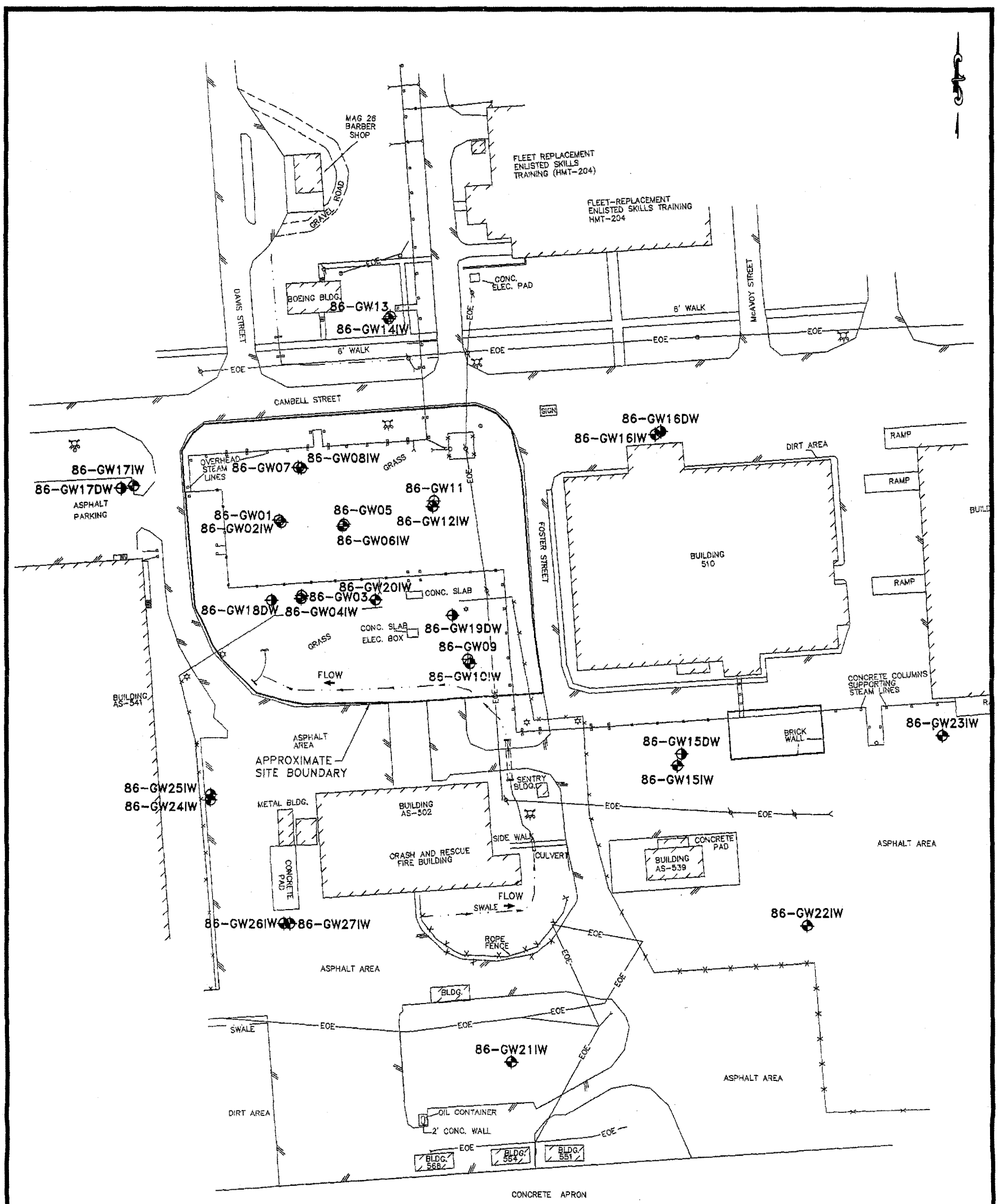
O'BRIEN & GERE ENGINEERS, INC.

Remedial Investigation (Baker, 1996)



LEGEND		NORTH		REMEDIAL INVESTIGATION CTO-0303 MARINE CORPS AIR STATION, NEW RIVER NORTH CAROLINA	Baker Baker Environmental, Inc.	SOIL SAMPLING LOCATIONS SITE 86, ABOVE GROUND TANK STORAGE AREA	FIGRE No
SOURCE LANTDIV FEBRUARY 1992 SURVEY BRENT A LANIER AND ASSOCIATES 1995	DRAWN REL REVIEWED TFT S O # 62470-303 CADD# 303048RI			BAKER ENVIRONMENTAL, Inc Coraopolis, Pennsylvania		SCALE 1" = 40' DATE JANUARY 1996	3-1

01719W03X



303049RI

LEGEND

86-GW01	SHALLOW MONITORING WELL
86-GW04IW	INTERMEDIATE MONITORING WELL
86-GW18DW	DEEP MONITORING WELL
FLOW	DIRECTION OF SURFACE WATER FLOW
EOE	OVERHEAD ELECTRIC LINE & UTILITY POLE
	ASPHALT ROAD
	CENTERLINE OF DRAINAGE SWALE
	LIGHTPOLE
	STRUCTURE
	FENCE
	GUY WIRE
	FIRE HYDRANT

SOURCE: LANTDIV, OCT. 1991

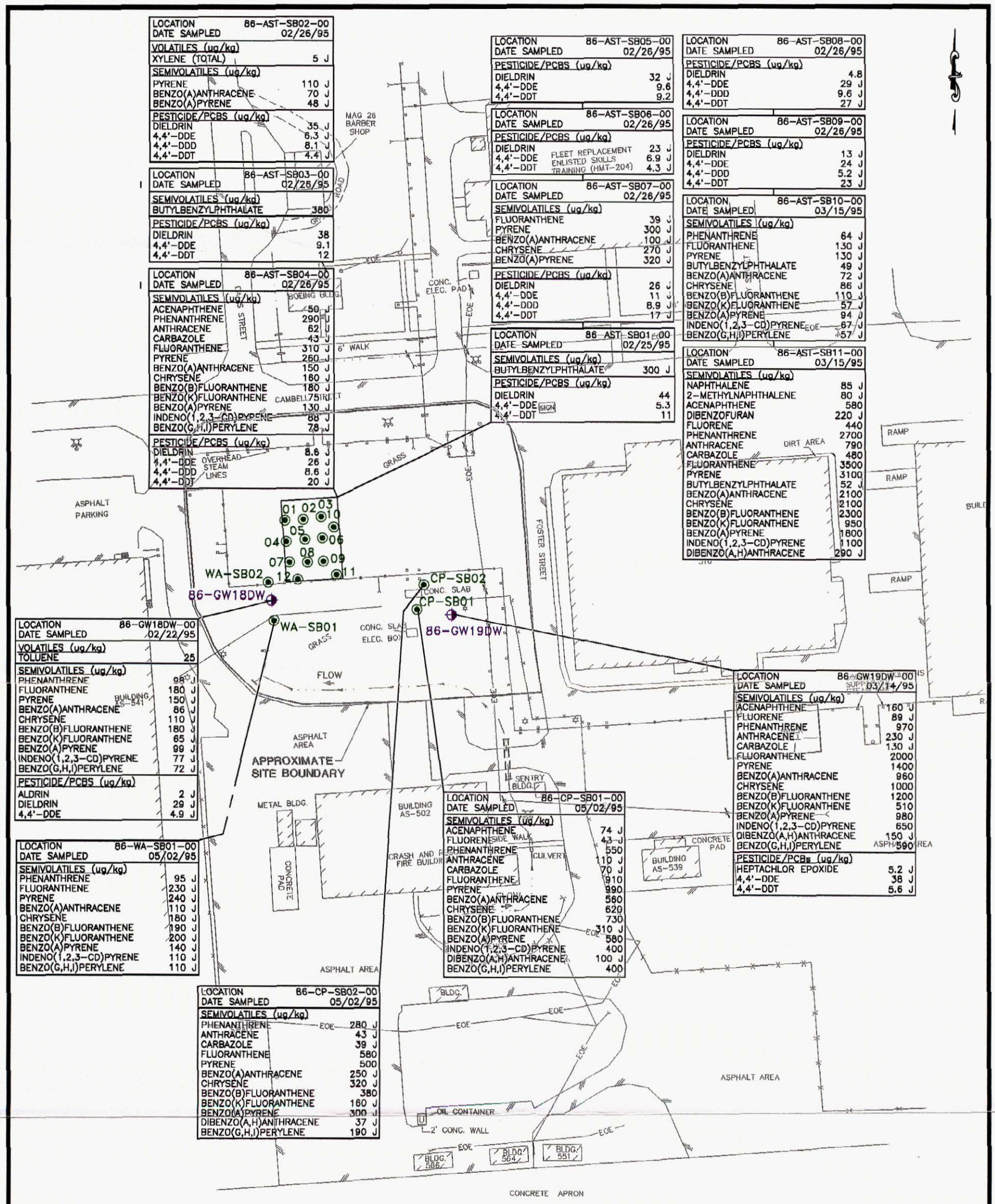
80 0 40 80
1 inch = 80 ft.

Baker
Baker Environmental, Inc.

3-2
MONITORING WELL LOCATIONS
SITE 86, ABOVE GROUND STORAGE TANK AREA
REMEDIAL INVESTIGATION, CTO-0303

MARINE CORPS AIR STATION, NEW RIVER
CAMP LEJEUNE

01719W042



LOCATION	86-AST-SB02-00
DATE SAMPLED	02/26/95
VOLATILES (ug/kg)	
XYLENE (TOTAL)	5 J
SEMIVOLATILES (ug/kg)	
PYRENE	110 J
BENZO(A)ANTHRACENE	70 J
BENZO(A)PYRENE	48 J
PESTICIDE/PCBS (ug/kg)	
DIELDRIN	35 J
4,4'-DDE	6.3 J
4,4'-DDD	8.1 J
4,4'-DDT	4.4 J

LOCATION	86-AST-SB03-00
DATE SAMPLED	02/26/95
SEMIVOLATILES (ug/kg)	
BUTYLBENZYLPHTHALATE	380
PESTICIDE/PCBS (ug/kg)	
DIELDRIN	38
4,4'-DDE	9.1
4,4'-DDT	12

LOCATION	86-AST-SB04-00
DATE SAMPLED	02/26/95
SEMIVOLATILES (ug/kg)	
ACENAPHTHENE	50 J
PHENANTHRENE	290 J
ANTHRACENE	62 J
CARBAZOLE	43 J
FLUORANTHENE	310 J
PYRENE	260 J
BENZO(A)ANTHRACENE	150 J
CHRYSENE	160 J
BENZO(B)FLUORANTHENE	180 J
BENZO(K)FLUORANTHENE	75 J
BENZO(A)PYRENE	130 J
INDENO(1,2,3-CD)PYRENE	88 J
BENZO(G,H,I)PERYLENE	78 J
PESTICIDE/PCBS (ug/kg)	
DIELDRIN	8.6 J
4,4'-DDE	26 J
4,4'-DDD	8.6 J
4,4'-DDT	20 J

LOCATION	86-AST-SB05-00
DATE SAMPLED	02/26/95
PESTICIDE/PCBS (ug/kg)	
DIELDRIN	32 J
4,4'-DDE	9.6
4,4'-DDT	9.2

LOCATION	86-AST-SB06-00
DATE SAMPLED	02/26/95
PESTICIDE/PCBS (ug/kg)	
DIELDRIN	23 J
4,4'-DDE	6.9 J
4,4'-DDT	4.3 J

FLEET REPLACEMENT ENLISTED SKILLS TRAINING (HMT-204)

LOCATION	86-AST-SB07-00
DATE SAMPLED	02/26/95
SEMIVOLATILES (ug/kg)	
FLUORANTHENE	39 J
PYRENE	300 J
BENZO(A)ANTHRACENE	100 J
CHRYSENE	270 J
BENZO(A)PYRENE	320 J
PESTICIDE/PCBS (ug/kg)	
DIELDRIN	26 J
4,4'-DDE	11 J
4,4'-DDD	8.9 J
4,4'-DDT	17 J

LOCATION	86-AST-SB01-00
DATE SAMPLED	02/25/95
SEMIVOLATILES (ug/kg)	
BUTYLBENZYLPHTHALATE	300 J
PESTICIDE/PCBS (ug/kg)	
DIELDRIN	44
4,4'-DDE	5.3
4,4'-DDT	11

SIGN

LOCATION	86-AST-SB08-00
DATE SAMPLED	02/26/95
PESTICIDE/PCBS (ug/kg)	
DIELDRIN	4.8
4,4'-DDE	29 J
4,4'-DDD	9.6 J
4,4'-DDT	27 J

LOCATION	86-AST-SB09-00
DATE SAMPLED	02/26/95
PESTICIDE/PCBS (ug/kg)	
DIELDRIN	13 J
4,4'-DDE	24 J
4,4'-DDD	5.2 J
4,4'-DDT	23 J

LOCATION	86-AST-SB10-00
DATE SAMPLED	03/15/95
SEMIVOLATILES (ug/kg)	
PHENANTHRENE	64 J
FLUORANTHENE	130 J
PYRENE	130 J
BUTYLBENZYLPHTHALATE	49 J
BENZO(A)ANTHRACENE	72 J
CHRYSENE	86 J
BENZO(B)FLUORANTHENE	110 J
BENZO(K)FLUORANTHENE	57 J
BENZO(A)PYRENE	94 J
INDENO(1,2,3-CD)PYRENE	67 J
BENZO(G,H,I)PERYLENE	57 J

LOCATION	86-AST-SB11-00
DATE SAMPLED	03/15/95
SEMIVOLATILES (ug/kg)	
NAPHTHALENE	85 J
2-METHYLNAPHTHALENE	80 J
ACENAPHTHENE	580
DIBENZOFURAN	220 J
FLUORENE	440
PHENANTHRENE	2700
ANTHRACENE	790
CARBAZOLE	480
FLUORANTHENE	3500
PYRENE	3100
BUTYLBENZYLPHTHALATE	52 J
BENZO(A)ANTHRACENE	2100
CHRYSENE	2100
BENZO(B)FLUORANTHENE	2300
BENZO(K)FLUORANTHENE	950
BENZO(A)PYRENE	1800
INDENO(1,2,3-CD)PYRENE	1100
DIBENZO(A,H)ANTHRACENE	290 J

LOCATION	86-GW18DW-00
DATE SAMPLED	02/22/95
VOLATILES (ug/kg)	
TOLUENE	25
SEMIVOLATILES (ug/kg)	
PHENANTHRENE	98 J
FLUORANTHENE	180 J
PYRENE	150 J
BENZO(A)ANTHRACENE	86 J
CHRYSENE	110 J
BENZO(B)FLUORANTHENE	180 J
BENZO(K)FLUORANTHENE	65 J
BENZO(A)PYRENE	99 J
INDENO(1,2,3-CD)PYRENE	77 J
BENZO(G,H,I)PERYLENE	72 J
PESTICIDE/PCBS (ug/kg)	
ALDRIN	2 J
DIELDRIN	29 J
4,4'-DDE	4.9 J

LOCATION	86-WA-SB01-00
DATE SAMPLED	05/02/95
SEMIVOLATILES (ug/kg)	
PHENANTHRENE	95 J
FLUORANTHENE	230 J
PYRENE	240 J
BENZO(A)ANTHRACENE	110 J
CHRYSENE	180 J
BENZO(B)FLUORANTHENE	190 J
BENZO(K)FLUORANTHENE	200 J
BENZO(A)PYRENE	140 J
INDENO(1,2,3-CD)PYRENE	110 J
BENZO(G,H,I)PERYLENE	110 J

LOCATION	86-CP-SB01-00
DATE SAMPLED	05/02/95
SEMIVOLATILES (ug/kg)	
ACENAPHTHENE	74 J
FLUORENE	43 J
PHENANTHRENE	550
ANTHRACENE	110 J
CARBAZOLE	70 J
FLUORANTHENE	910
PYRENE	990
BENZO(A)ANTHRACENE	560
CHRYSENE	620
BENZO(B)FLUORANTHENE	730
BENZO(K)FLUORANTHENE	310 J
BENZO(A)PYRENE	580
INDENO(1,2,3-CD)PYRENE	400
DIBENZO(A,H)ANTHRACENE	100 J
BENZO(G,H,I)PERYLENE	400

LOCATION	86-GW19DW-00
DATE SAMPLED	03/14/95
SEMIVOLATILES (ug/kg)	
ACENAPHTHENE	160 J
FLUORENE	89 J
PHENANTHRENE	970
ANTHRACENE	230 J
CARBAZOLE	130 J
FLUORANTHENE	2000
PYRENE	1400
BENZO(A)ANTHRACENE	960
CHRYSENE	1000
BENZO(B)FLUORANTHENE	1200
BENZO(K)FLUORANTHENE	510
BENZO(A)PYRENE	980
INDENO(1,2,3-CD)PYRENE	650
DIBENZO(A,H)ANTHRACENE	150 J
BENZO(G,H,I)PERYLENE	590
PESTICIDE/PCBs (ug/kg)	
HEPTACHLOR EPOXIDE	5.2 J
4,4'-DDE	38 J
4,4'-DDT	5.6 J

LOCATION	86-CP-SB02-00
DATE SAMPLED	05/02/95
SEMIVOLATILES (ug/kg)	
PHENANTHRENE	280 J
ANTHRACENE	43 J
CARBAZOLE	39 J
FLUORANTHENE	580
PYRENE	500
BENZO(A)ANTHRACENE	250 J
CHRYSENE	320 J
BENZO(B)FLUORANTHENE	380
BENZO(K)FLUORANTHENE	160 J
BENZO(A)PYRENE	300 J
DIBENZO(A,H)ANTHRACENE	37 J
BENZO(G,H,I)PERYLENE	190 J

303067RI

LEGEND

- 86-GW18DW — PILOT TEST BORING FOR DEEP MONITORING WELL
- SB09 — SOIL BORING LOCATION
- FLOW — DIRECTION OF SURFACE WATER FLOW
- EOE — OVERHEAD ELECTRIC LINE & UTILITY POLE
- ASPHALT ROAD
- GRAVEL ROAD
- CENTERLINE OF DRAINAGE SWALE
- FENCE
- LIGHTPOLE
- GUY WIRE
- STRUCTURE
- FIRE HYDRANT

SOURCE: LANTDIV, OCT. 1991

NOTE: LOCATIONS SHOWN WITHOUT CONCENTRATIONS INDICATE NONDETECTABLE LEVELS.

80 0 40 80

1 inch = 80 ft.

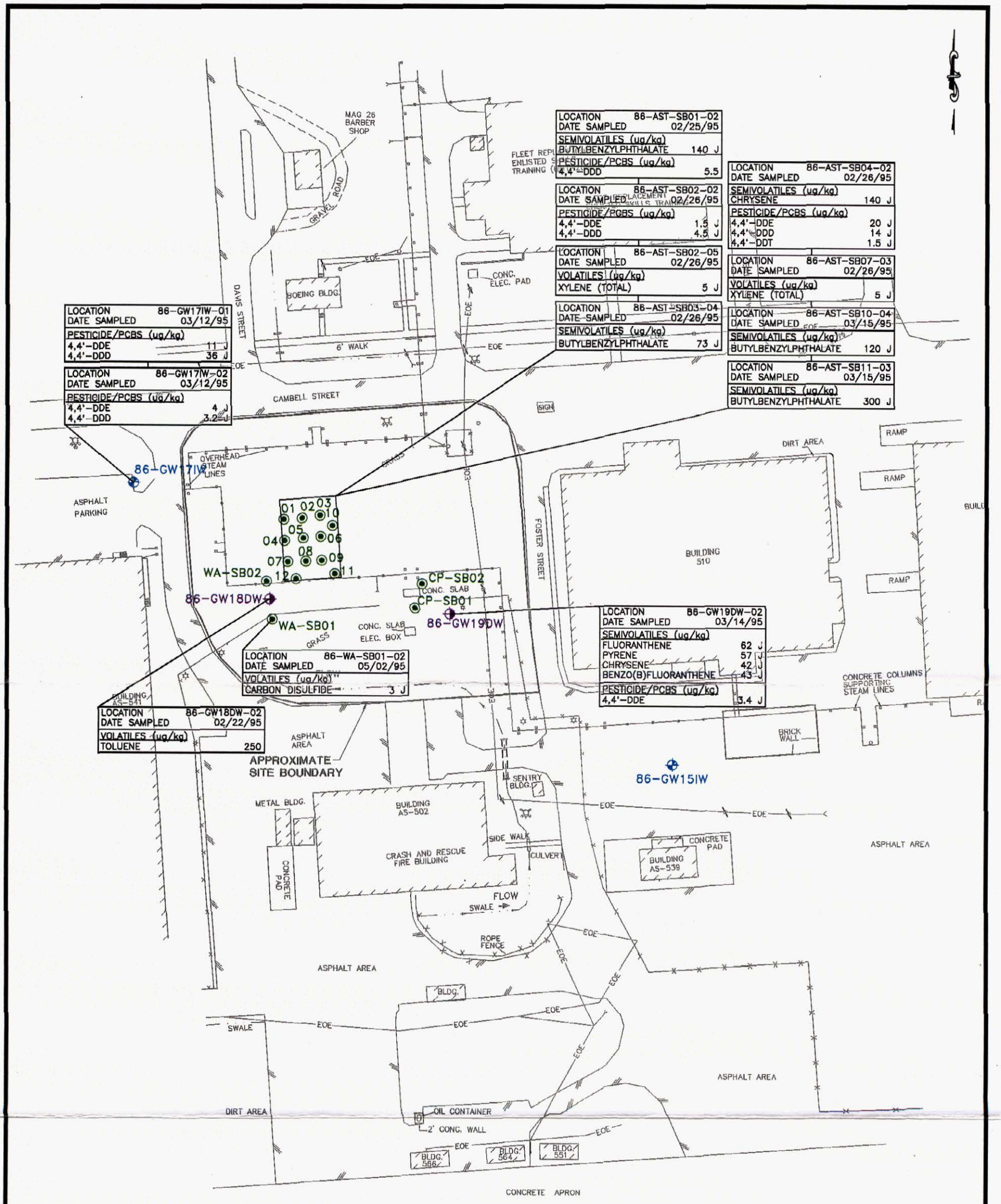
Baker

Baker Environmental, Inc.

FIGURE 4-1
ORGANIC COMPOUNDS IN SURFACE SOIL
SITE 86, ABOVE GROUND STORAGE TANK AREA
REMEDIAL INVESTIGATION, CTO-0303

MARINE CORPS AIR STATION, NEW RIVER
NORTH CAROLINA

01719WB5Y



303086RI

LEGEND

- 86-GW04IW — PILOT TEST BORING FOR INTERMEDIATE MONITORING WELL
- 86-GW18DW — PILOT TEST BORING FOR DEEP MONITORING WELL
- SB09 — SOIL BORING LOCATION
- FLOW — DIRECTION OF SURFACE WATER FLOW
- EOE — OVERHEAD ELECTRIC LINE & UTILITY POLE
- ASPHALT ROAD
- GRAVEL ROAD
- CENTERLINE OF DRAINAGE SWALE
- FENCE
- LIGHTPOLE
- GUY WIRE
- STRUCTURE
- FIRE HYDRANT

SOURCE: LANTDIV, OCT. 1991

NOTE: LOCATIONS SHOWN WITHOUT CONCENTRATIONS INDICATE NONDETECTABLE LEVELS.

80 0 40 80

1 inch = 80 ft.

Baker

Baker Environmental, Inc.

FIGURE 4-2
ORGANIC COMPOUNDS IN SUBSURFACE SOIL
SITE 86, ABOVE GROUND STORAGE TANK AREA
REMEDIAL INVESTIGATION, CTO-0303

MARINE CORPS AIR STATION, NEW RIVER
NORTH CAROLINA

303116RI

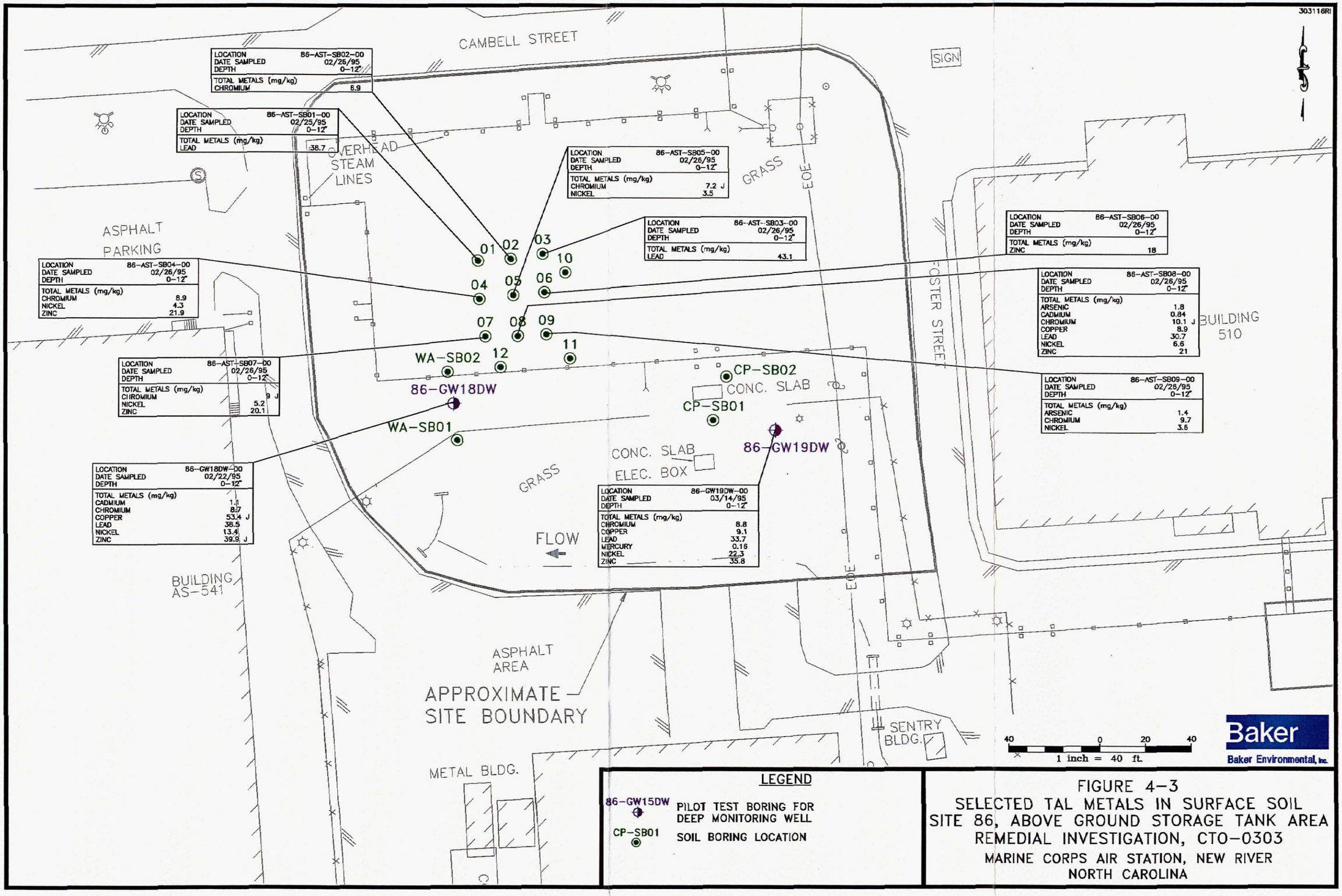
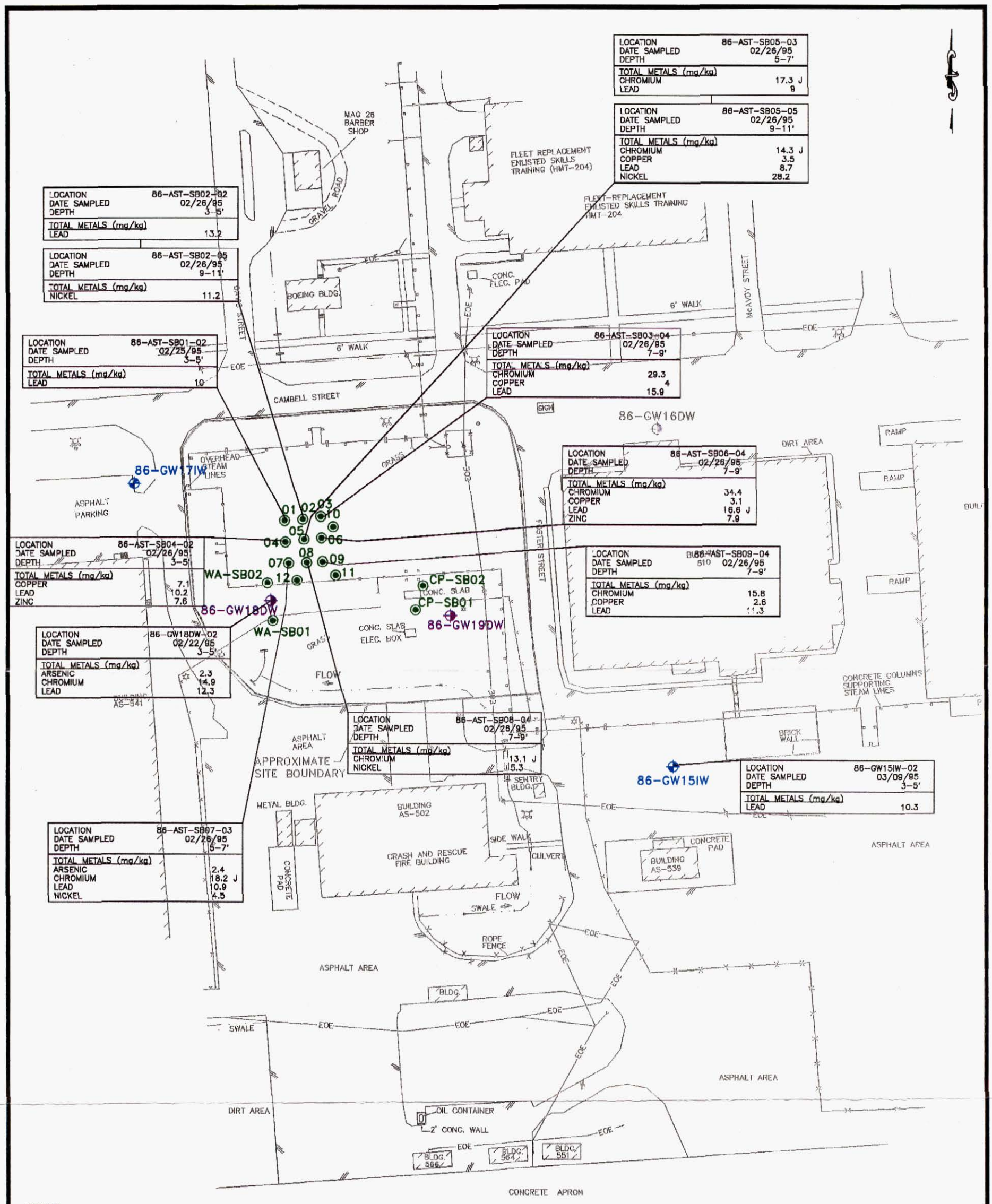


FIGURE 4-3
SELECTED TAL METALS IN SURFACE SOIL
SITE 86, ABOVE GROUND STORAGE TANK AREA
REMEDIAL INVESTIGATION, CTO-0303
MARINE CORPS AIR STATION, NEW RIVER
NORTH CAROLINA



303115RI

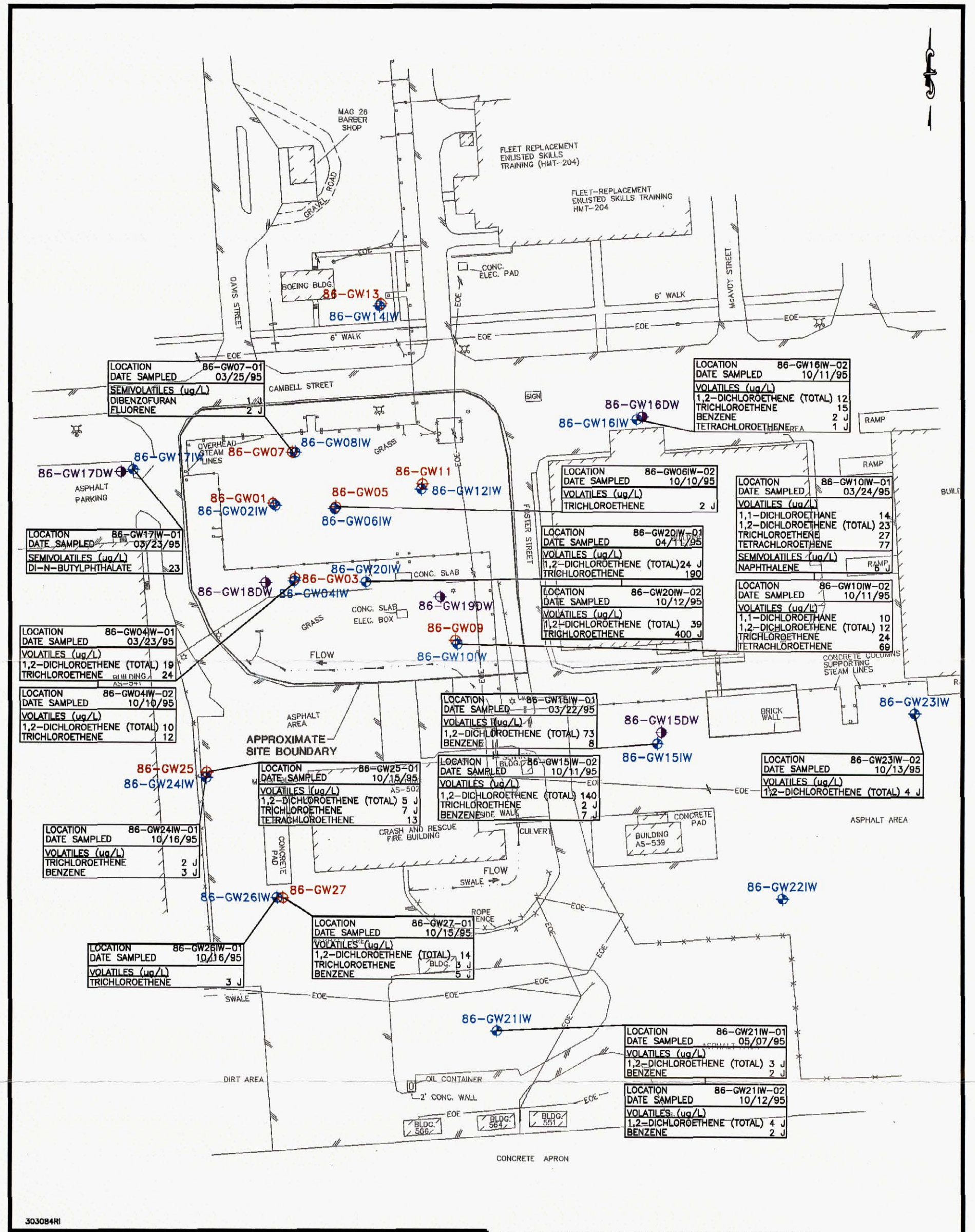
LEGEND

86-GW15IW	PILOT TEST BORING FOR INTERMEDIATE MONITORING WELL
86-GW18DW	PILOT TEST BORING FOR DEEP MONITORING WELL
SB09	SOIL BORING LOCATION
FLOW	DIRECTION OF SURFACE WATER FLOW
EOE	OVERHEAD ELECTRIC LINE & UTILITY POLE
	ASPHALT ROAD
	GRAVEL ROAD
	CENTERLINE OF DRAINAGE SWALE
	FENCE
	LIGHTPOLE
	GUY WIRE
	STRUCTURE
	FIRE HYDRANT

SOURCE: LANTDIV, OCT. 1991

Baker
Baker Environmental, Inc.

FIGURE 4-4
SELECTED TAL METALS IN SUBSURFACE SOIL
SITE 86, ABOVE GROUND STORAGE TANK AREA
REMEDIAL INVESTIGATION, CTO-0303
MARINE CORPS AIR STATION, NEW RIVER
NORTH CAROLINA



303084RI

LEGEND

- 86-GW01 — SHALLOW MONITORING WELL
- 86-GW04IW — INTERMEDIATE MONITORING WELL
- 86-GW18DW — DEEP MONITORING WELL
- FLOW — DIRECTION OF SURFACE WATER FLOW
- EOE — OVERHEAD ELECTRIC LINE & UTILITY POLE
- ASPHALT ROAD
- GRAVEL ROAD
- CENTERLINE OF DRAINAGE SWALE
- FENCE
- LIGHTPOLE
- GUY WIRE
- STRUCTURE
- FIRE HYDRANT

SOURCE: LANTDIV, OCT. 1991

NOTE: LOCATIONS SHOWN WITHOUT CONCENTRATIONS INDICATE NONDETECTABLE LEVELS.

80 0 40 80

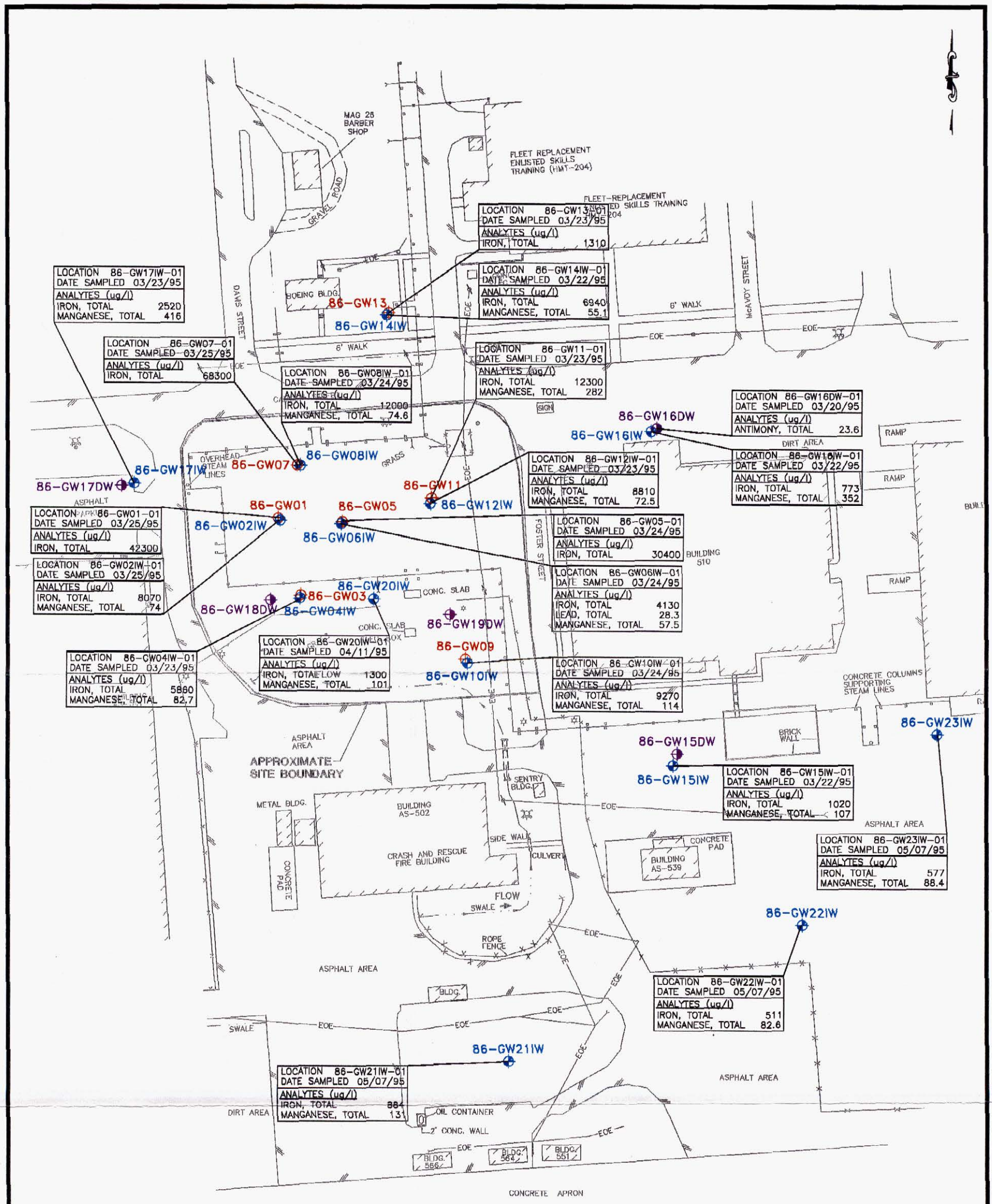
1 inch = 80 ft.

Baker

Baker Environmental, Inc.

FIGURE 4-5
ORGANIC COMPOUNDS IN GROUNDWATER
SITE 86, ABOVE GROUND STORAGE TANK AREA
REMEDIAL INVESTIGATION, CTO-0303

MARINE CORPS AIR STATION, NEW RIVER
NORTH CAROLINA



303085RI

LEGEND

- 86-GW01 — SHALLOW MONITORING WELL
- 86-GW04IW — INTERMEDIATE MONITORING WELL
- 86-GW18DW — DEEP MONITORING WELL
- FLOW — DIRECTION OF SURFACE WATER FLOW
- EOE — OVERHEAD ELECTRIC LINE & UTILITY POLE
- ASPHALT ROAD
- GRAVEL ROAD
- CENTERLINE OF DRAINAGE SWALE
- FENCE
- LIGHTPOLE
- GUY WIRE
- STRUCTURE
- FIRE HYDRANT

SOURCE: LANTDIV, OCT. 1991

80 0 40 80

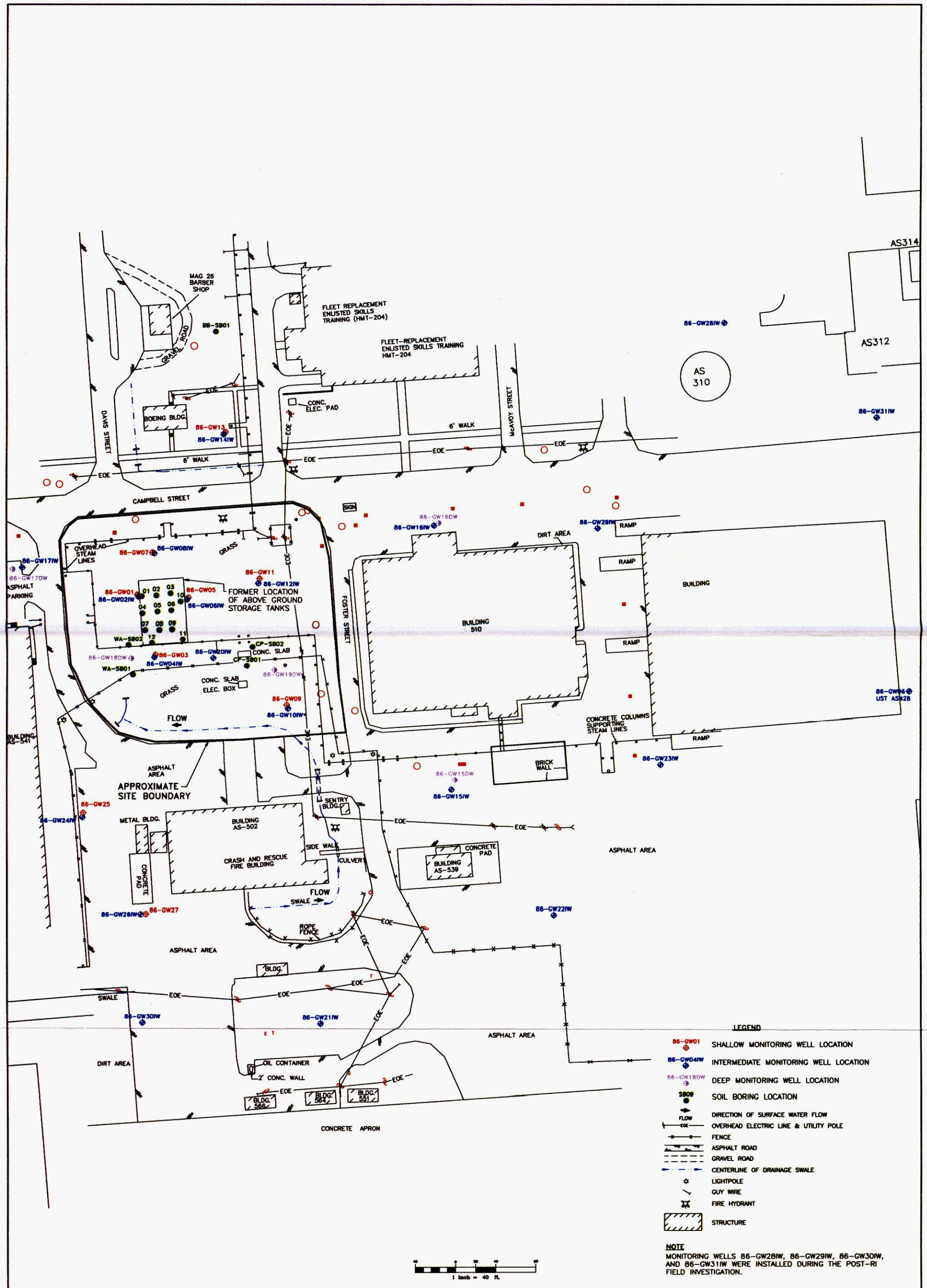
1 inch = 80 ft.

Baker

Baker Environmental, Inc.

FIGURE 4-6
TAL METALS IN GROUNDWATER
ABOVE SCREENING STANDARDS
SITE 86, ABOVE GROUND STORAGE TANK AREA
REMEDIAL INVESTIGATION, CTO-0303
MARINE CORPS AIR STATION, NEW RIVER
NORTH CAROLINA

Post Remedial Investigation Sampling (Baker, 1998)



LEGEND

- 86-GW01 — SHALLOW MONITORING WELL LOCATION
- 86-GW04IW — INTERMEDIATE MONITORING WELL LOCATION
- 86-GW18DW — DEEP MONITORING WELL LOCATION
- SB09 — SOIL BORING LOCATION
- FLOW — DIRECTION OF SURFACE WATER FLOW
- EOE — OVERHEAD ELECTRIC LINE & UTILITY POLE
- FENCE
- ASPHALT ROAD
- GRAVEL ROAD
- CENTERLINE OF DRAINAGE SWALE
- LIGHTPOLE
- GUY WIRE
- FIRE HYDRANT
- STRUCTURE

NOTE

MONITORING WELLS 86-GW28IW, 86-GW29IW, 86-GW30IW, AND 86-GW31IW WERE INSTALLED DURING THE POST-RI FIELD INVESTIGATION.

LEGEND SOURCE: LANTDIV, FEBRUARY 1992 SURVEY: BRENT A. LANIER AND ASSOCIATES, 1995	DRAWN REL REVIEWED TFT B.O.# 62470-303 CADD# 303014FS	NORTH		FEASIBILITY STUDY, CTO-0303 MARINE CORPS AIR STATION, NEW RIVER NORTH CAROLINA BAKER ENVIRONMENTAL, Inc. Coraopolis, Pennsylvania	Baker Baker Environmental, Inc.	REMEDIAL INVESTIGATION SAMPLING LOCATIONS SITE 86, TANK AREA AS-419-AS421 AT MCAS SCALE 1"= 40' DATE JUNE 1996	FIGURE No. 1-2

Amended Remedial Investigation (CH2M HILL Hill, Baker, CDM, 2003)

TABLE 4-8

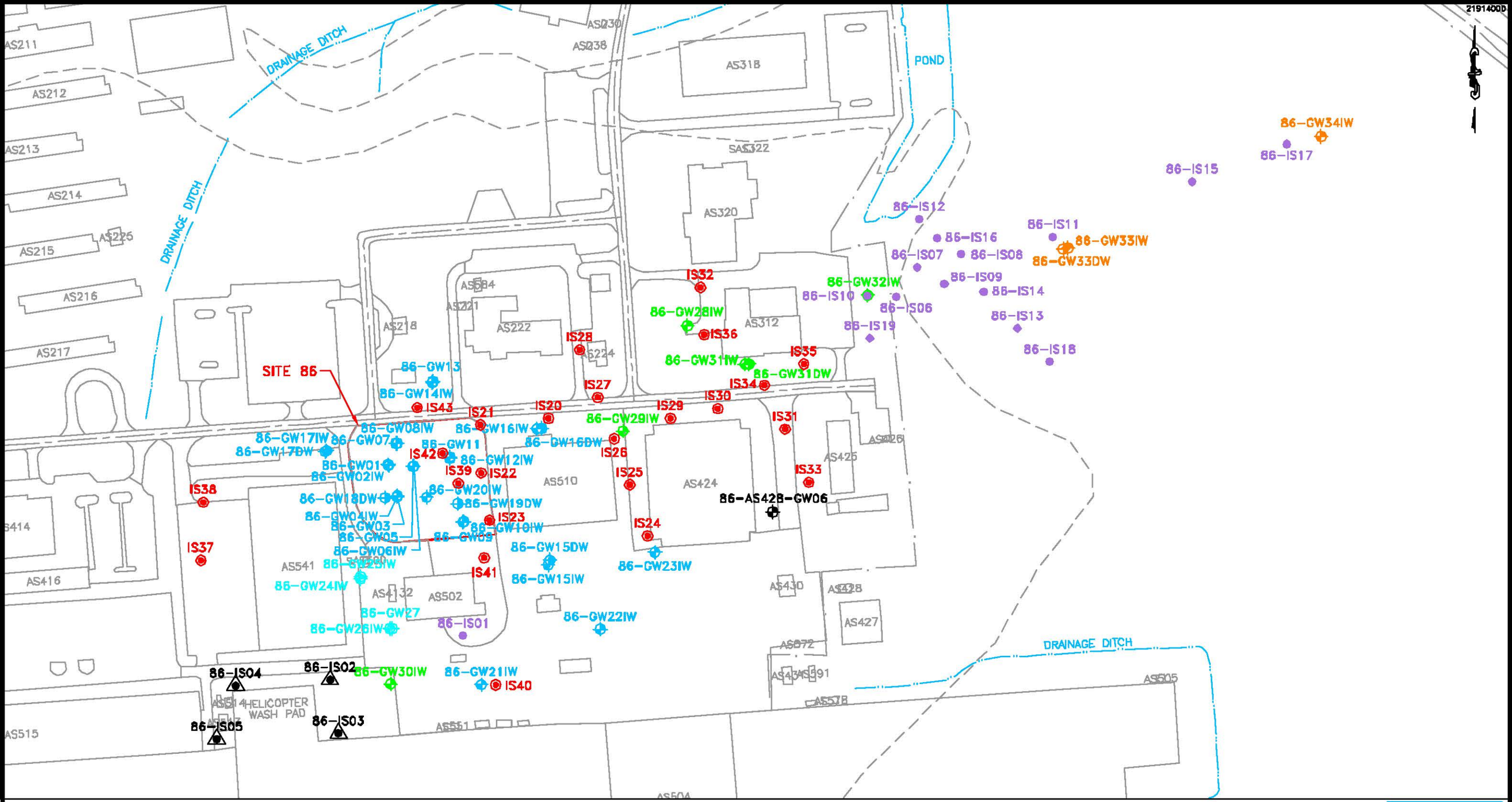
STATISTICAL SUMMARY
OPERABLE UNIT NO. 20 - SITE 86
AMENDED RI INVESTIGATION, CTO-0191
MCB, CAMP LEJEUNE, NORTH CAROLINA

Compound	Minimum Detected	Maximum Detected	Frequency of Detection	Frequency of NC Standard Exceedences	Frequency of Federal Standard Exceedences	Arithmatic Mean Positive Detects	Location of Maximum Detect
Amended RI Groundwater Analytical Results - Mobile Laboratory							
Benzene	1	12	20/105	12/20	5/20	3.7529	IR86-IS04-03
Tetrachloroethene	1	18.444	14/105	14/14	3/14	4.4844	IR86-IS29-03
Trichloroethene	1	3758	57/105	49/57	36/57	158.2071	IR86-IS41-03
cis-1,2-Dichloroethene	1.074	149.286	70/105	7/70	7/70	31.2491	IR86-IS41-04
Trans-1,2-Dichloroethene	1.15	1.825	2/105	0/2	0/2	1.4875	IR86-IS41-04
Vinyl Chloride	1	9	2/105	2/2	1/2	5	IR86-IS01-01
Amended RI Groundwater Analytical Results - Fixed-Base Laboratory							
Benzene	6	7	2/4	2/2	2/2	6.5000	IS07-01D
Carbon disulfide	1 J	1 J	1/4	0/1	0/1	1.0000	IR86-IS07-01
Chloromethane	1 J	1 J	1/4	0/1	0/1	0.7000	IR86-IS01-01
cis-1,2-Dichloroethene	11	26	3/4	0/3	0/3	16.3333	IR86-IS01-01
Methyl acetate	7	7	1/4	0/1	0/1	7.0000	IR86-IS07-01
Trichloroethene	46	52	2/4	2/2	2/2	49.0000	IS07-01D
Vinyl Chloride	21	21	1/4	1/1	1/1	21.0000	IR86-IS01-01
Xylene (total)	0	0	0/4	0/0	0/0		
LTM Groundwater Analytical Results - Fixed-Base Laboratory							
1,1,2-Trichloro-1,2,2-Trifluoroethane	590	660	2/2	0/2	0/2	625	IR86-GW10IW-02A
1,1-Dichloroethane	6	61	2/19	0/2	0/2	33.5	IR86-GW25IW-02A
1,1-Dichloroethene	800	800	1/19	1/1	1/1	800	IR86-GW25IW-02A
1,2-Dichloroethane	5	5	1/19	0/1	0/1	5	IR86-GW25IW-02A
Benzene	3 J	4 J	3/19	3/3	0/3	3.6667	IR86-AS428-GWO6-02A,IR86-GW15IW-02A
Cis-1,2-Dichloroethene	4 J	220	11/19	3/11	3/11	54.1818	IR86-GW15IW-02A
Tetrachloroethene	5 J	120 J	2/19	2/2	2/2	62.5	IR86-GW10IW-02A
Total 1,2-Dichloroethene	4 J	220	11/19	--	--	54.1818	IR86-GW15IW-02A
Trans-1,2-Dichloroethene	9	9	1/19	0/1	0/1	9	IR86-GW15IW-02A
Trichloroethene	4 J	840	8/19	8/8	6/8	150.75	IR86-GW29IW-02A
Vinyl Chloride	1 J	40	5/19	5/5	5/5	9	IR86-GW10IW-02A
Xylenes (Total)	9	9	1/19	0/1	0/1	9	IR86-GW25IW-02A
Antimony	4.8 B	4.8 B	1/1	0/1	0/1	4.8	

TABLE 4-8

STATISTICAL SUMMARY
OPERABLE UNIT NO. 20 - SITE 86
AMENDED RI INVESTIGATION, CTO-0191
MCB, CAMP LEJEUNE, NORTH CAROLINA

Compound	Minimum Detected	Maximum Detected	Frequency of Detection	Frequency of NC Standard Exceedences	Frequency of Federal Standard Exceedences	Arithmatic Mean Positive Detects	Location of Maximum Detect
Arsenic	3 B	3 B	1/1	0/1	0/1	3	
Barium	14	14	1/1	0/1	0/1	14	
Beryllium	0.59 B	0.59 B	1/1	0/1	0/1	0.59	
Calcium	130000	130000	1/1	0/1	0/1	130000	
Chloride	24	24	1/1	0/1	0/1	24	
Cobalt	0.8 B	0.8 B	1/1	0/1	0/1	0.8	
Iron	5700	5700	1/1	1/1	1/1	5700	
Magnesium	3100	3100	1/1	0/1	0/1	3100	
Manganese	68	68	1/1	1/1	1/1	68	
Potassium	2600	2600	1/1	0/1	0/1	2600	
Sodium	16000	16000	1/1	0/1	0/1	16000	
Sulfate as SO4	32	32	1/1	0/1	0/1	32	
Zinc	3.1 B	3.1 B	1/1	0/1	0/1	3.1	
Amended RI Subsurface Soil Analytical Results - Fixed-Base Laboratory							
Acetone	15 J	65 J	9/9	0/9	0/9	34	IR86-IS03-04
Bromoform	2 J	2 J	1/9	1/1	0/1	2	IR86-IS05-03
Carbon disulfide	1 J	1 J	2/9	0/2	0/2	1	IR86-IS03-01,IR86-IS04-01
cis-1,2-Dichloroethene	2 J	3 J	2/9	0/2	0/2	3	IR86-IS04-01
Methylene Chloride	2 J	6 J	9/9	0/9	0/9	3	IR86-IS03-04
Toluene	1 J	2 J	4/9	0/4	0/4	2	IR86-IS03-01,IR86-IS04-02
Trichloroethene	4 J	43	2/9	1/2	1/2	24	IR86-IS04-02
Xylene (total)	2 J	2 J	1/9	0/1	0/1	2	IR86-IS04-01



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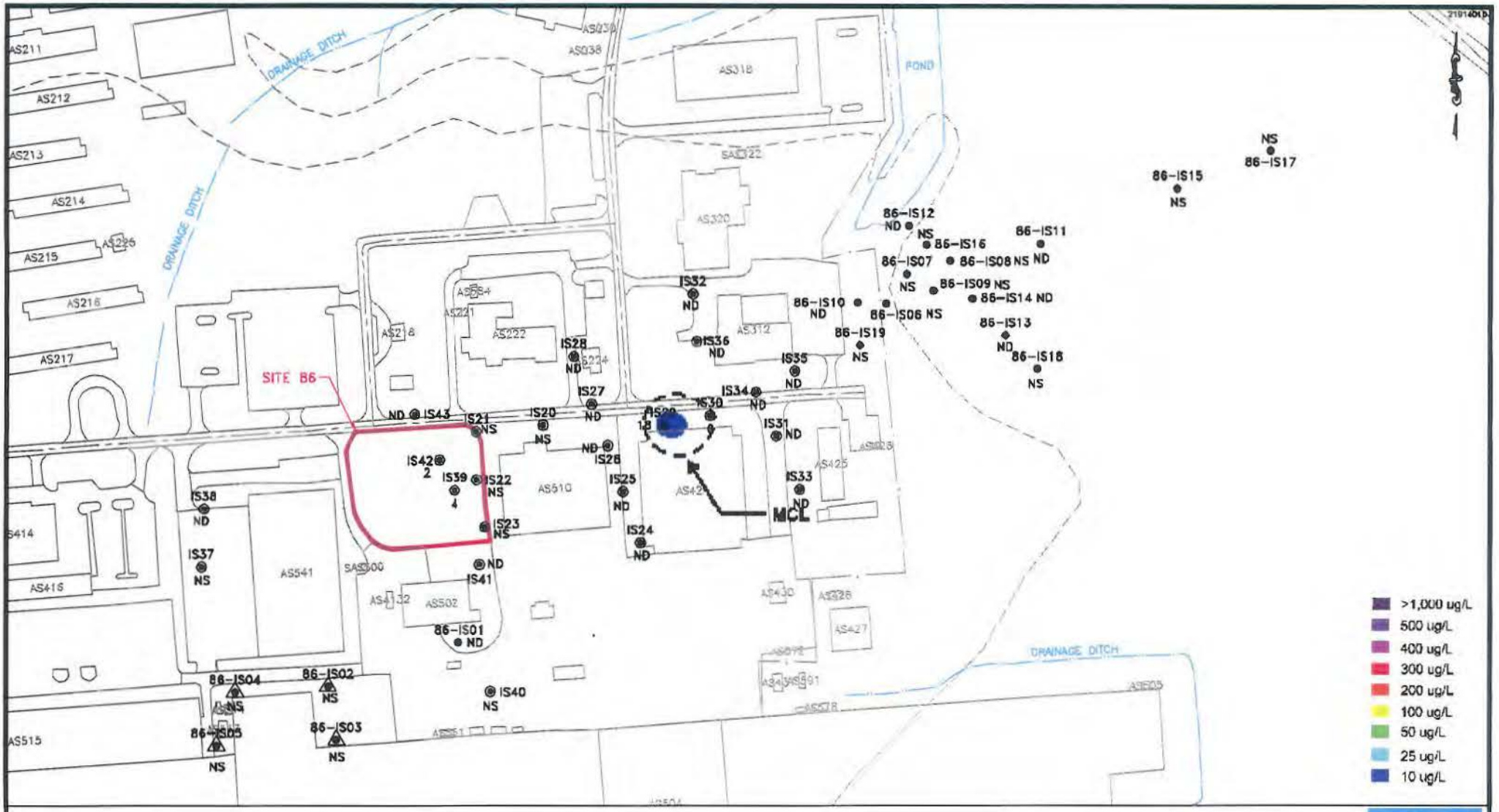
Baker Environmental, Inc.

LEGEND

- SHALLOW MONITORING WELL (RI – 1995)
- INTERMEDIATE MONITORING WELL (UST PROGRAM)
- INTERMEDIATE MONITORING WELL (RI – 1995)
- INTERMEDIATE MONITORING WELL (POST RI – 1997)
- INTERMEDIATE MONITORING WELL (AMENDED RI – 2002)
- DEEP MONITORING WELL (RI – 1995)
- DEEP MONITORING WELL (POST RI – 1995)
- DEEP MONITORING WELL (POST RI – 1997)
- DEEP MONITORING WELL (AMENDED RI – 2002)
- AUGUST 2001 GROUNDWATER SAMPLING LOCATION
- SUBSURFACE SOIL AND GROUNDWATER SAMPLING LOCATION
- JANUARY 2002 GROUNDWATER SAMPLING LOCATION

SOURCE: MCB CAMP LEJEUNE, 2000.

FIGURE 3-1
SAMPLE LOCATION MAP
OPERABLE UNIT No. 20 – SITE 86
AMENDED RI REPORT
CTO – 0191
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



Baker
Baker Environmental, Inc.

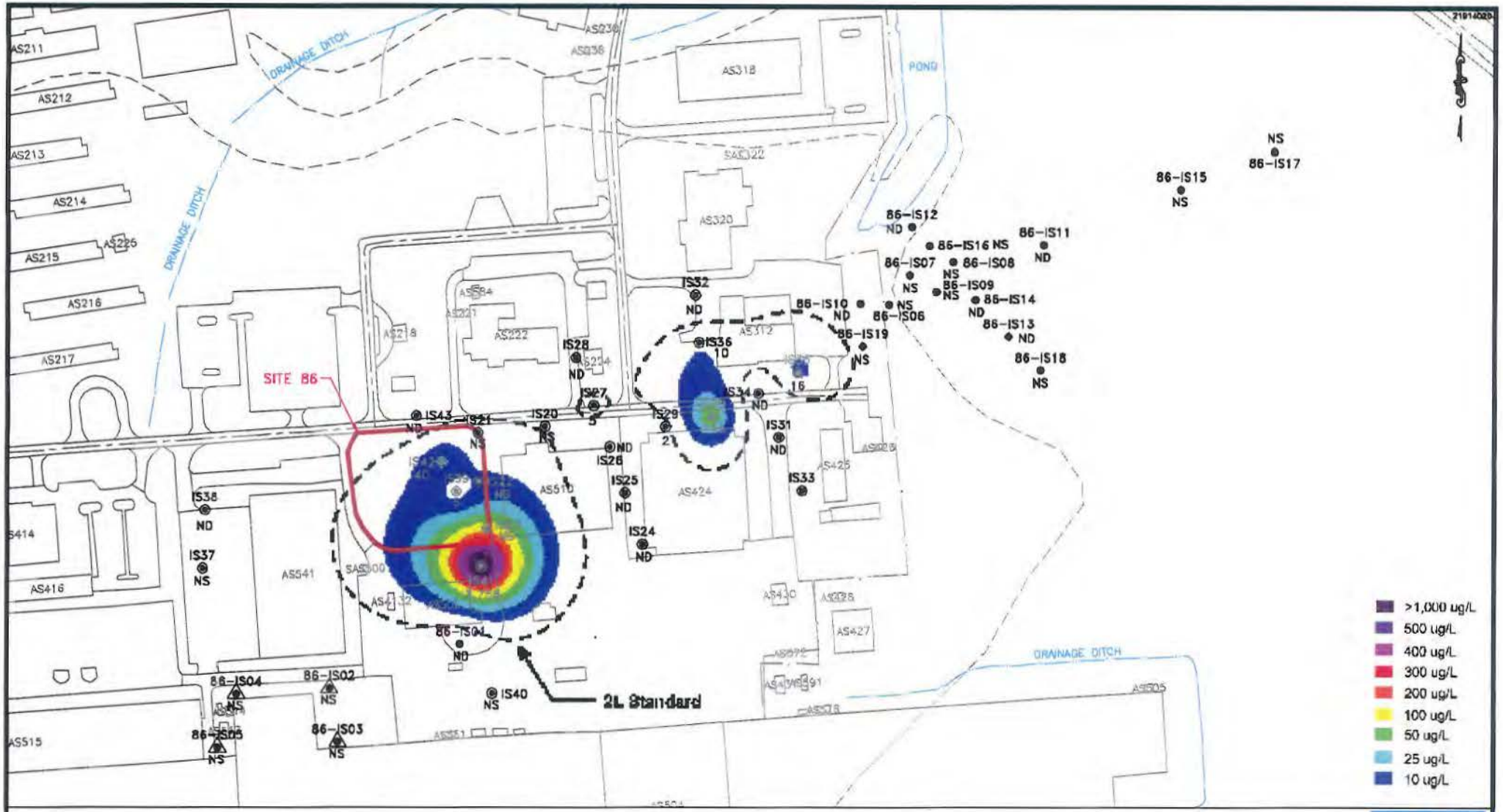
LEGEND

- ● – AUGUST 2001 GROUNDWATER SAMPLING LOCATION
- △ – SUBSURFACE SOIL AND GROUNDWATER SAMPLING LOCATION
- ◉ – JANUARY 2002 GROUNDWATER SAMPLING LOCATION
- ND – COMPOUND NOT DETECTED
- NS – INTERVAL NOT SAMPLED

SOURCE: MCB CAMP LEJEUNE, 2000.

FIGURE 4-1
EXTENT OF PCE ABOVE THE DETECTION LIMIT (30 TO 34 FEET BGS)
OPERABLE UNIT No. 20 – SITE 86
AMENDED RI REPORT
CTO – 0191

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



200 0 100 200
1 inch = 200 ft.

Baker
Baker Environmental Inc.

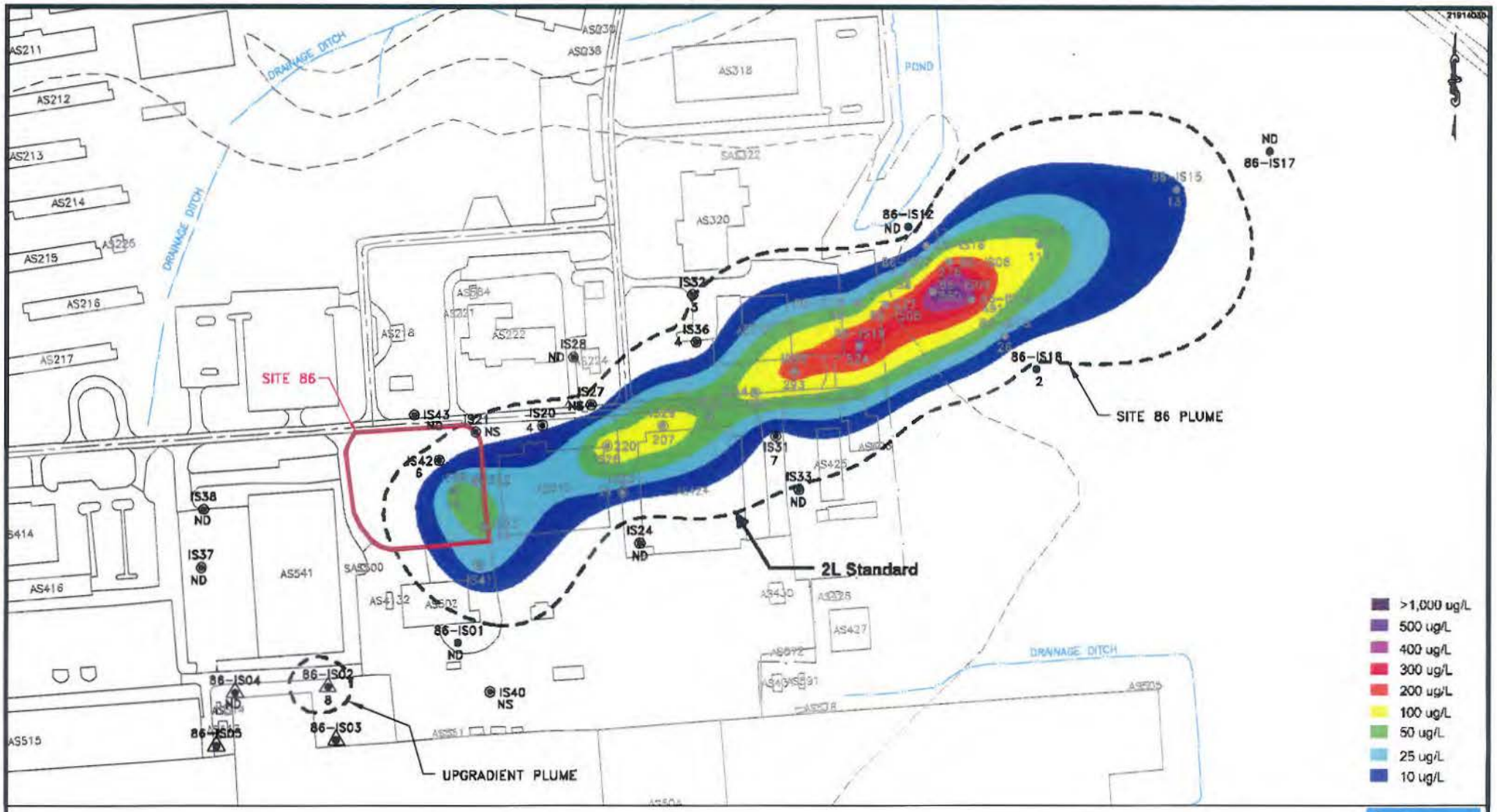
LEGEND

- ● – AUGUST 2001 GROUNDWATER SAMPLING LOCATION
- △ – SUBSURFACE SOIL AND GROUNDWATER SAMPLING LOCATION
- ◉ – JANUARY 2002 GROUNDWATER SAMPLING LOCATION
- ND – COMPOUND NOT DETECTED
- NS – INTERVAL NOT SAMPLED

FIGURE 4-2
EXTENT OF TCE ABOVE THE 2L STANDARD (30 TO 34 FEET BGS)
OPERABLE UNIT No. 20 – SITE 86
AMENDED RI REPORT
CTO – 0191

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: MCB CAMP LEJEUNE, 2000.



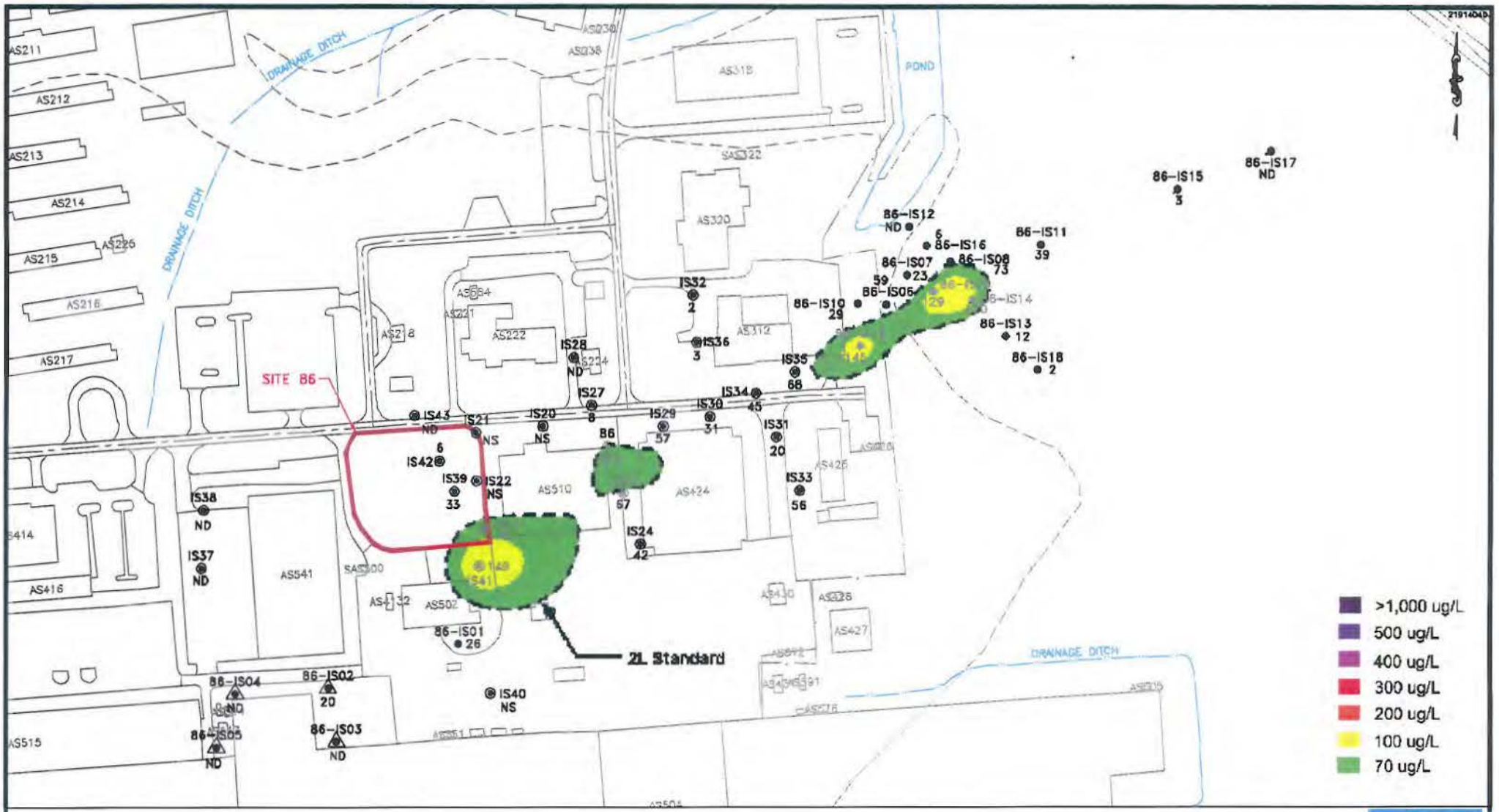
LEGEND

- ● – AUGUST 2001 GROUNDWATER SAMPLING LOCATION
- ▲ – SUBSURFACE SOIL AND GROUNDWATER SAMPLING LOCATION
- ◉ – JANUARY 2002 GROUNDWATER SAMPLING LOCATION
- ND – COMPOUND NOT DETECTED
- NS – INTERVAL NOT SAMPLED

FIGURE 4-3
EXTENT OF TCE ABOVE THE 2L STANDARD (40 TO 44 FEET BGS)
OPERABLE UNIT No. 20 – SITE 86
AMENDED RI REPORT
CTO – 0191

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: MCB CAMP LEJEUNE, 2000.



Baker
Baker Environmental Inc.

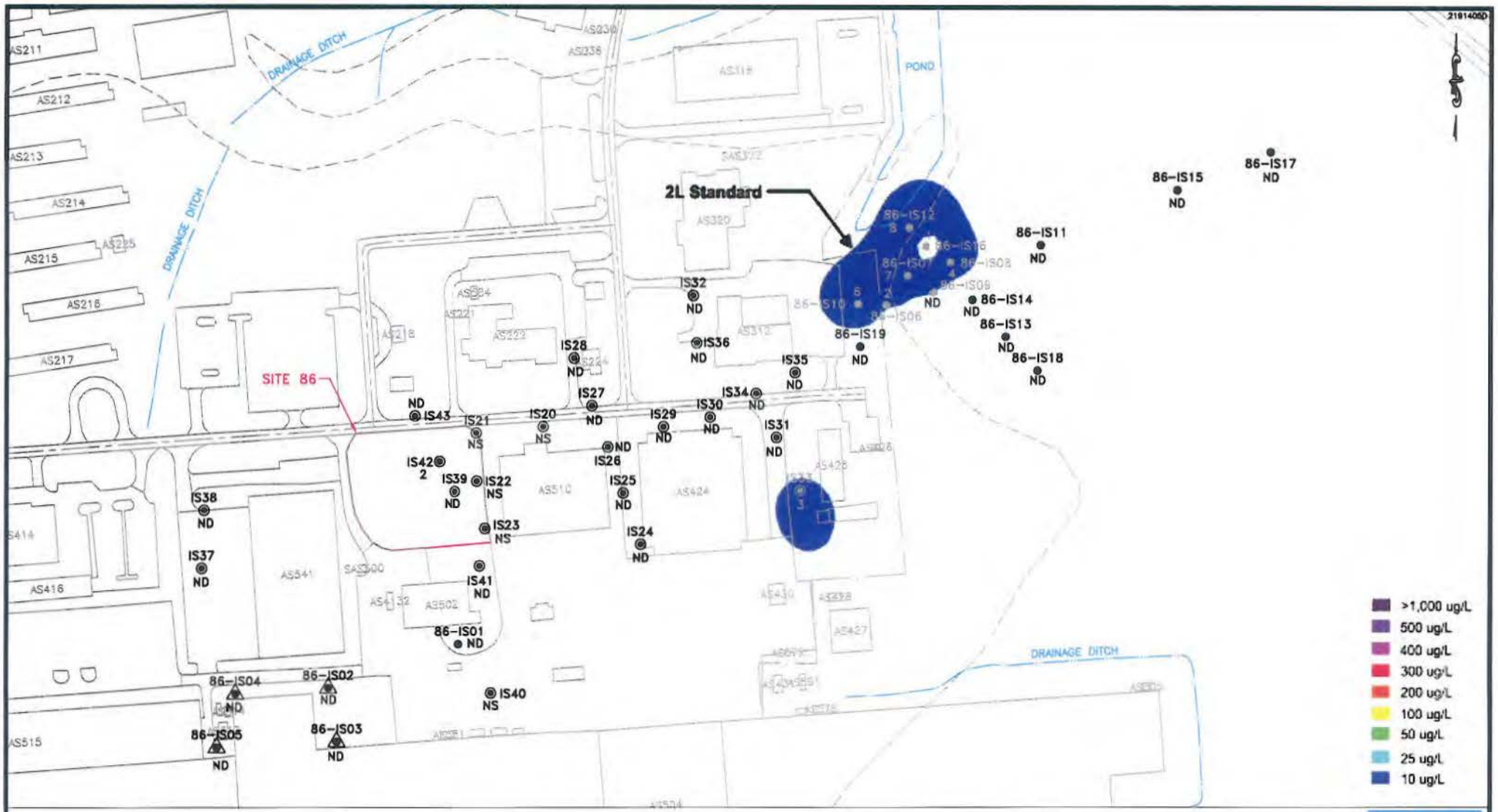
LEGEND

- ● – AUGUST 2001 GROUNDWATER SAMPLING LOCATION
- △ – SUBSURFACE SOIL AND GROUNDWATER SAMPLING LOCATION
- ◉ – JANUARY 2002 GROUNDWATER SAMPLING LOCATION
- ND – COMPOUND NOT DETECTED
- NS – INTERVAL NOT SAMPLED

FIGURE 4-4
EXTENT OF cis-DCE ABOVE THE 2L STANDARD (40 TO 44 FEET BGS)
OPERABLE UNIT No. 20 – SITE 86
AMENDED RI REPORT
CTO – 0191

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: MCB CAMP LEJEUNE, 2000.



Baker
Baker Environmental, Inc.

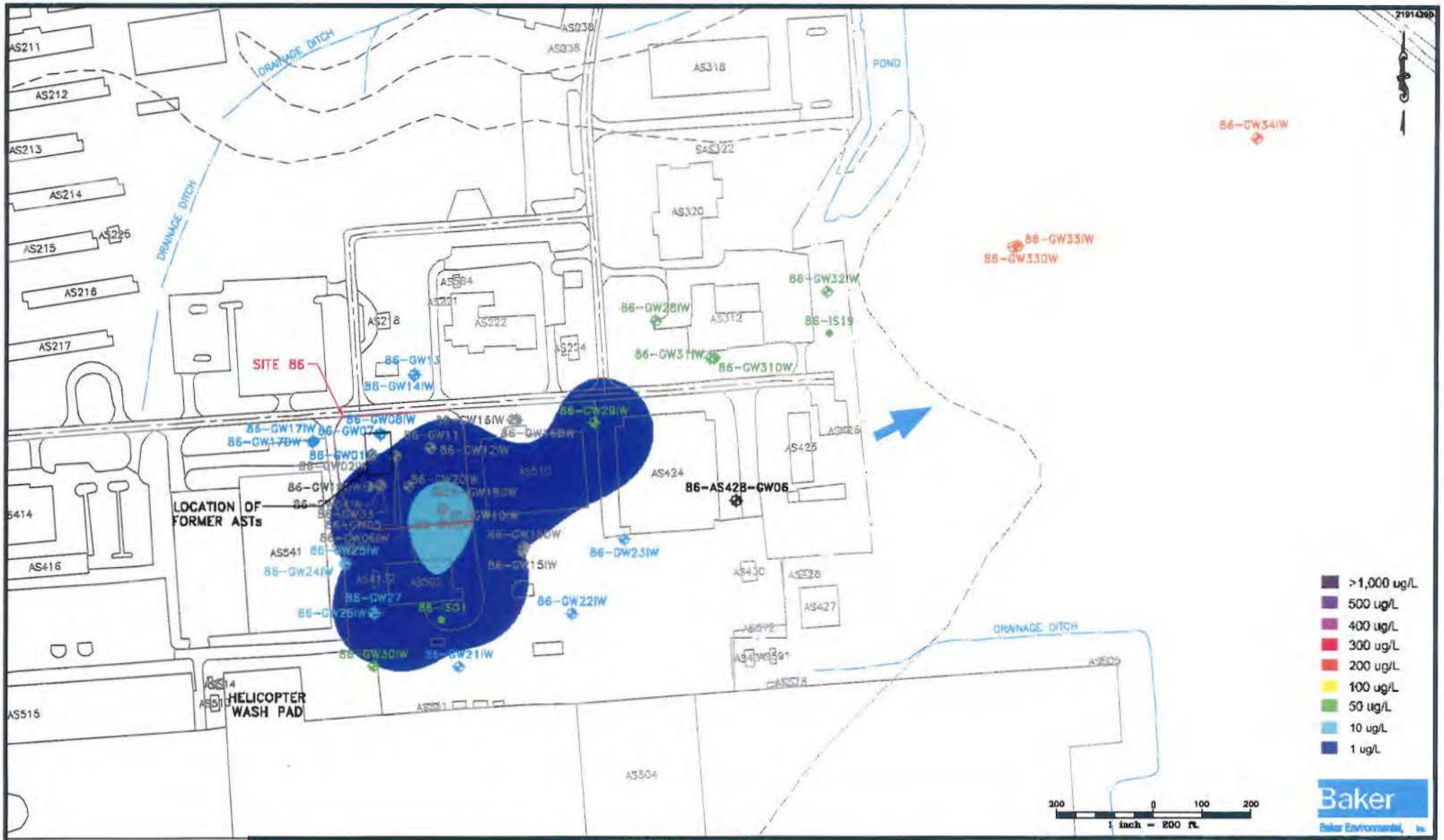
LEGEND

- ● – AUGUST 2001 GROUNDWATER SAMPLING LOCATION
- ▲ – SUBSURFACE SOIL AND GROUNDWATER SAMPLING LOCATION
- ◉ – JANUARY 2002 GROUNDWATER SAMPLING LOCATION
- ND – COMPOUND NOT DETECTED
- NS – INTERVAL NOT SAMPLED

FIGURE 4-5
EXTENT OF BENZENE ABOVE THE 2L STANDARD (40 TO 44 FEET BGS)
OPERABLE UNIT No. 20 – SITE 86
AMENDED RI REPORT
CTO – 0191

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: MCB CAMP LEJEUNE, 2000.

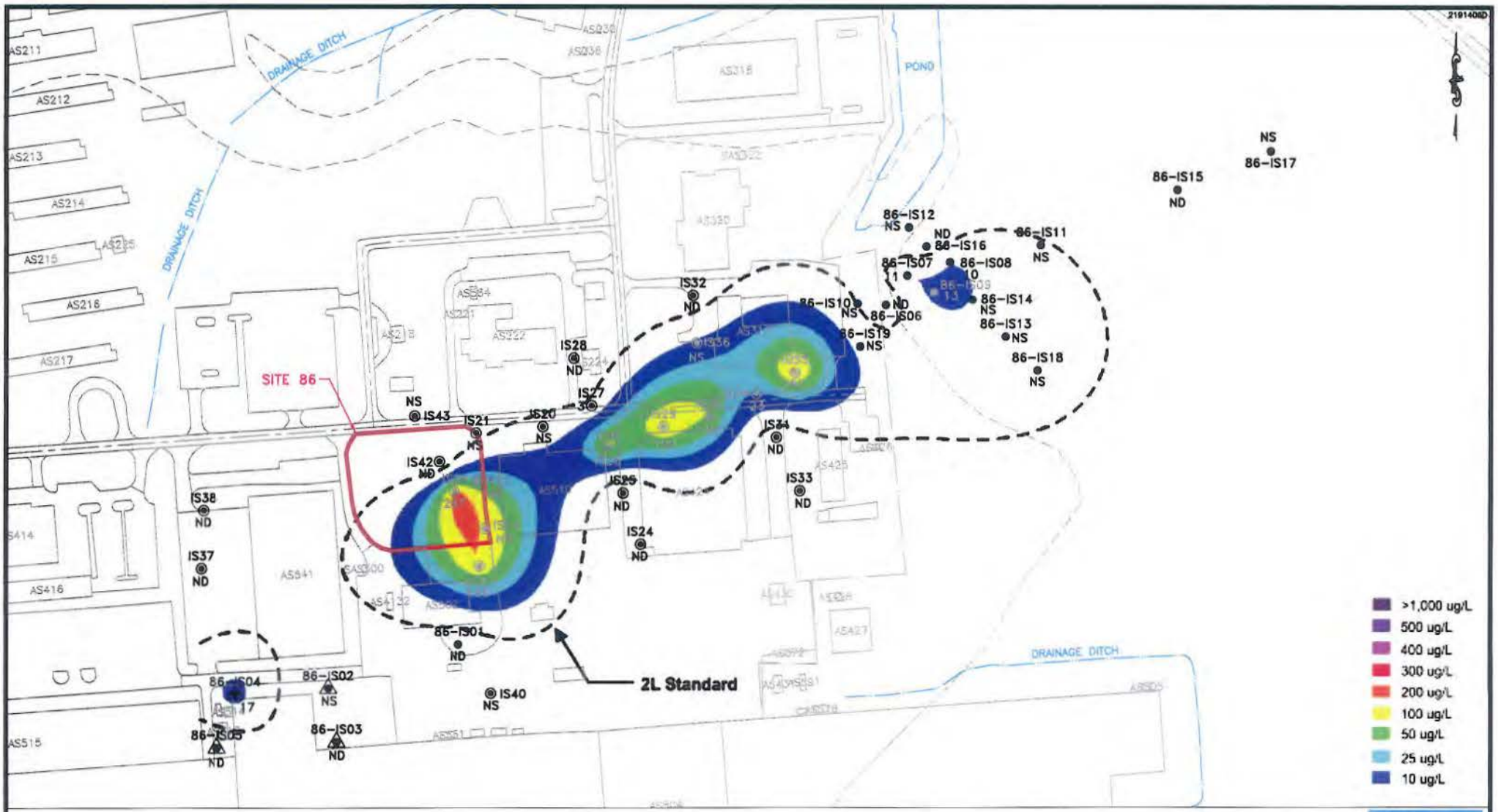


LEGEND

- SHALLOW MONITORING WELL (RI – 1995)
- INTERMEDIATE MONITORING WELL (UST PROGRAM)
- INTERMEDIATE MONITORING WELL (RI – 1995)
- INTERMEDIATE MONITORING WELL (POST RI – 1997)
- INTERMEDIATE MONITORING WELL (AMENDED RI – 2002)
- DEEP MONITORING WELL (RI – 1995)
- AUGUST 2001 GROUNDWATER SAMPLING LOCATION
- DEEP MONITORING WELL (POST RI – 1995)
- DEEP MONITORING WELL (POST RI – 1997)
- DEEP MONITORING WELL (AMENDED RI – 2002)
- FENCE
- GROUND SURFACE ELEVATION CONTOUR
- PREDOMINANT GROUNDWATER FLOW DIRECTION (CASTLE HAYNE AQUIFER)

SOURCE: MCB CAMP LEJEUNE, 2000.

FIGURE 4-5
EXTENT OF VINYL CHLORIDE ABOVE DETECTION LIMITS IN INTERMEDIATE WELLS
AMENDED RI REPORT
CTO – 0191
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



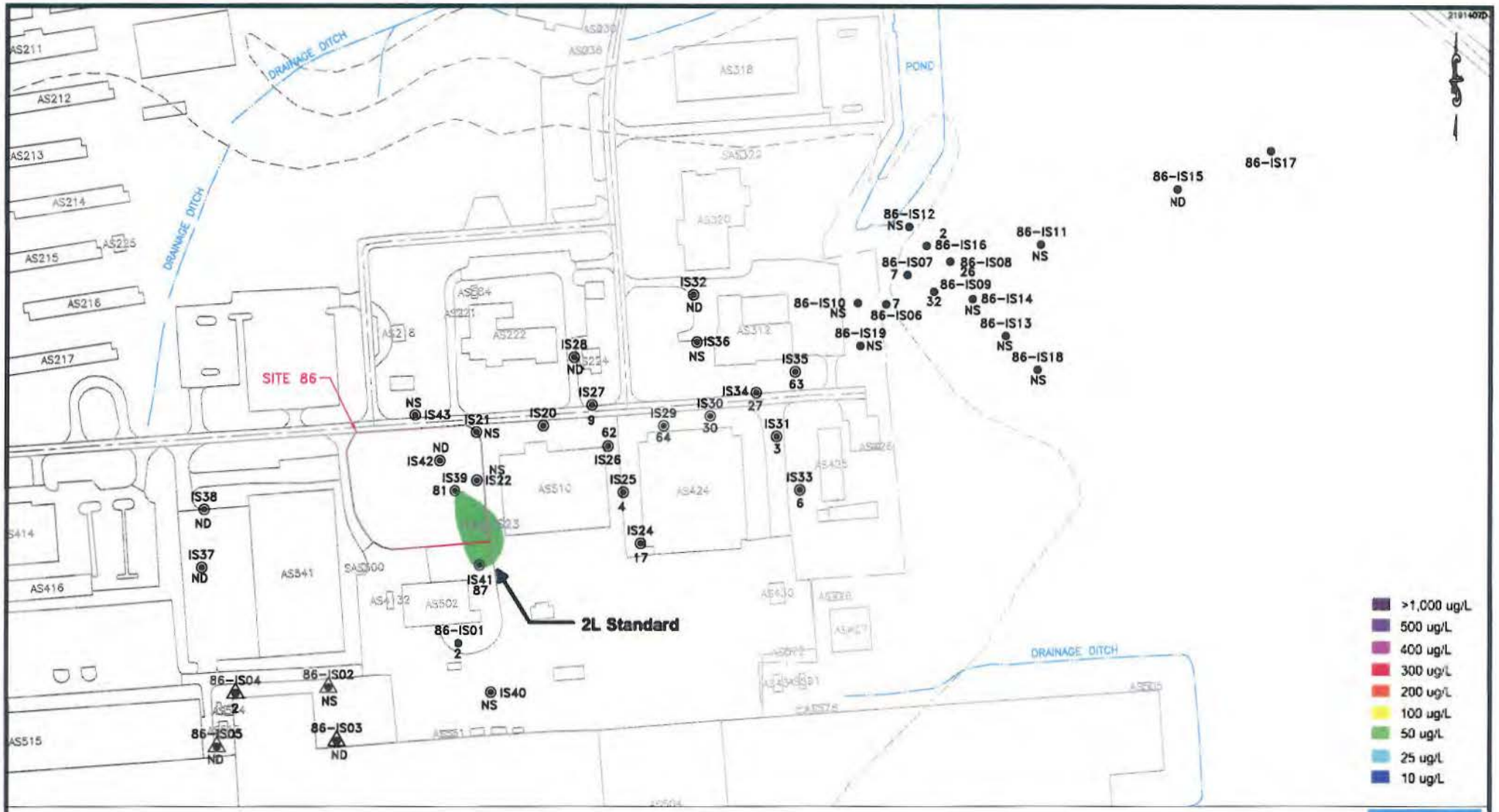
SOURCE: MCB CAMP LEJEUNE, 2000.

LEGEND

- ● – AUGUST 2001 GROUNDWATER SAMPLING LOCATION
- ▲ – SUBSURFACE SOIL AND GROUNDWATER SAMPLING LOCATION
- ◉ – JANUARY 2002 GROUNDWATER SAMPLING LOCATION
- ND – COMPOUND NOT DETECTED
- NS – INTERVAL NOT SAMPLED

FIGURE 4-6
EXTENT OF TCE ABOVE THE 2L STANDARD (50 TO 54 FEET BGS)
OPERABLE UNIT No. 20 – SITE 86
AMENDED RI REPORT
CTO – 0191

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



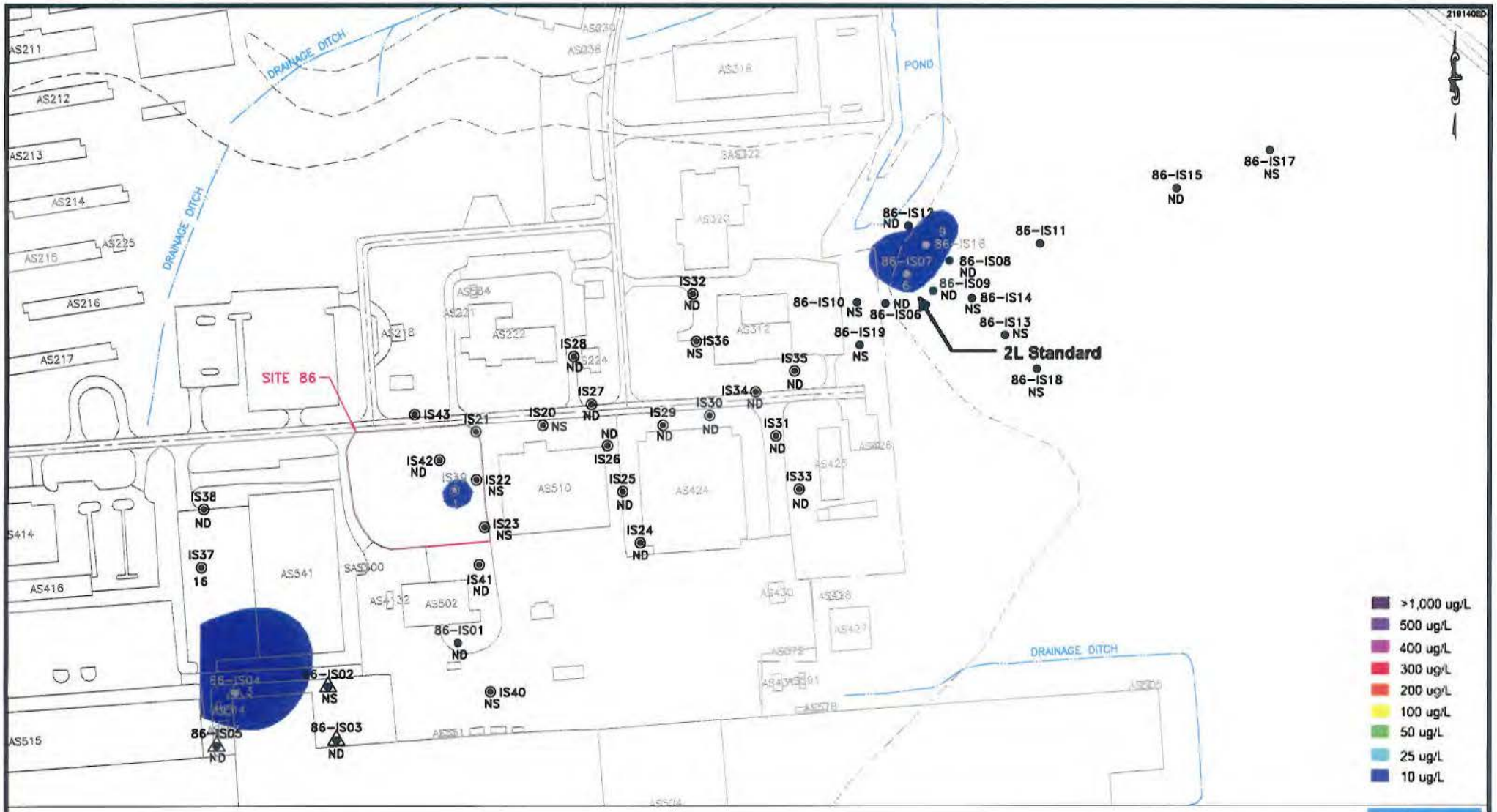
SOURCE: MCB CAMP LEJEUNE, 2000.

LEGEND

- ● – AUGUST 2001 GROUNDWATER SAMPLING LOCATION
- ▲ – SUBSURFACE SOIL AND GROUNDWATER SAMPLING LOCATION
- ◉ – JANUARY 2002 GROUNDWATER SAMPLING LOCATION
- ND – COMPOUND NOT DETECTED
- NS – INTERVAL NOT SAMPLED

FIGURE 4-7
EXTENT OF cis-DCE ABOVE THE 2L STANDARD (50 TO 54 FEET BGS)
OPERABLE UNIT No. 20 – SITE 86
AMENDED RI REPORT
CTO – 0191

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



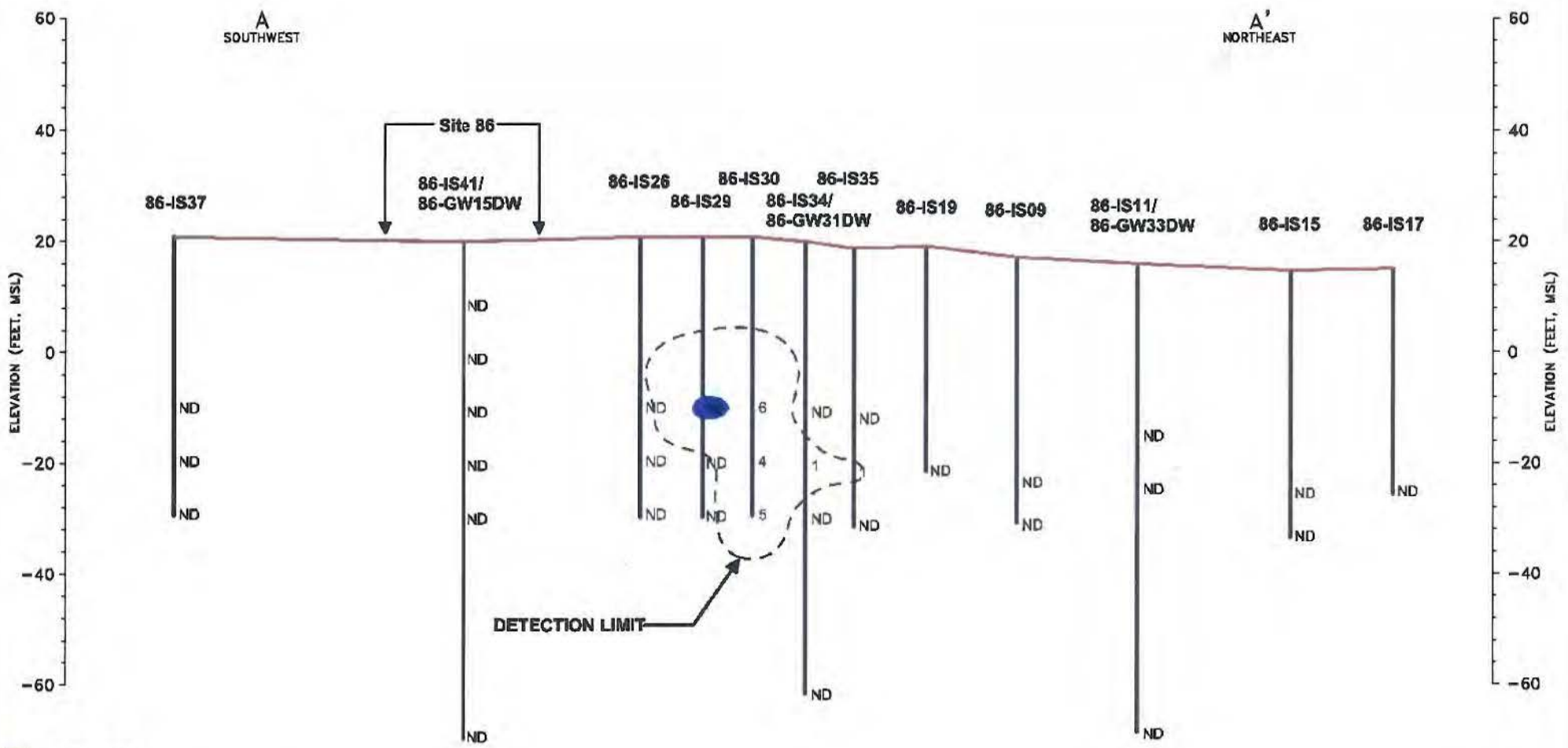
LEGEND

- ● – AUGUST 2001 GROUNDWATER SAMPLING LOCATION
- ▲ – SUBSURFACE SOIL AND GROUNDWATER SAMPLING LOCATION
- ◉ – JANUARY 2002 GROUNDWATER SAMPLING LOCATION
- ND – COMPOUND NOT DETECTED
- NS – INTERVAL NOT SAMPLED

FIGURE 4-8
EXTENT OF BENZENE ABOVE THE 2L STANDARD (50 TO 54 FEET BGS)
OPERABLE UNIT No. 20 – SITE 86
AMENDED RI REPORT
CTO – 0191

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: MCB CAMP LEJEUNE, 2000.



>1,000 ug/L
500 ug/L
400 ug/L
300 ug/L
200 ug/L
100 ug/L
50 ug/L
25 ug/L
10 ug/L

200 0 100 200 400
Horizontal Scale: 1 inch = 200 ft.

20 0 10 20 40
Vertical Scale: 1 inch = 20 ft.

THE SOIL BORING INFORMATION IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. SUBSURFACE CONDITIONS INTERPOLATED BETWEEN BORINGS ARE ESTIMATED BASED ON ACCEPTED SOIL ENGINEERING PRINCIPLES AND GEOLOGIC JUDGEMENT.

LEGEND

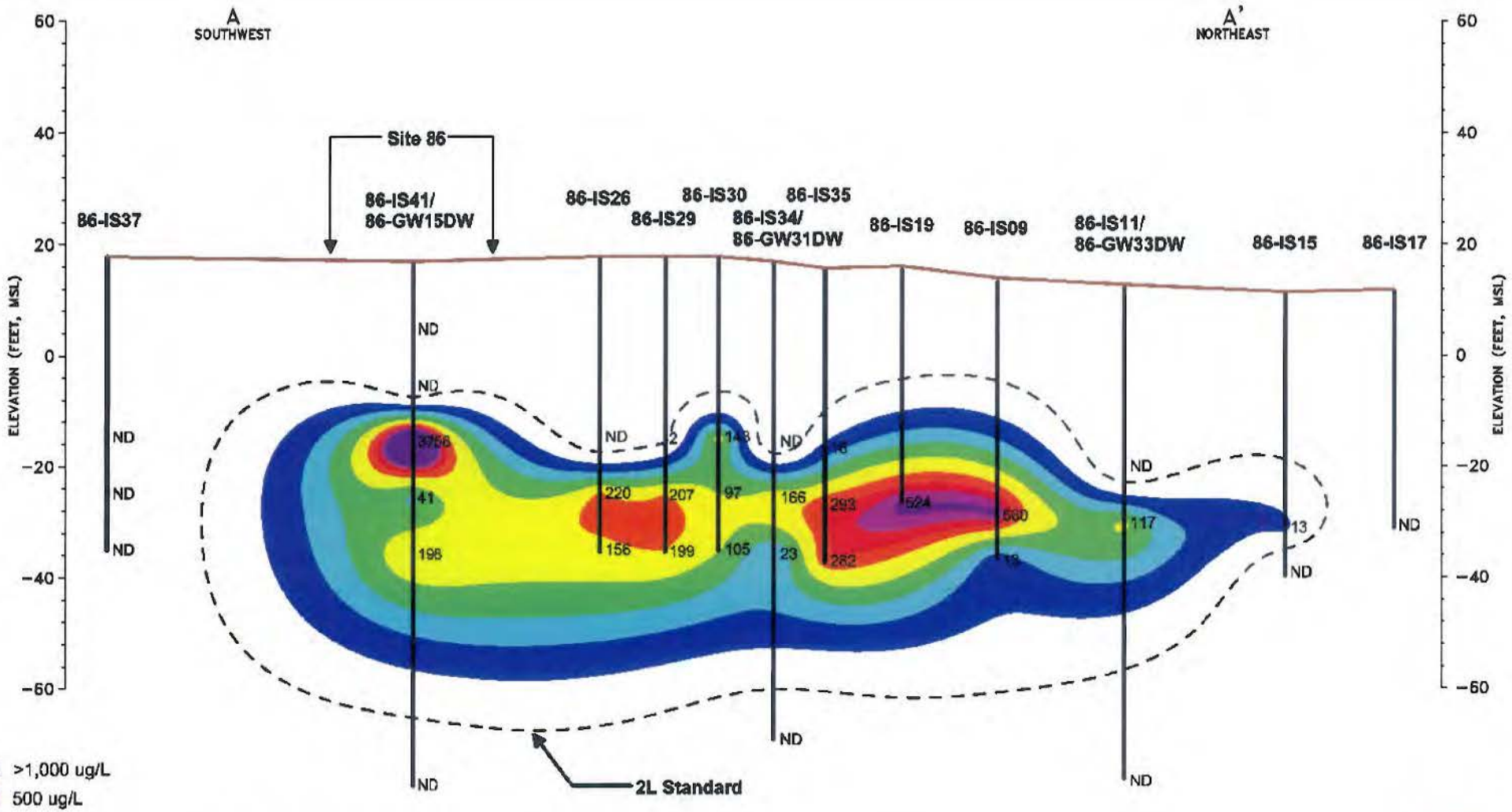
CONCENTRATIONS EXPRESSED IN ug/L

ND – COMPOUND NOT DETECTED

NS – INTERVAL NOT SAMPLED

Baker
Baker Environmental, Inc.

FIGURE 4-10
PCE CROSS SECTION OF THE EXTENT OF PCE ABOVE DETECTION LIMITS
OPERABLE UNIT NO. 20 – SITE 86
AMENDED RI REPORT, CTO – 0191
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



>1,000 ug/L
500 ug/L
400 ug/L
300 ug/L
200 ug/L
100 ug/L
50 ug/L
25 ug/L
10 ug/L

200 0 100 200 400
Horizontal Scale: 1 inch = 200 ft.

20 0 10 20 40
Vertical Scale: 1 inch = 20 ft.

THE SOIL BORING INFORMATION IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. SUBSURFACE CONDITIONS INTERPOLATED BETWEEN BORINGS ARE ESTIMATED BASED ON ACCEPTED SOIL ENGINEERING PRINCIPLES AND GEOLOGIC JUDGEMENT.

LEGEND

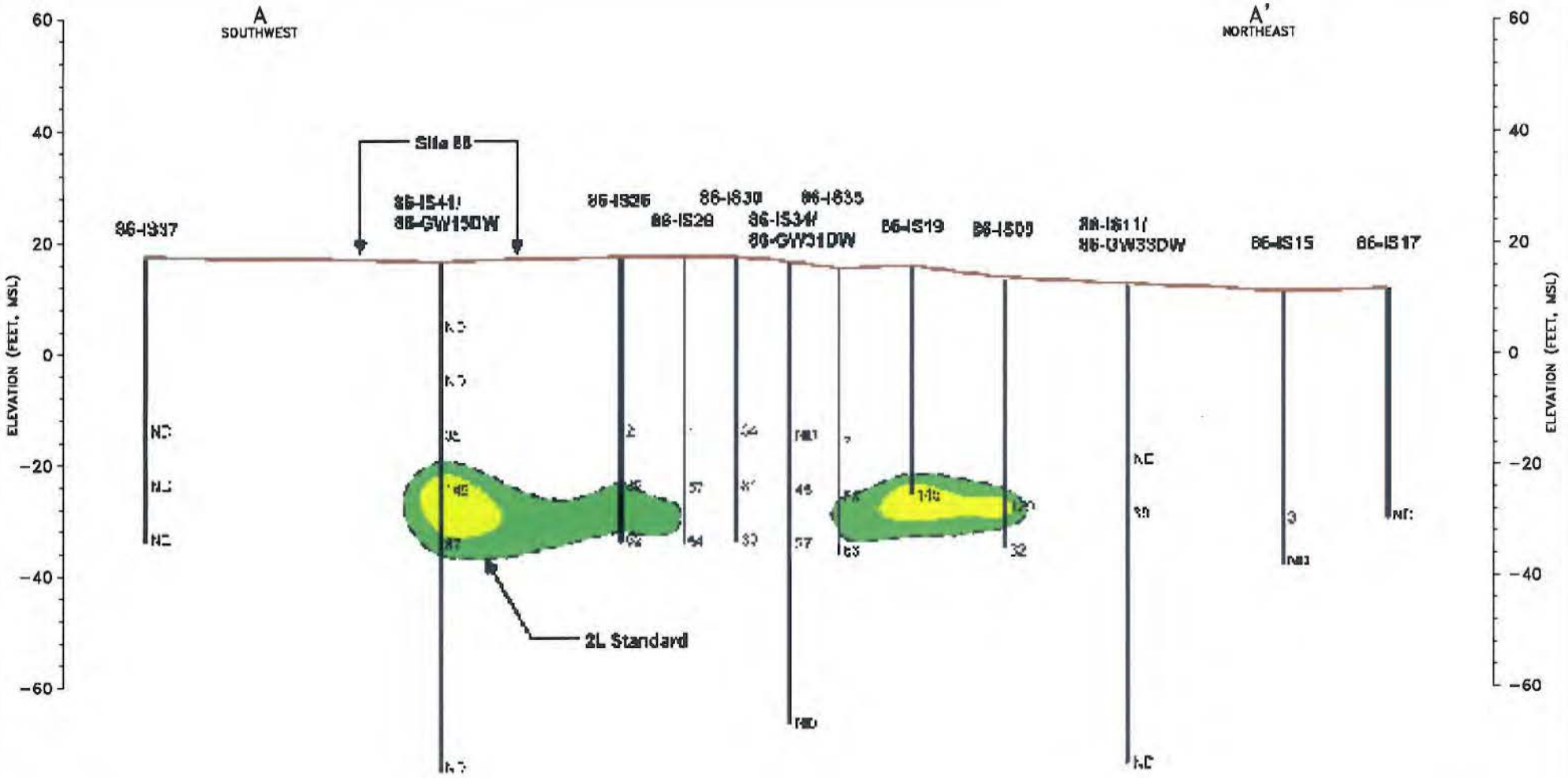
CONCENTRATIONS EXPRESSED IN ug/L

ND - COMPOUND NOT DETECTED

NS - INTERVAL NOT SAMPLED

Baker
Baker Environmental, Inc.

FIGURE 4-11
CROSS SECTION OF THE EXTENT OF TCE ABOVE THE 2L STANDARD
OPERABLE UNIT NO. 20 - SITE 86
AMENDED RI REPORT, CTO - 0191
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



>1,000 ug/L
500 ug/L
400 ug/L
300 ug/L
200 ug/L
100 ug/L
70 ug/L

200 0 100 200 400
Horizontal Scale: 1 inch = 200 ft.

20 0 10 20 40
Vertical Scale: 1 inch = 20 ft.

THE SOIL BORING INFORMATION IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. SUBSURFACE CONDITIONS INTERPOLATED BETWEEN BORINGS ARE ESTIMATED BASED ON ACCEPTED SOIL ENGINEERING PRINCIPLES AND GEOLOGIC JUDGEMENT.

Baker
Baker Environmental, Inc.

LEGEND

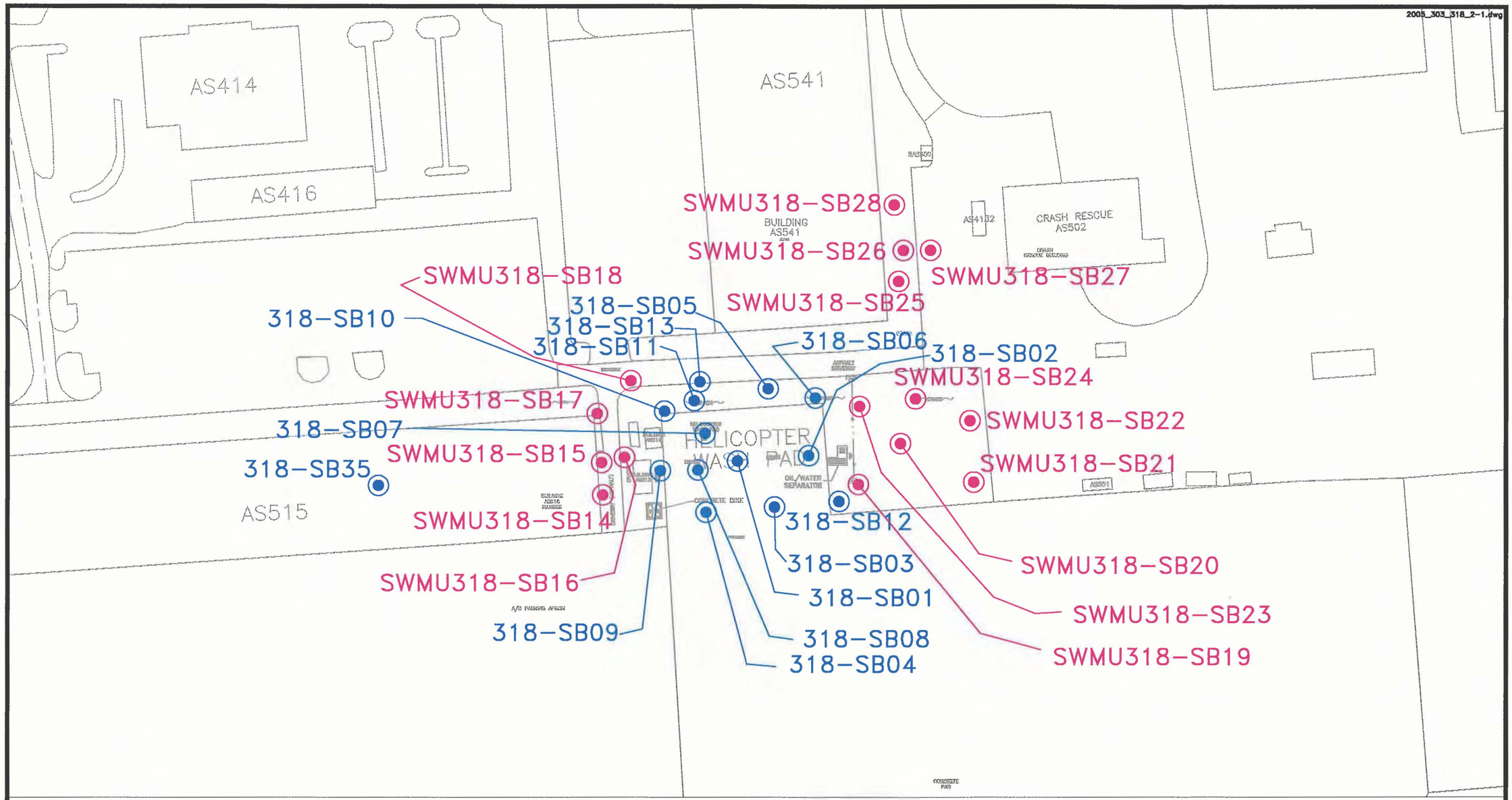
CONCENTRATIONS EXPRESSED IN ug/L

ND - COMPOUND NOT DETECTED

NS - INTERVAL NOT SAMPLED

FIGURE 4-12
DCE CROSS SECTION
OPERABLE UNIT NO. 20 - SITE 86
AMENDED RI REPORT, CTO - 0191
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SWMU 303/318 RCRA Facilities Investigation (CH2M HILL Hill, 2006)



Baker

SOURCE: MCB CAMP LEJEUNE, 2000.

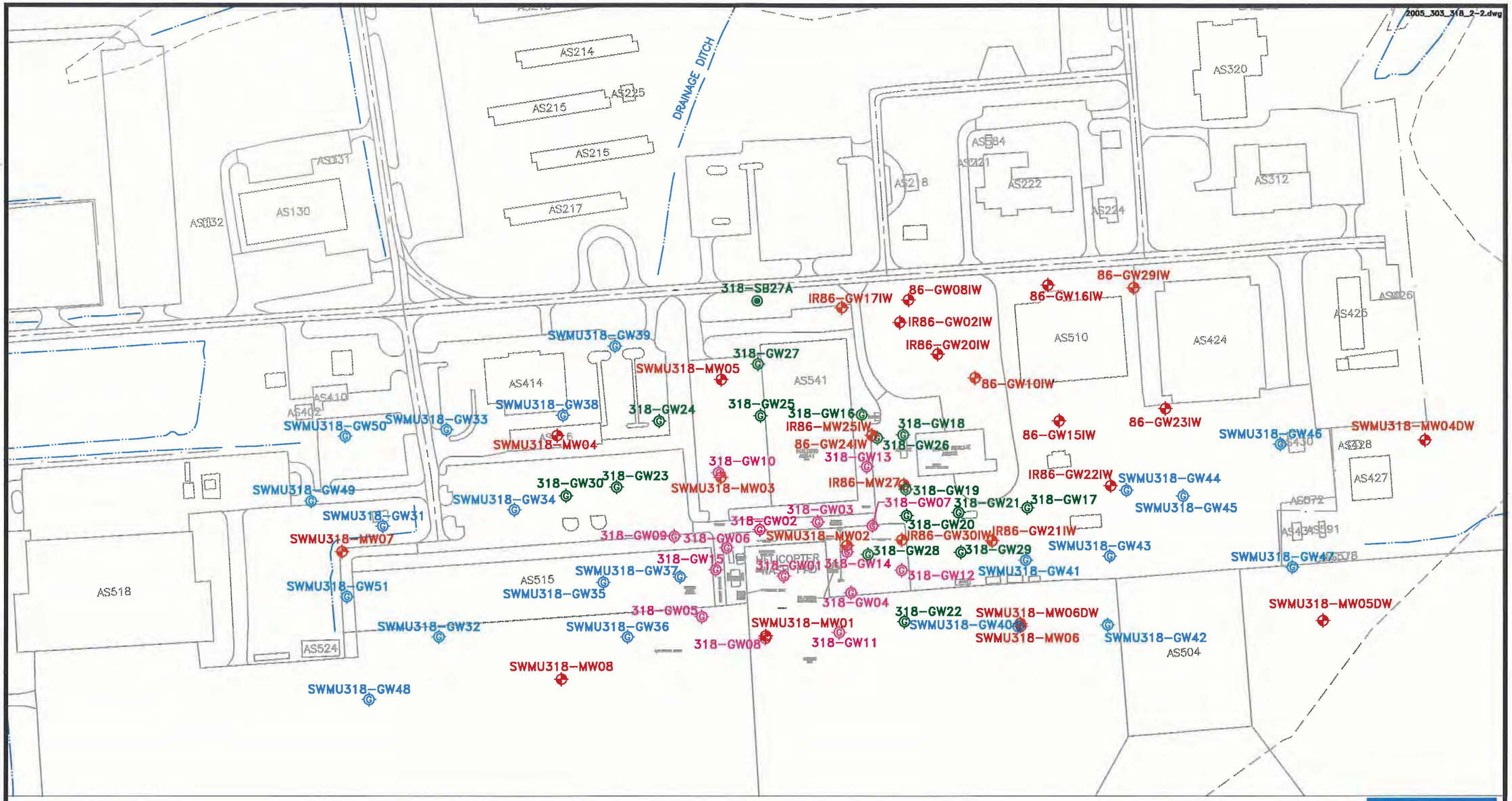
100 0 50 100
1 inch = 100 ft.

LEGEND

- PHASE I RFI SOIL BORING LOCATION
- PHASE III RFI SOIL BORING LOCATION

FIGURE 2-1
SOIL BORING LOCATION MAP
RCRA FACILITY INVESTIGATION
SWMU 303/318, CTO-0091

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



Baker
Michael Baker Jr. Inc.

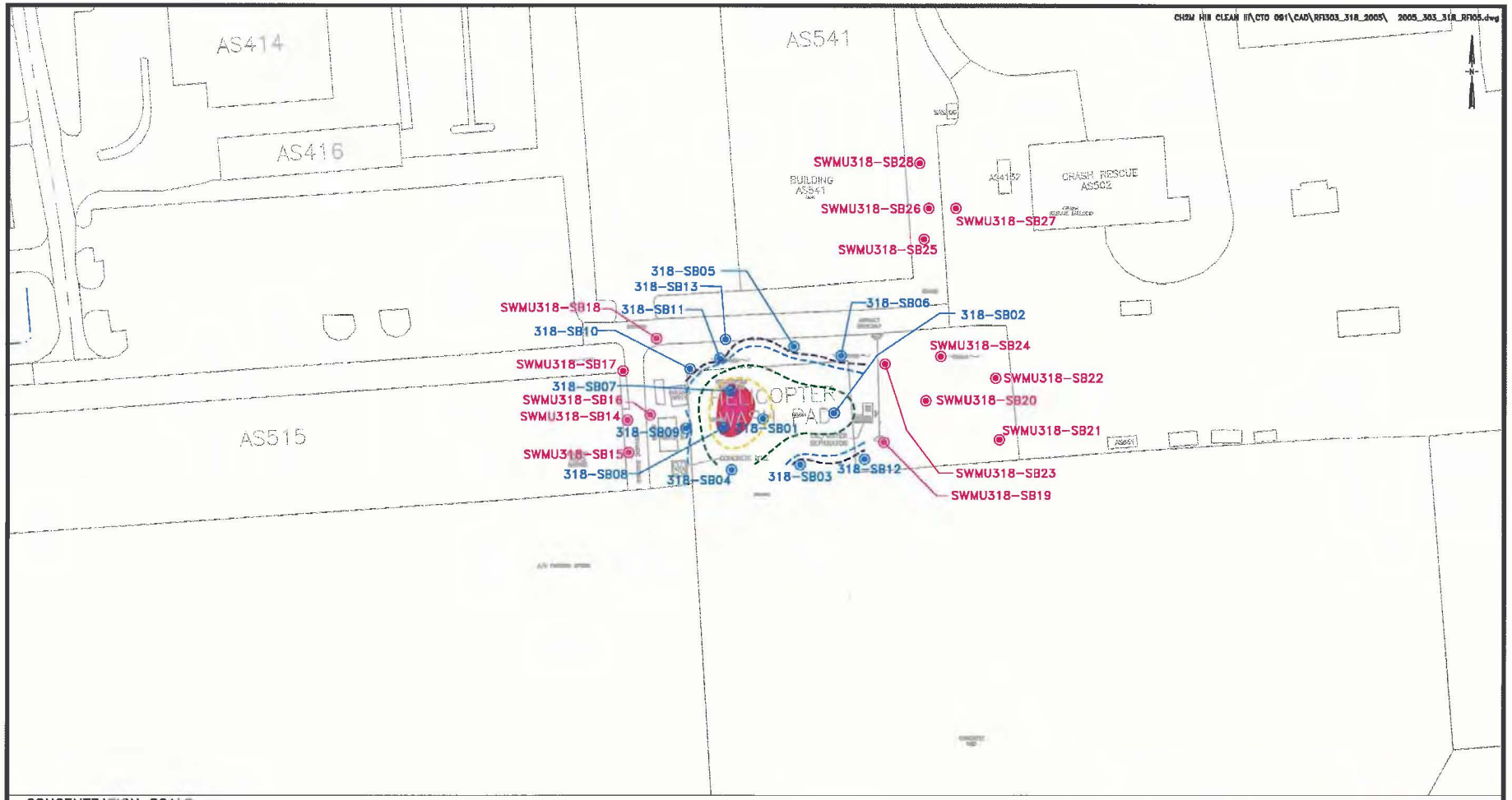
SOURCE: MCB CAMP LEJEUNE, 2000.

200 0 100 200
1 inch = 200 ft.

LEGEND

- PHASE I RFI GROUNDWATER GRAB LOCATION
- PHASE II RFI GROUNDWATER GRAB LOCATION
- PHASE III RFI GROUNDWATER GRAB LOCATION
- MONITORING WELL LOCATION

FIGURE 2-2
GROUNDWATER GRAB AND MONITORING WELL LOCATION MAP
RCRA FACILITY INVESTIGATION
SWMU 303/318, CTO-0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



CONCENTRATION SCALE

- 10,000 ppb
- 4,310 ppb (NC Soil-to-Groundwater)
- 1,000 ppb
- 100 ppb
- 10 ppb
- 5.4 ppb (Detection Limit)

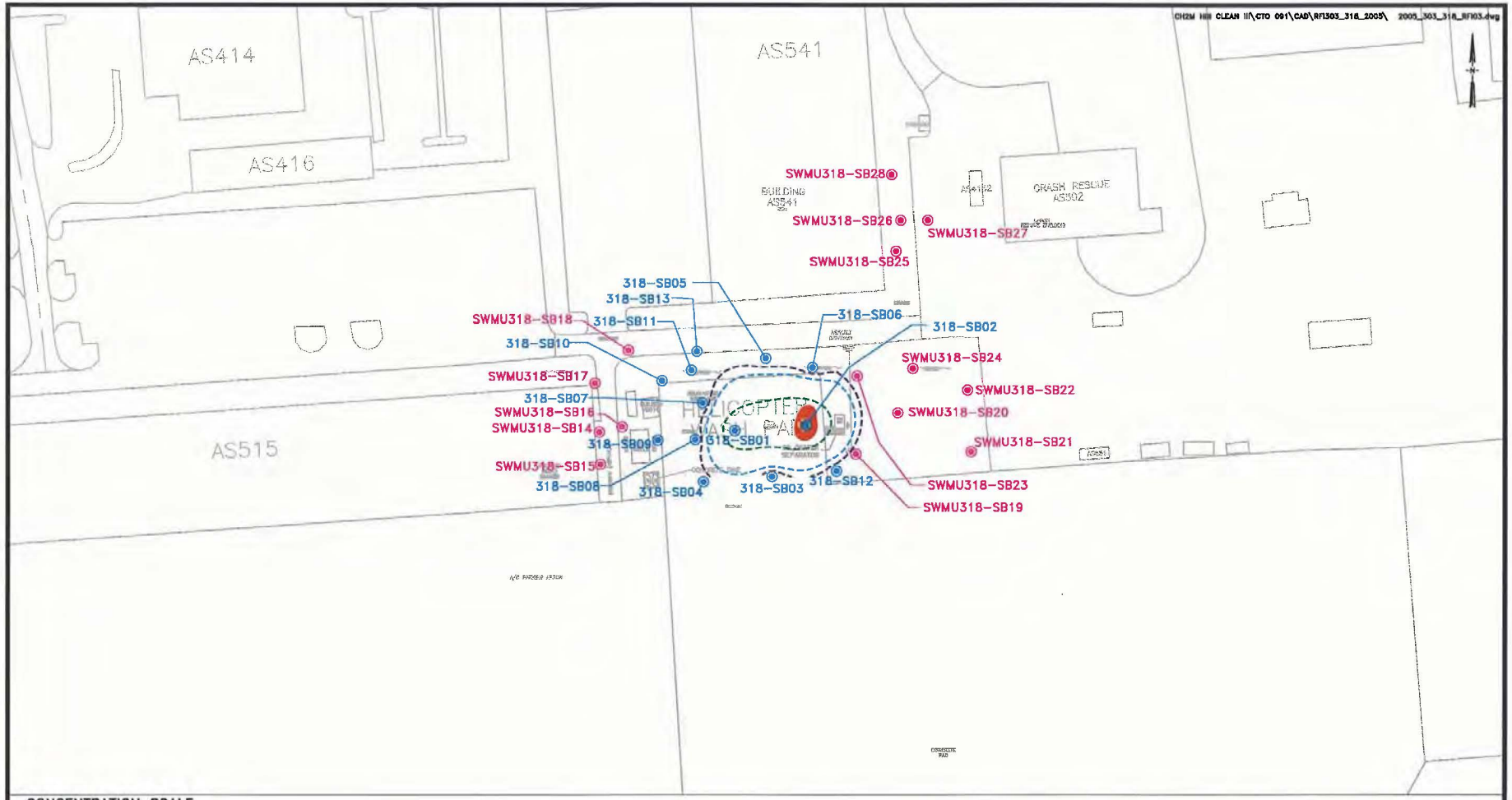
SOURCE: MCB CAMP LEJEUNE, 2000.

LEGEND

- PHASE I RFI SOIL BORING LOCATION
- PHASE III RFI SOIL BORING LOCATION

Baker

FIGURE 4-1
BUTYLBENZENE CONCENTRATIONS
IN SURFACE SOIL (0'-1')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



CONCENTRATION SCALE

- 10,000 ppb
- 1,680 ppb (NC Soil-to-Groundwater)
- 1,000 ppb
- 100 ppb
- 10 ppb
- 5.4 ppb (Detection Limit)

SOURCE: MCB CAMP LEJEUNE, 2000.

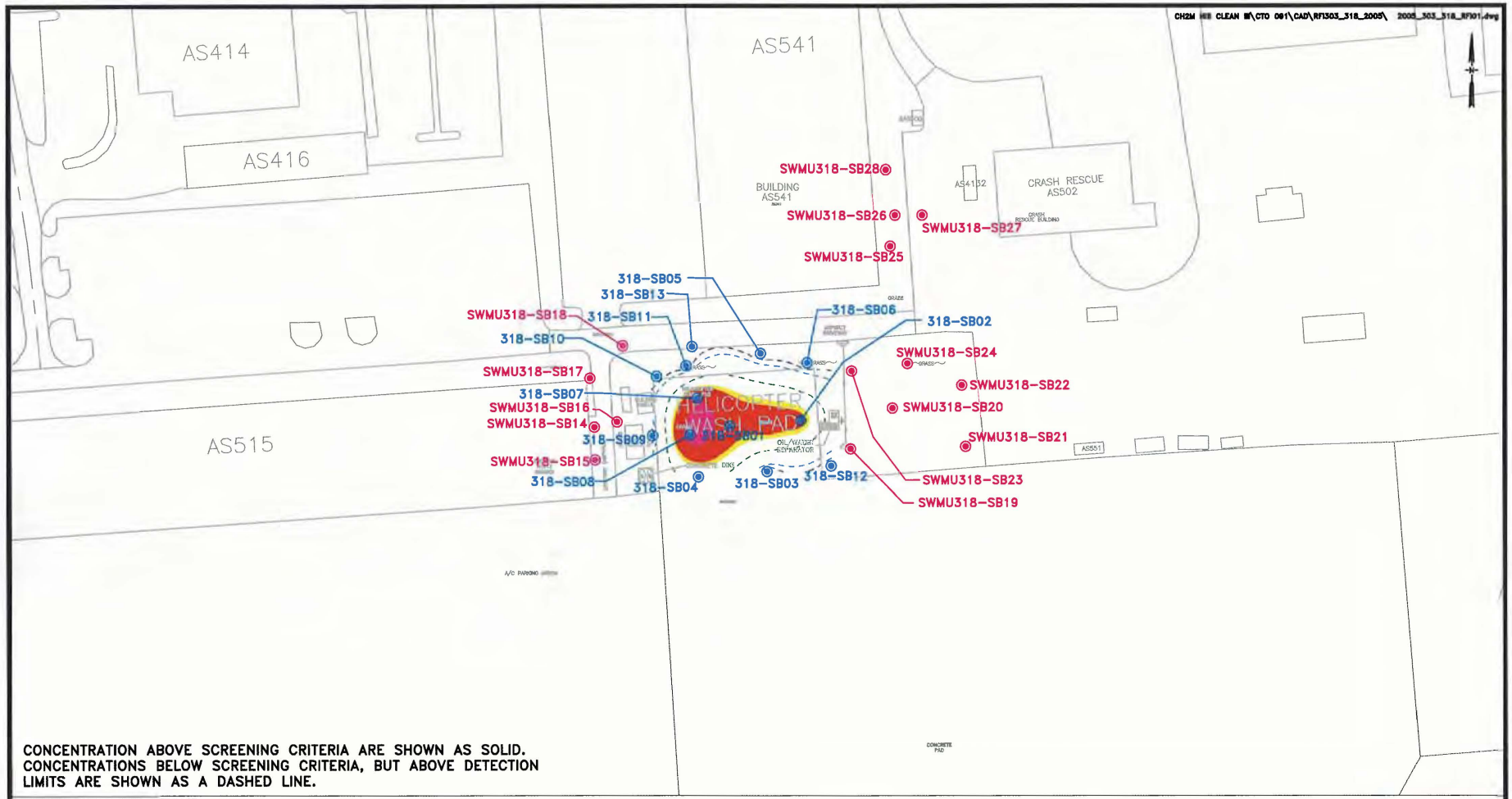
100 0 50 100
1 inch = 100 ft.

Baker

LEGEND

- PHASE I RFI SOIL BORING LOCATION
- PHASE III RFI SOIL BORING LOCATION

FIGURE 4-2
ISOPROPYLBENZENE CONCENTRATIONS
IN SURFACE SOIL (0'-1')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



CONCENTRATION ABOVE SCREENING CRITERIA ARE SHOWN AS SOLID. CONCENTRATIONS BELOW SCREENING CRITERIA, BUT ABOVE DETECTION LIMITS ARE SHOWN AS A DASHED LINE.

CONCENTRATION SCALE

- 10,000 ppb
- 1,000 ppb
- 585 ppb (NC Soil-to-Groundwater)
- 100 ppb
- 10 ppb
- 5.4 ppb (Detection Limit)

SOURCE: MCB CAMP LEJEUNE, 2000.

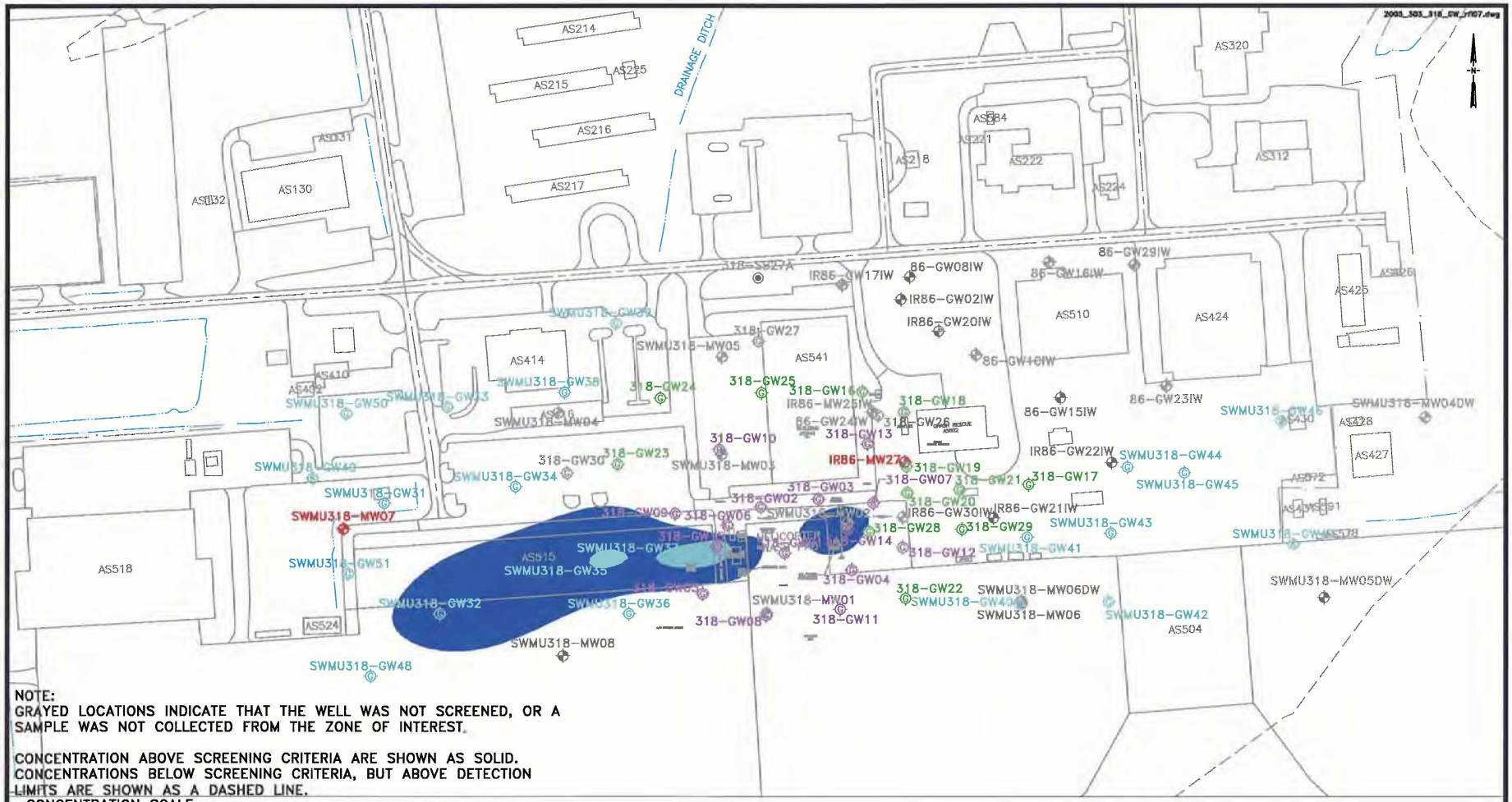
100 0 50 100
1 inch = 100 ft.

Baker

LEGEND

- PHASE I RFI SOIL BORING LOCATION
- PHASE III RFI SOIL BORING LOCATION

FIGURE 4-3
NAPHTHALENE CONCENTRATIONS IN SURFACE SOIL (0-1')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE:
GRAYED LOCATIONS INDICATE THAT THE WELL WAS NOT SCREENED, OR A SAMPLE WAS NOT COLLECTED FROM THE ZONE OF INTEREST.

CONCENTRATION ABOVE SCREENING CRITERIA ARE SHOWN AS SOLID. CONCENTRATIONS BELOW SCREENING CRITERIA, BUT ABOVE DETECTION LIMITS ARE SHOWN AS A DASHED LINE.

CONCENTRATION SCALE

- 5,000 ppb
- 1,000 ppb
- 100 ppb
- 10 ppb
- Detection Limit (2ppb)

200 0 100 200
1 inch = 200 ft.

LEGEND

- PHASE I RFI GROUNDWATER GRAB LOCATION
- PHASE II RFI GROUNDWATER GRAB LOCATION
- PHASE III RFI GROUNDWATER GRAB LOCATION
- MONITORING WELL LOCATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 4-6
BENZENE CONCENTRATIONS IN SHALLOW GROUNDWATER (10'-14')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

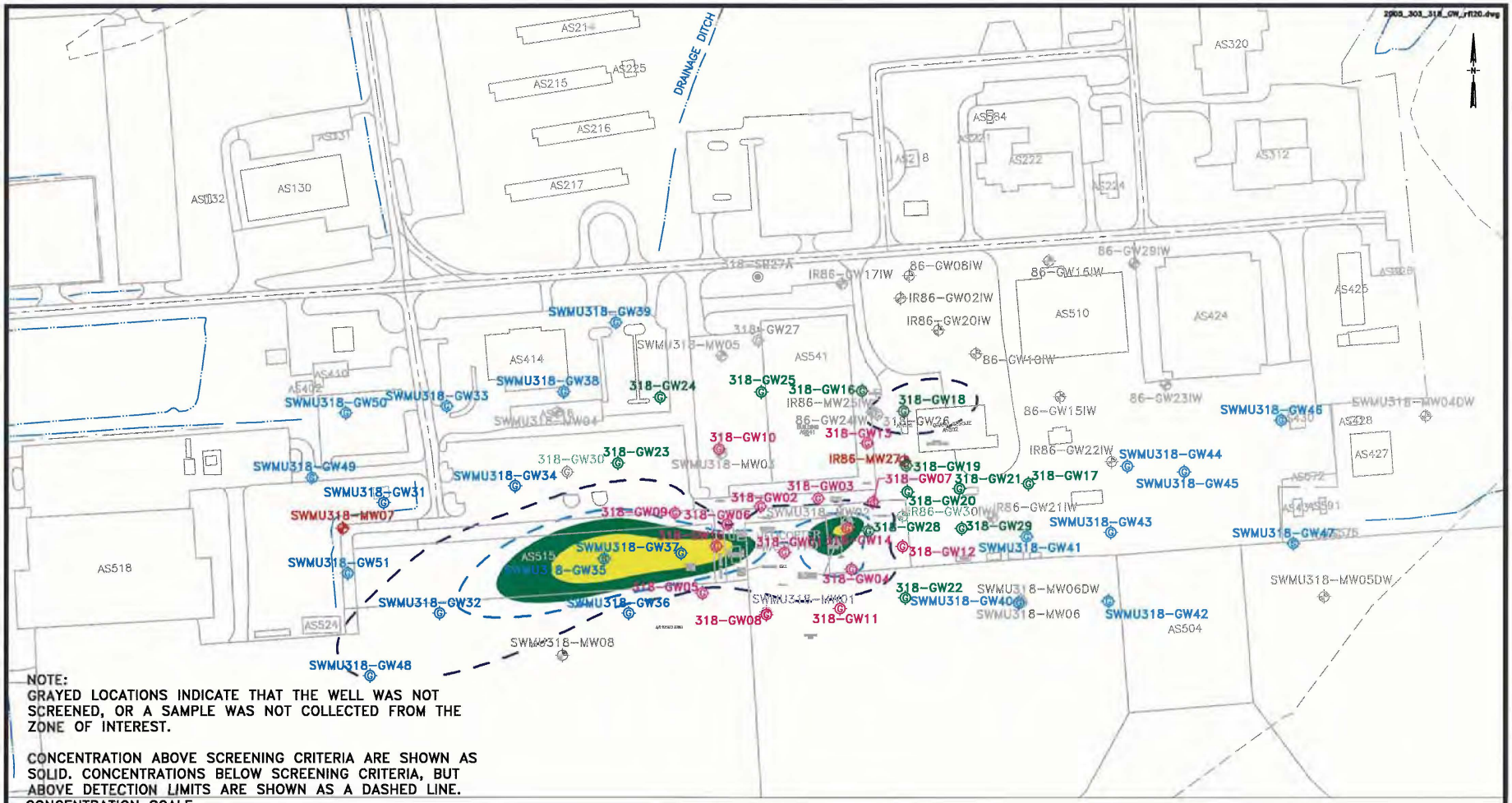
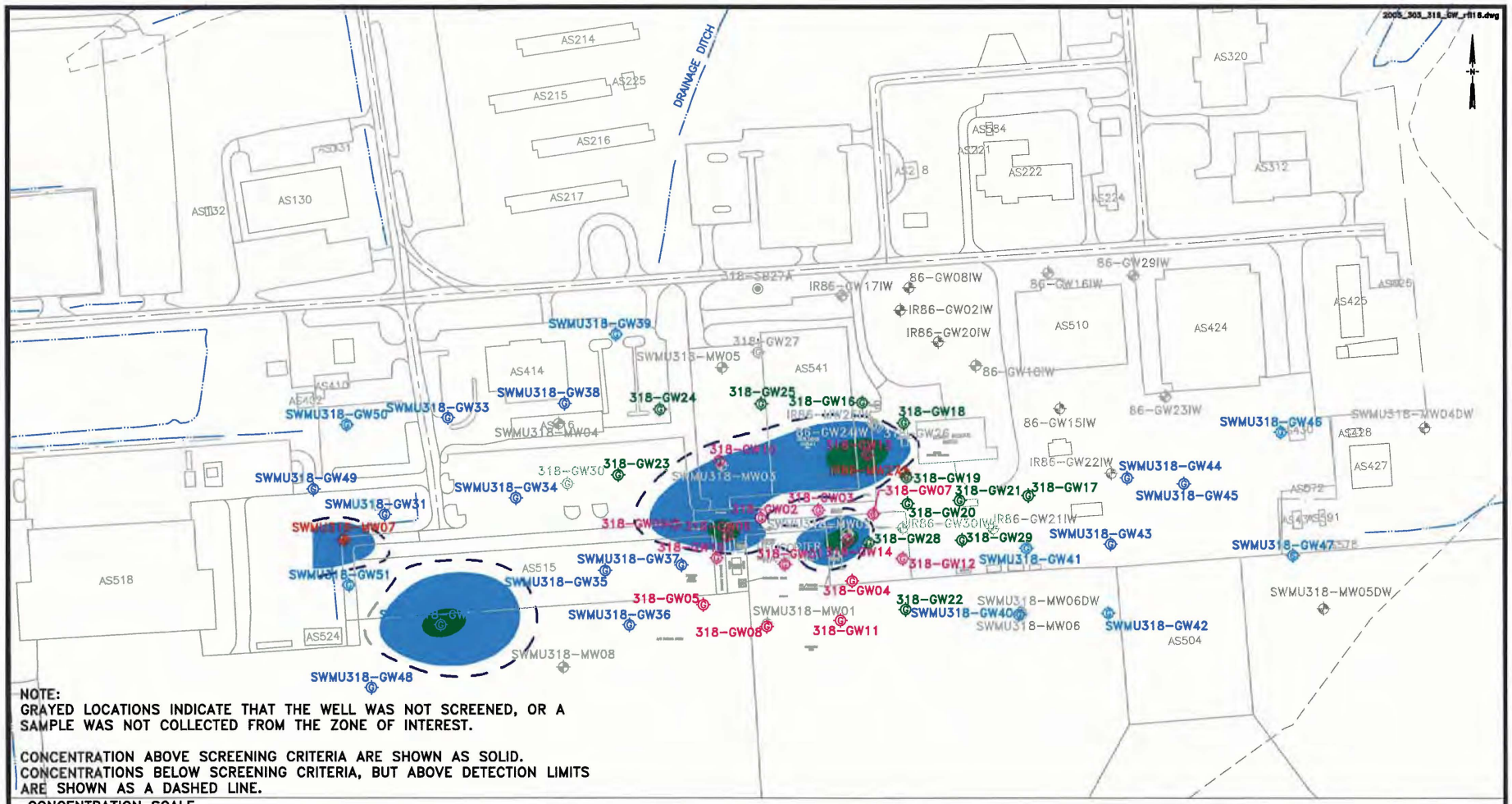


FIGURE 4-7
NAPHTHALENE CONCENTRATIONS IN SHALLOW GROUNDWATER (10'-14')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO – 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE:
GRAYED LOCATIONS INDICATE THAT THE WELL WAS NOT SCREENED, OR A SAMPLE WAS NOT COLLECTED FROM THE ZONE OF INTEREST.

CONCENTRATION ABOVE SCREENING CRITERIA ARE SHOWN AS SOLID. CONCENTRATIONS BELOW SCREENING CRITERIA, BUT ABOVE DETECTION LIMITS ARE SHOWN AS A DASHED LINE.

CONCENTRATION SCALE

- 5,000 ppb
- 1,000 ppb
- 100 ppb
- 2L Standard (2.8ppb)
- Detection Limit (2ppb)

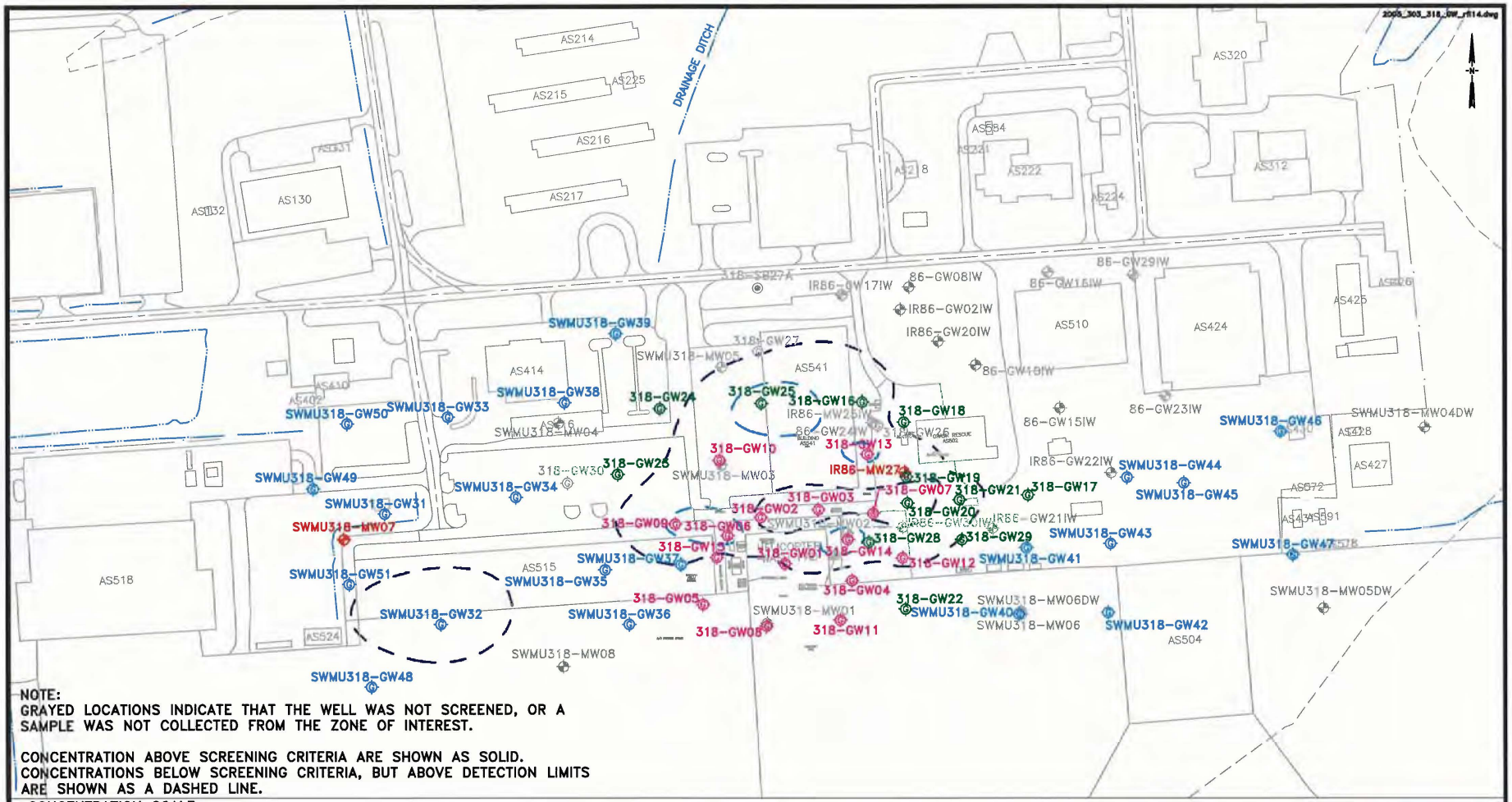
200 0 100 200
1 inch = 200 ft.

LEGEND

- PHASE I RFI GROUNDWATER GRAB LOCATION
- PHASE II RFI GROUNDWATER GRAB LOCATION
- PHASE III RFI GROUNDWATER GRAB LOCATION
- MONITORING WELL LOCATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 4-8
TCE CONCENTRATIONS IN SHALLOW GROUNDWATER (10'-14')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE:
GRAYED LOCATIONS INDICATE THAT THE WELL WAS NOT SCREENED, OR A SAMPLE WAS NOT COLLECTED FROM THE ZONE OF INTEREST.

CONCENTRATION ABOVE SCREENING CRITERIA ARE SHOWN AS SOLID.
CONCENTRATIONS BELOW SCREENING CRITERIA, BUT ABOVE DETECTION LIMITS ARE SHOWN AS A DASHED LINE.

CONCENTRATION SCALE

- 5,000 ppb
- 1,000 ppb
- 100 ppb
- 2L Standard (70 ppb)
- 10 ppb
- Detection Limit (2ppb)

200 0 100 200
1 inch = 200 ft.

Baker

LEGEND

- PHASE I RFI GROUNDWATER GRAB LOCATION
- PHASE II RFI GROUNDWATER GRAB LOCATION
- PHASE III RFI GROUNDWATER GRAB LOCATION
- MONITORING WELL LOCATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 4-9
CIS-DCE CONCENTRATIONS IN SHALLOW GROUNDWATER (10'-14')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

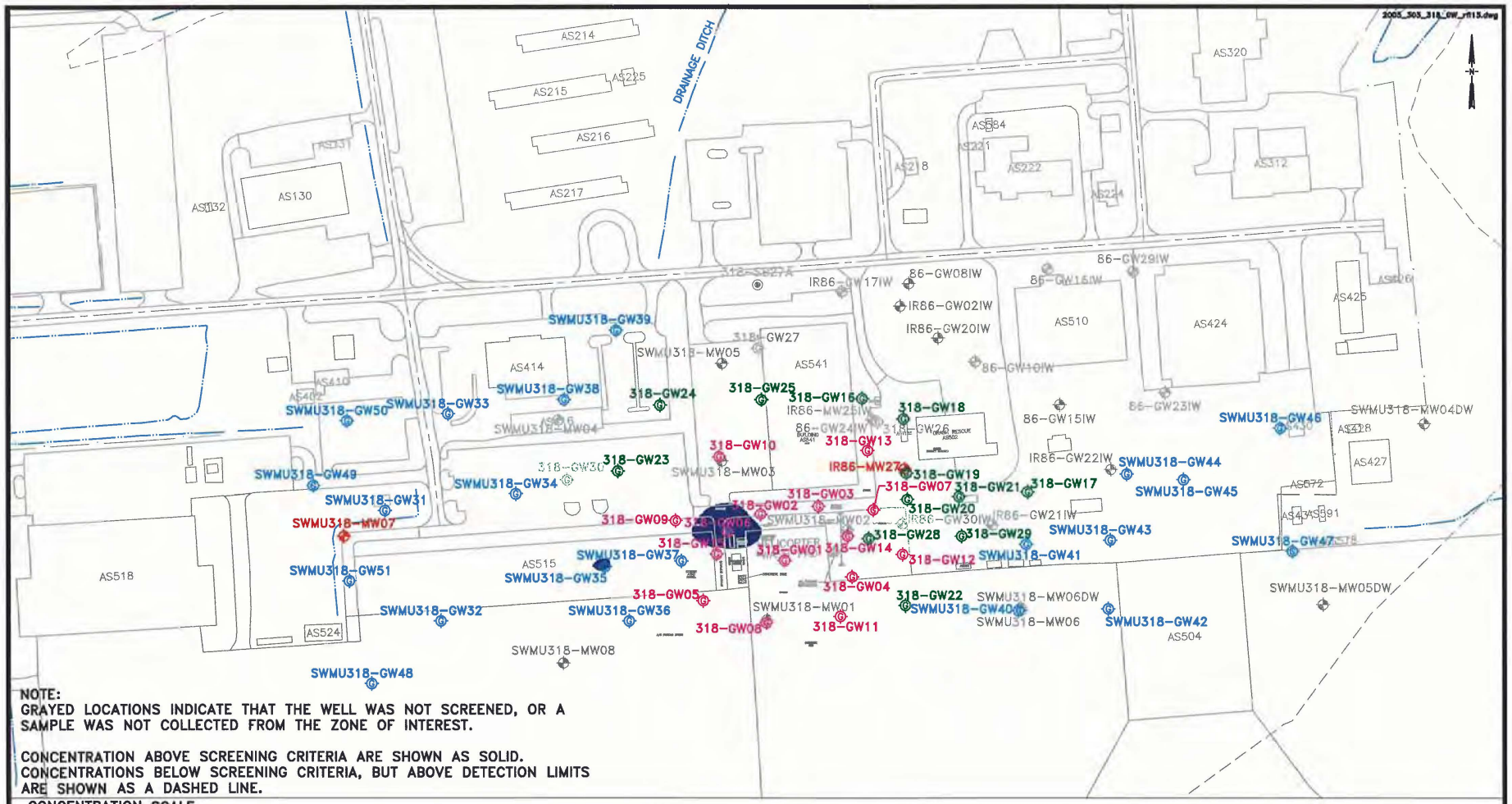


FIGURE 4-10
VINYL CHLORIDE CONCENTRATIONS IN SHALLOW GROUNDWATER (10'-14')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO – 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

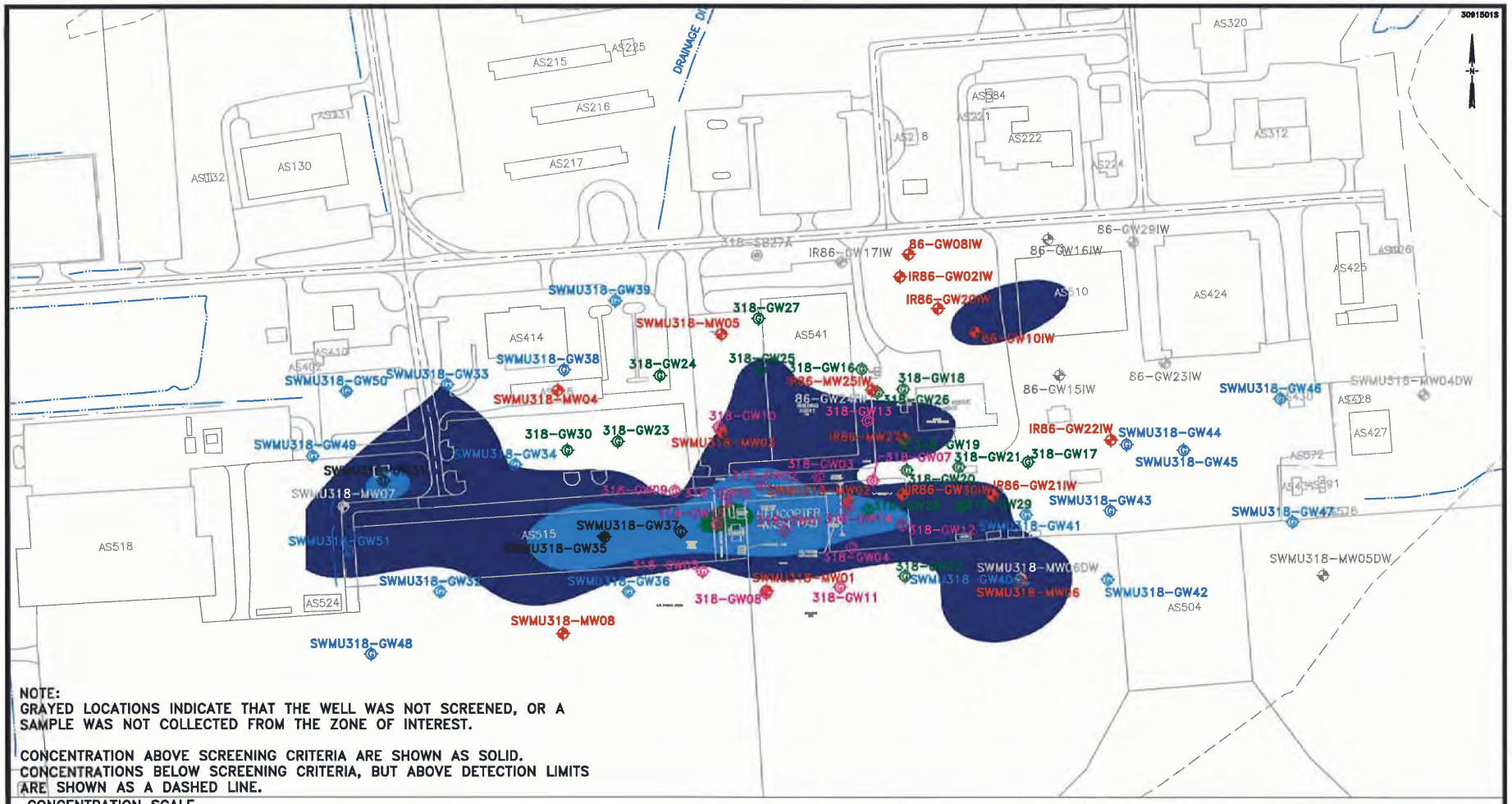
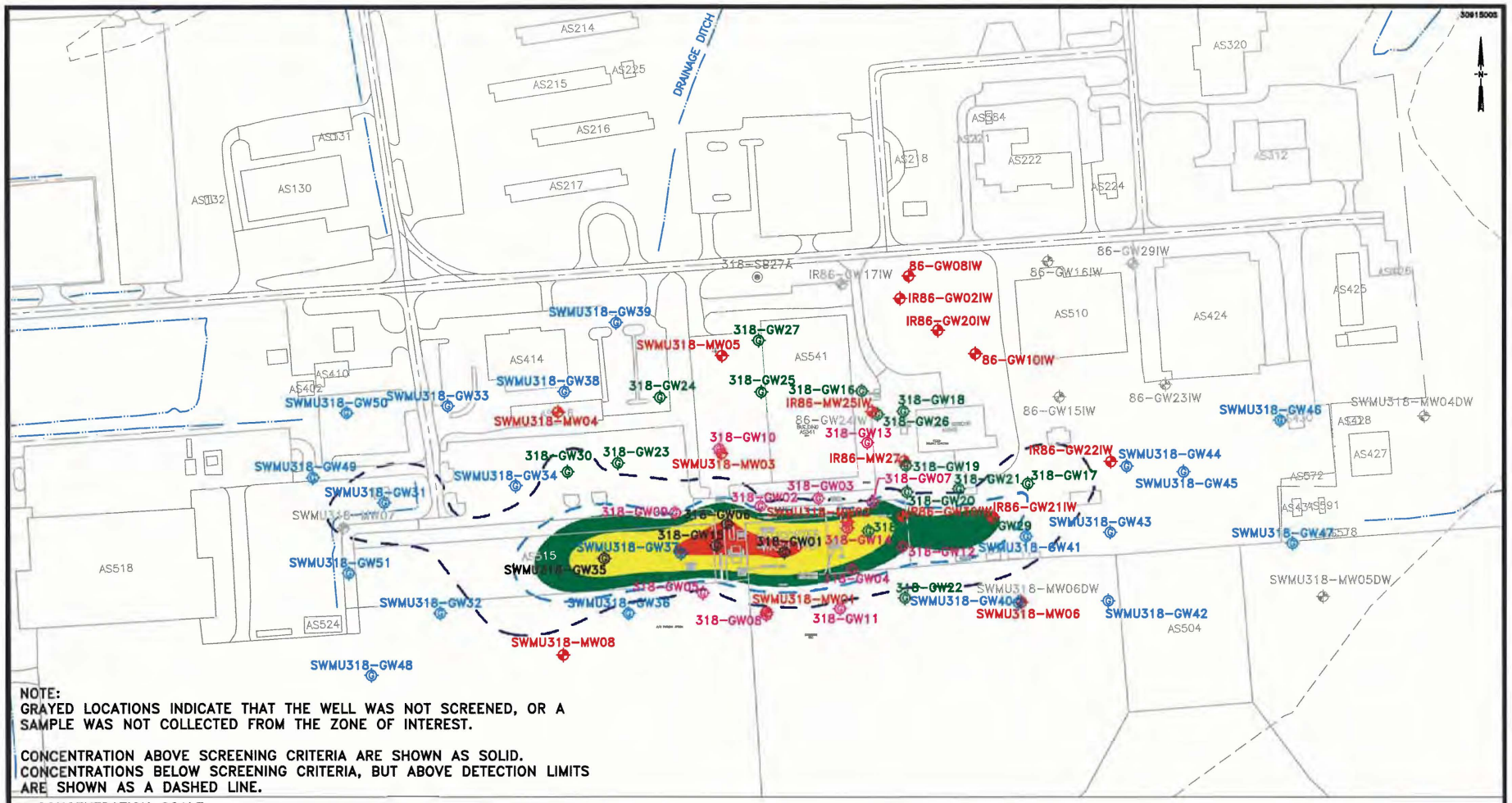


FIGURE 4-11
BENZENE CONCENTRATIONS IN INTERMEDIATE GROUNDWATER (25'-34')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO – 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE:
GRAYED LOCATIONS INDICATE THAT THE WELL WAS NOT SCREENED, OR A SAMPLE WAS NOT COLLECTED FROM THE ZONE OF INTEREST.

CONCENTRATION ABOVE SCREENING CRITERIA ARE SHOWN AS SOLID. CONCENTRATIONS BELOW SCREENING CRITERIA, BUT ABOVE DETECTION LIMITS ARE SHOWN AS A DASHED LINE.

CONCENTRATION SCALE

- 5,000 ppb
- 1,000 ppb
- 100 ppb
- 2L Standard (21 ppb)
- 10 ppb
- Detection Limit (2 ppb)

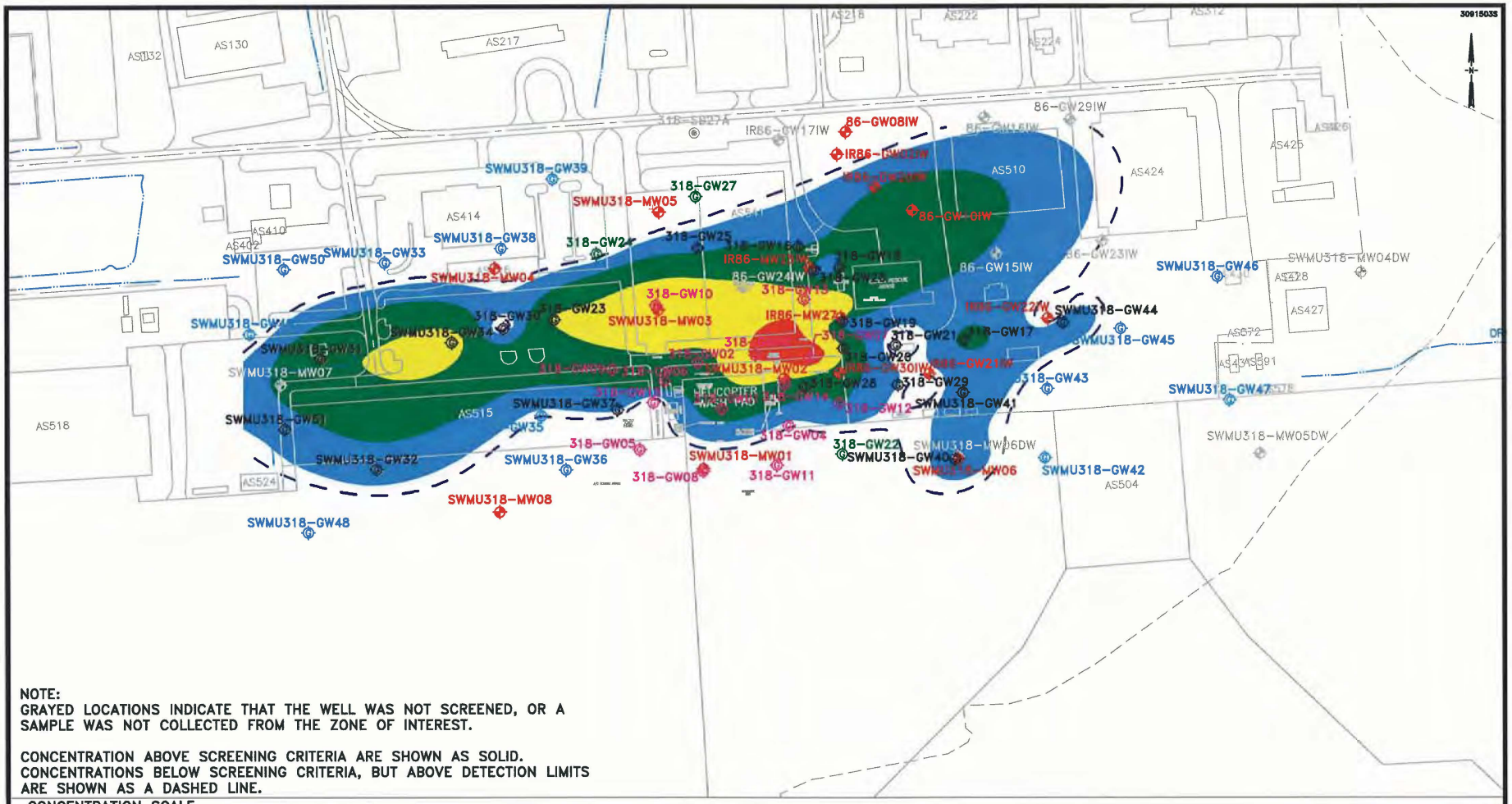
SOURCE: MCB, CAMP LEJEUNE, MARCH 2000.

LEGEND

- PHASE I RFI GROUNDWATER GRAB LOCATION
- PHASE II RFI GROUNDWATER GRAB LOCATION
- PHASE III RFI GROUNDWATER GRAB LOCATION
- MONITORING WELL LOCATION

Baker

FIGURE 4-12
NAPHTHALENE CONCENTRATIONS IN INTERMEDIATE GROUNDWATER (25'-34')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE:
GRAYED LOCATIONS INDICATE THAT THE WELL WAS NOT SCREENED, OR A SAMPLE WAS NOT COLLECTED FROM THE ZONE OF INTEREST.

CONCENTRATION ABOVE SCREENING CRITERIA ARE SHOWN AS SOLID. CONCENTRATIONS BELOW SCREENING CRITERIA, BUT ABOVE DETECTION LIMITS ARE SHOWN AS A DASHED LINE.

CONCENTRATION SCALE

- 5,000 ppb
- 1,000 ppb
- 100 ppb
- 10 ppb
- 2L Standard (2.8 ppb)
- Detection Limit (2 ppb)

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000.

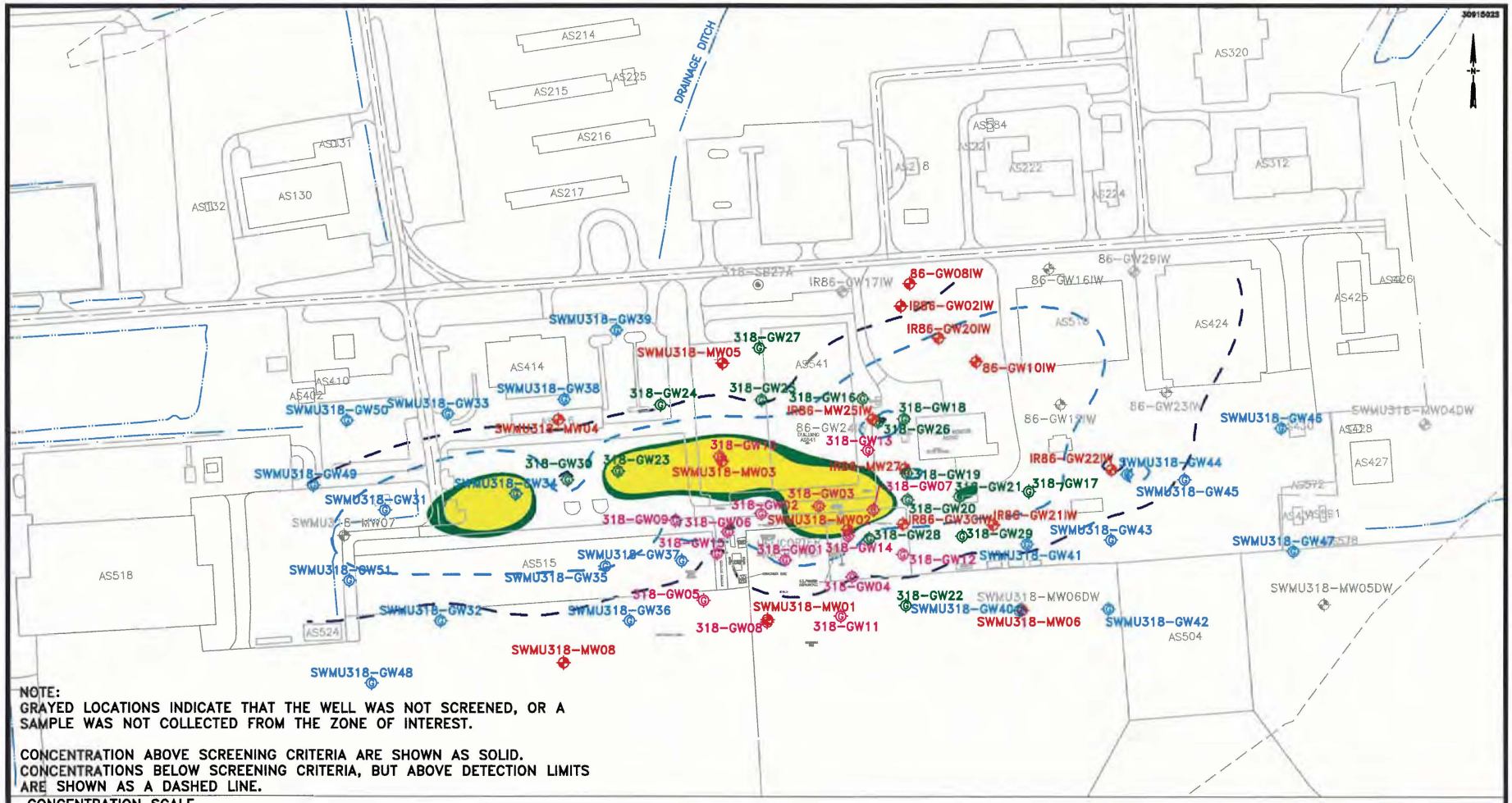
200 0 100 200
1 inch = 200 ft.

Baker

LEGEND

- PHASE I RFI GROUNDWATER GRAB LOCATION
- PHASE II RFI GROUNDWATER GRAB LOCATION
- PHASE III RFI GROUNDWATER GRAB LOCATION
- MONITORING WELL LOCATION

FIGURE 4-13
TCE CONCENTRATIONS IN INTERMEDIATE GROUNDWATER (25'-34')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE:
GRAYED LOCATIONS INDICATE THAT THE WELL WAS NOT SCREENED, OR A SAMPLE WAS NOT COLLECTED FROM THE ZONE OF INTEREST.

CONCENTRATION ABOVE SCREENING CRITERIA ARE SHOWN AS SOLID. CONCENTRATIONS BELOW SCREENING CRITERIA, BUT ABOVE DETECTION LIMITS ARE SHOWN AS A DASHED LINE.

CONCENTRATION SCALE

- 5,000 ppb
- 1,000 ppb
- 100 ppb
- 2L Standard (70 ppb)
- 10 ppb
- Detection Limit (2 ppb)

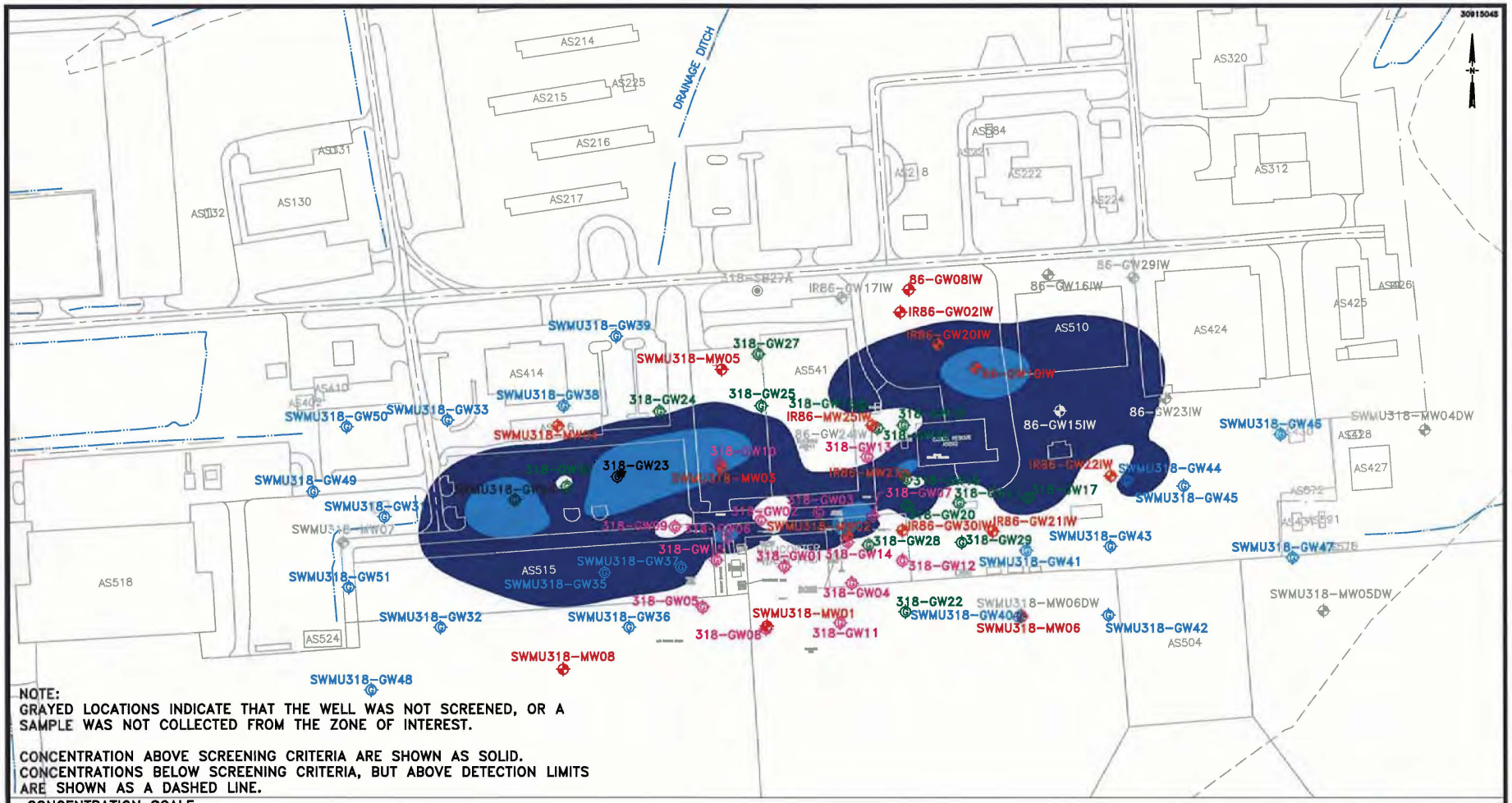
SOURCE: MCB, CAMP LEJEUNE, MARCH 2000.

LEGEND

- PHASE I RFI GROUNDWATER GRAB LOCATION
- PHASE II RFI GROUNDWATER GRAB LOCATION
- PHASE III RFI GROUNDWATER GRAB LOCATION
- MONITORING WELL LOCATION

Baker

FIGURE 4-14
CIS-1,2-DCE CONCENTRATIONS IN INTERMEDIATE GROUNDWATER (25'-34')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE:
GRAYED LOCATIONS INDICATE THAT THE WELL WAS NOT SCREENED, OR A SAMPLE WAS NOT COLLECTED FROM THE ZONE OF INTEREST.

CONCENTRATION ABOVE SCREENING CRITERIA ARE SHOWN AS SOLID.
CONCENTRATIONS BELOW SCREENING CRITERIA, BUT ABOVE DETECTION LIMITS ARE SHOWN AS A DASHED LINE.

CONCENTRATION SCALE

- 5,000 ppb
- 1,000 ppb
- 100 ppb
- 10 ppb
- Detection Limit (2 ppb)

200 0 100 200
1 inch = 200 ft.

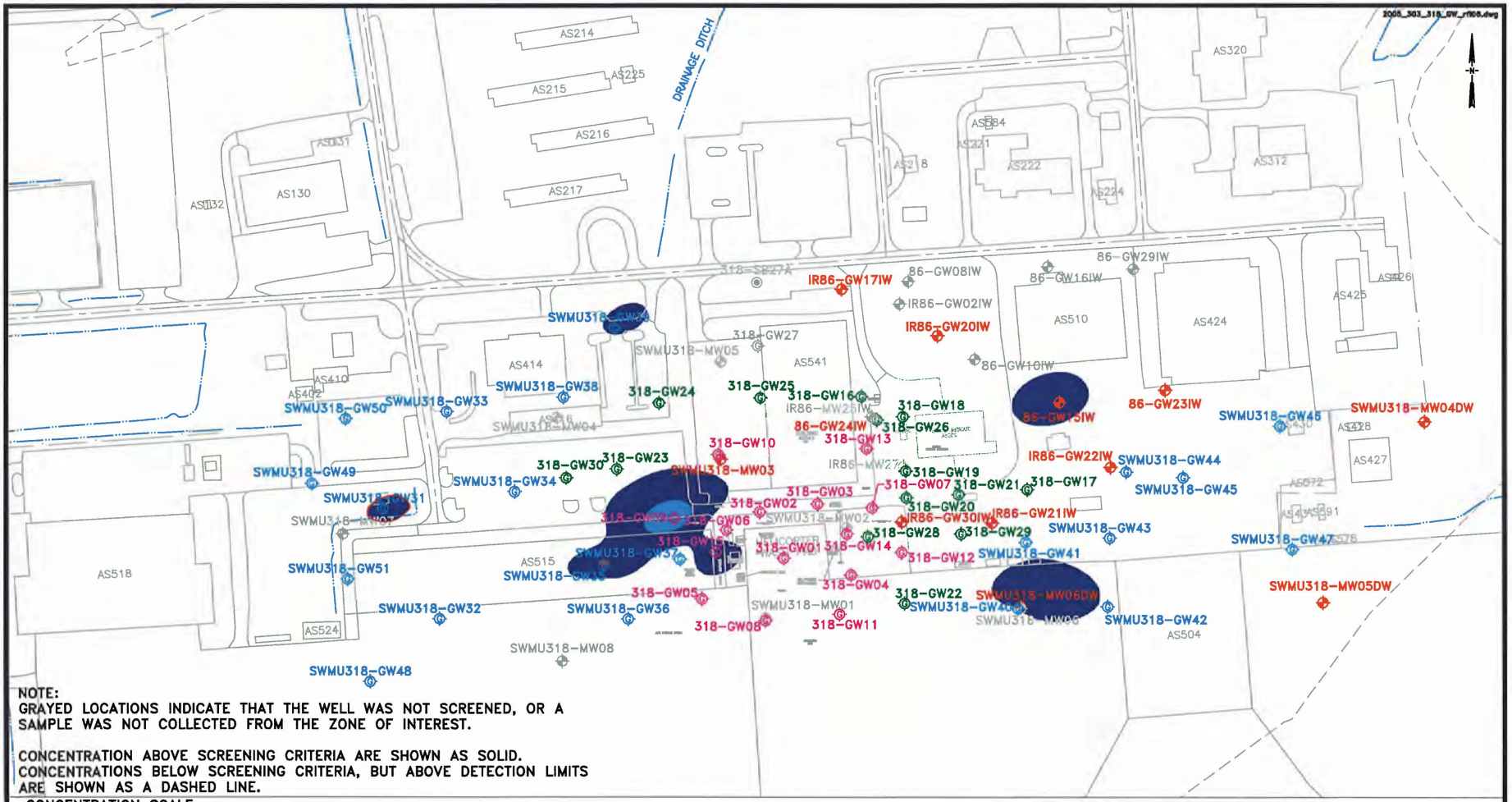
Baker

LEGEND

- PHASE I RFI GROUNDWATER GRAB LOCATION
- PHASE II RFI GROUNDWATER GRAB LOCATION
- PHASE III RFI GROUNDWATER GRAB LOCATION
- MONITORING WELL LOCATION

FIGURE 4-15
VINYL CHLORIDE CONCENTRATIONS IN INTERMEDIATE GROUNDWATER (25'-34')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000.



NOTE:
GRAYED LOCATIONS INDICATE THAT THE WELL WAS NOT SCREENED, OR A SAMPLE WAS NOT COLLECTED FROM THE ZONE OF INTEREST.

CONCENTRATION ABOVE SCREENING CRITERIA ARE SHOWN AS SOLID. CONCENTRATIONS BELOW SCREENING CRITERIA, BUT ABOVE DETECTION LIMITS ARE SHOWN AS A DASHED LINE.

CONCENTRATION SCALE

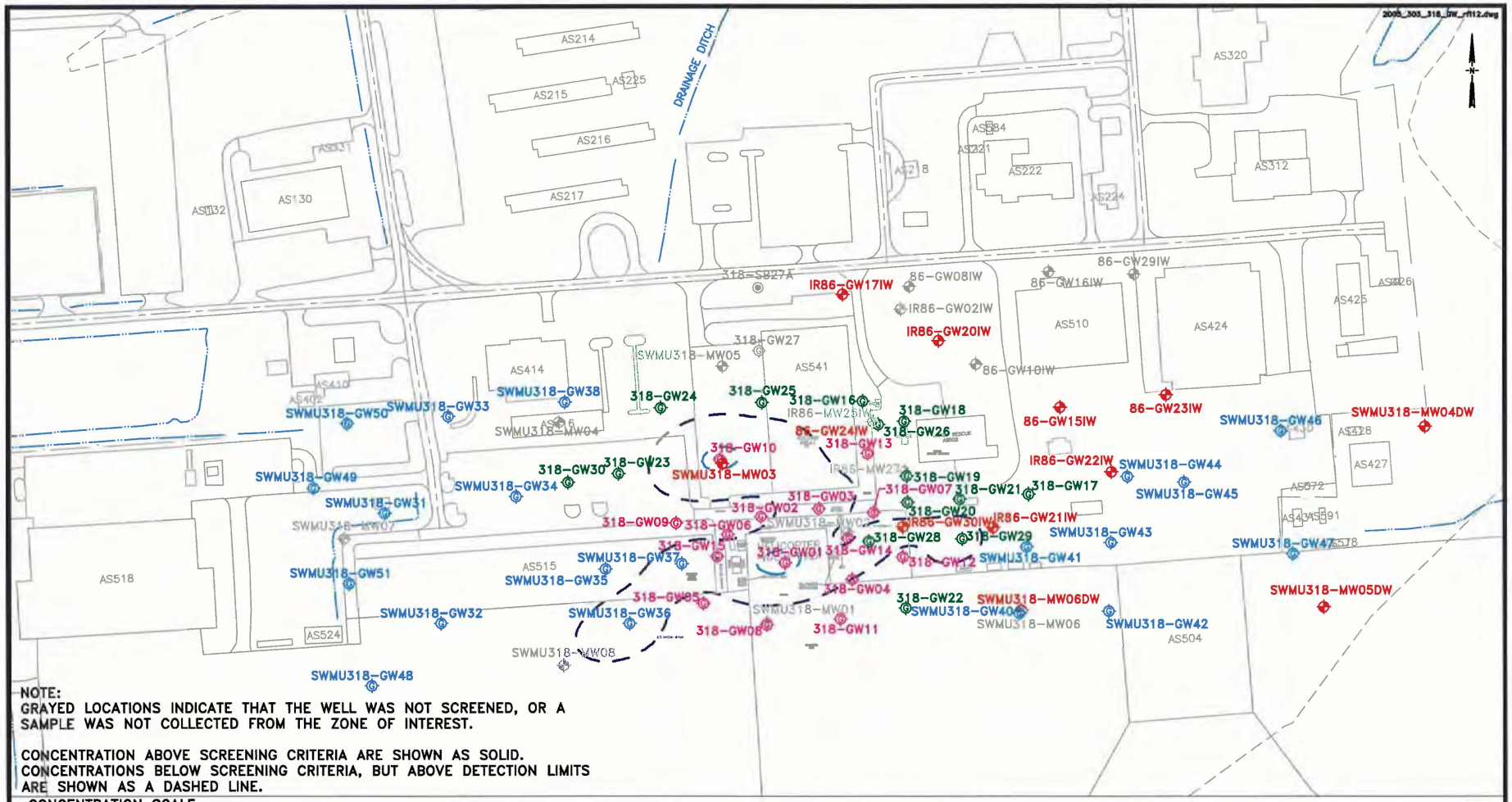
- 5,000 ppb
- 1,000 ppb
- 100 ppb
- 10 ppb
- Detection Limit (2ppb)

LEGEND

- PHASE I RFI GROUNDWATER GRAB LOCATION
- PHASE II RFI GROUNDWATER GRAB LOCATION
- PHASE III RFI GROUNDWATER GRAB LOCATION
- MONITORING WELL LOCATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 4-16
BENZENE CONCENTRATIONS IN DEEP GROUNDWATER (40'-44')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE:
GRAYED LOCATIONS INDICATE THAT THE WELL WAS NOT SCREENED, OR A SAMPLE WAS NOT COLLECTED FROM THE ZONE OF INTEREST.

CONCENTRATION ABOVE SCREENING CRITERIA ARE SHOWN AS SOLID. CONCENTRATIONS BELOW SCREENING CRITERIA, BUT ABOVE DETECTION LIMITS ARE SHOWN AS A DASHED LINE.

CONCENTRATION SCALE

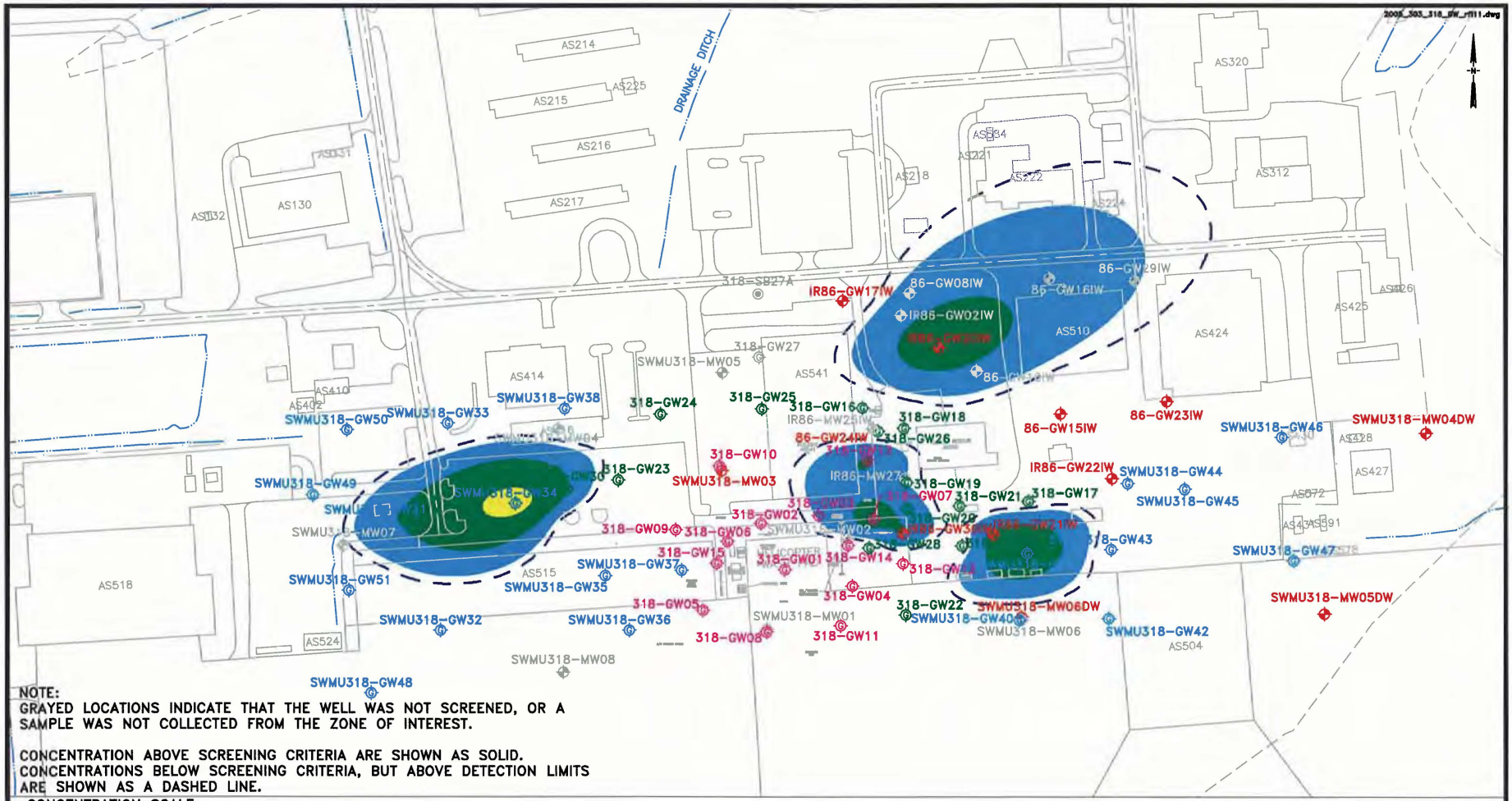
- 5,000 ppb
- 1,000 ppb
- 100 ppb
- 2L Standard (21 ppb)
- 10 ppb
- Detection Limit (2ppb)

LEGEND

- PHASE I RFI GROUNDWATER GRAB LOCATION
- PHASE II RFI GROUNDWATER GRAB LOCATION
- PHASE III RFI GROUNDWATER GRAB LOCATION
- MONITORING WELL LOCATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 4-17
NAPHTHALENE CONCENTRATIONS IN DEEP GROUNDWATER (40-44')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE:
GRAYED LOCATIONS INDICATE THAT THE WELL WAS NOT SCREENED, OR A SAMPLE WAS NOT COLLECTED FROM THE ZONE OF INTEREST.

CONCENTRATION ABOVE SCREENING CRITERIA ARE SHOWN AS SOLID. CONCENTRATIONS BELOW SCREENING CRITERIA, BUT ABOVE DETECTION LIMITS ARE SHOWN AS A DASHED LINE.

CONCENTRATION SCALE

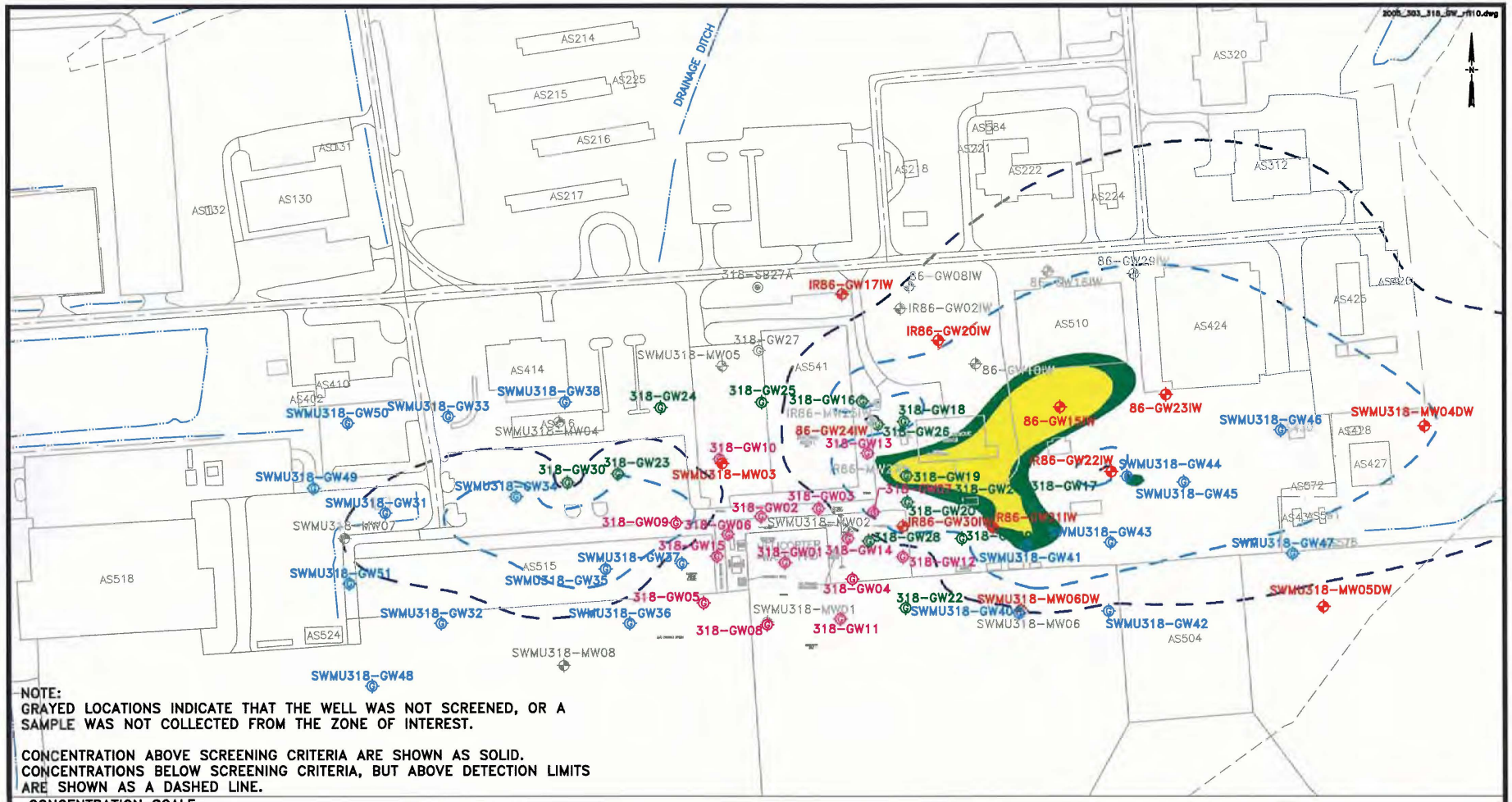
- 5,000 ppb
- 1,000 ppb
- 100 ppb
- 2L Standard (2.8ppb)
- Detection Limit (2ppb)

LEGEND

- PHASE I RFI GROUNDWATER GRAB LOCATION
- PHASE II RFI GROUNDWATER GRAB LOCATION
- PHASE III RFI GROUNDWATER GRAB LOCATION
- MONITORING WELL LOCATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 4-18
TCE CONCENTRATIONS IN DEEP GROUNDWATER (40-44')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE:
GRAYED LOCATIONS INDICATE THAT THE WELL WAS NOT SCREENED, OR A SAMPLE WAS NOT COLLECTED FROM THE ZONE OF INTEREST.

CONCENTRATION ABOVE SCREENING CRITERIA ARE SHOWN AS SOLID. CONCENTRATIONS BELOW SCREENING CRITERIA, BUT ABOVE DETECTION LIMITS ARE SHOWN AS A DASHED LINE.

CONCENTRATION SCALE

- 5,000 ppb
- 1,000 ppb
- 100 ppb
- 2L Standard (70 ppb)
- 10 ppb
- Detection Limit (2ppb)

200 0 100 200
1 inch = 200 ft.

Baker

LEGEND

- PHASE I RFI GROUNDWATER GRAB LOCATION
- PHASE II RFI GROUNDWATER GRAB LOCATION
- PHASE III RFI GROUNDWATER GRAB LOCATION
- MONITORING WELL LOCATION

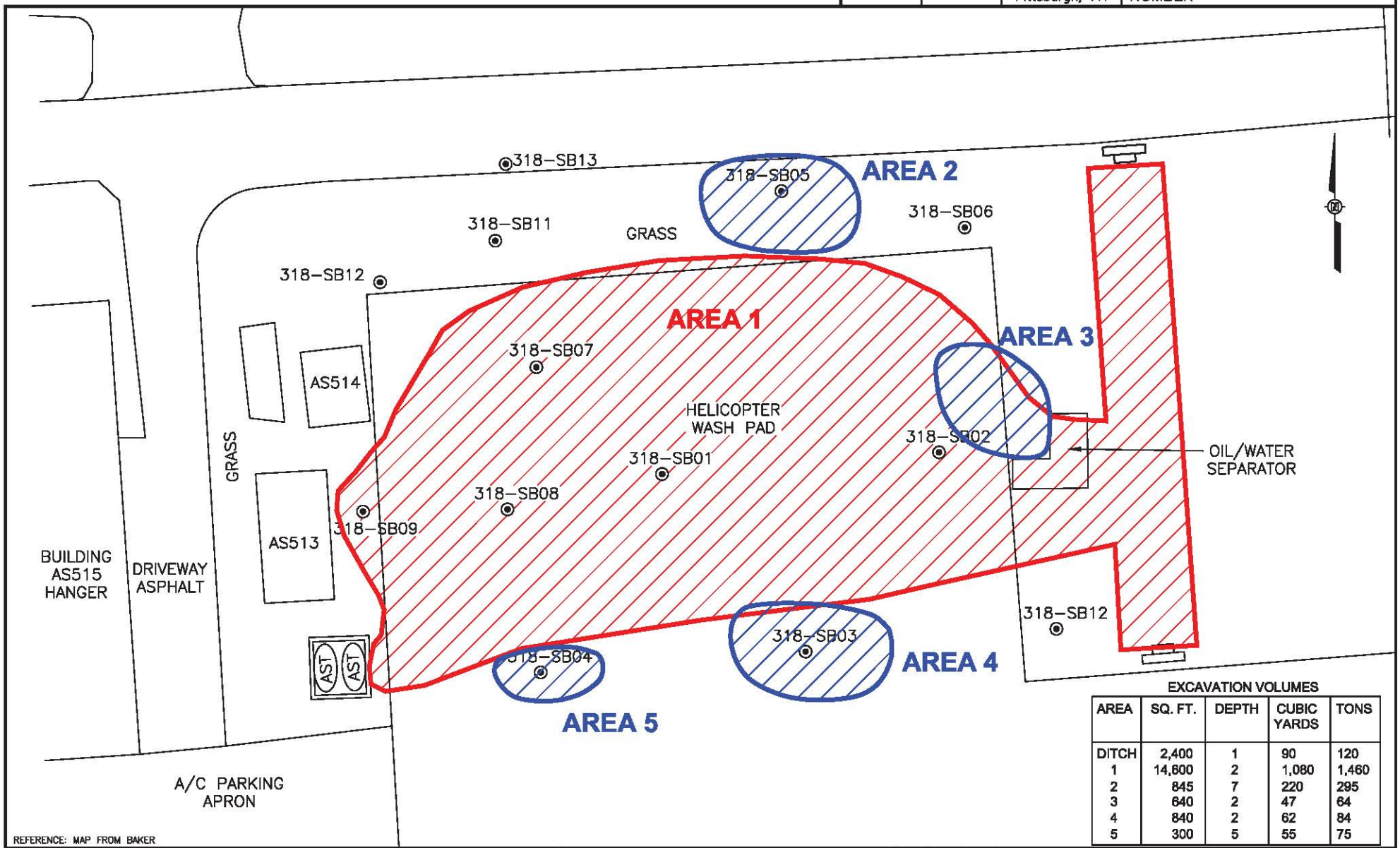
FIGURE 4-19
CIS-1,2-DCE CONCENTRATIONS IN DEEP GROUNDWATER (40-44')
SWMU 303/318
RCRA FACILITY INVESTIGATION
CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: MCB CAMP LEJEUNE MARCH 2000

Interim Measure Implementation Report (Shaw, 2006)

File: Y:\LEJEUNE-6-05\RAC_IV\TO_14-SWMUS\WORK_PLANS\846069-SWMU-303-318-1-7.dwg
Plot Date/Time: Dec 19, 2005 - 3:37pm Xref:
Plotted By: john.lange Image: lejeune1.tif

IMAGE	X-REF	OFFICE	DRAWING NUMBER	846069-FIG1
---	---	Pittsburgh, PA		



EXCAVATION VOLUMES

AREA	SQ. FT.	DEPTH	CUBIC YARDS	TONS
DITCH	2,400	1	90	120
1	14,600	2	1,080	1,460
2	845	7	220	295
3	640	2	47	64
4	840	2	62	84
5	300	5	55	75

REFERENCE: MAP FROM BAKER

SHEET I.D. 1.7
NAVFAC DRAWING NO. ?
CONSTR. CONTRACT NO. N62470-02-D-3250
DELIVERY ORDER NO. 0014
SCALE: AS SHOWN
SIZE: A

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

SWMU 303/318 SITE MAP

SITE PLAN

Shaw Environmental, Inc. PROJECT NO. 846069

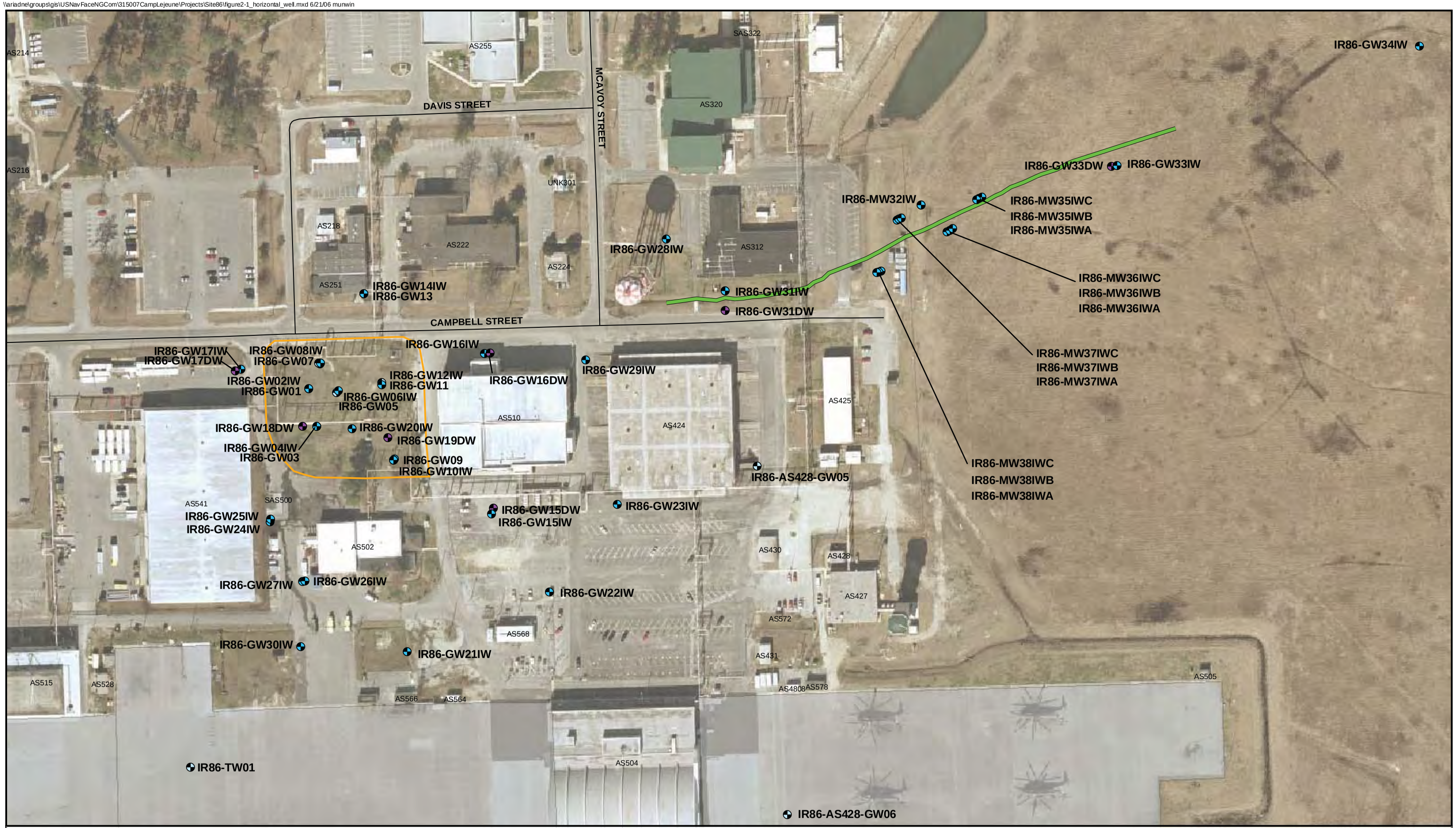
DESIGNED BY			CHECKED BY		
DRAWN BY			APPROVED BY		

REV	DATE	BY	CHK'D	APR'VD	DESCRIPTION/ISSUE

REVISIONS

Technology Evaluation (CH2M HILL, 2003) and Air/Ozone Sparging Pilot Study (CH2M HILL Hill, 2006b)

\\ariadne\groups\gis\USNavFaceNGCom\315007CampLejeune\Projects\Site86\figure2-1_horizontal_well.mxd 6/21/06 munwin



Legend

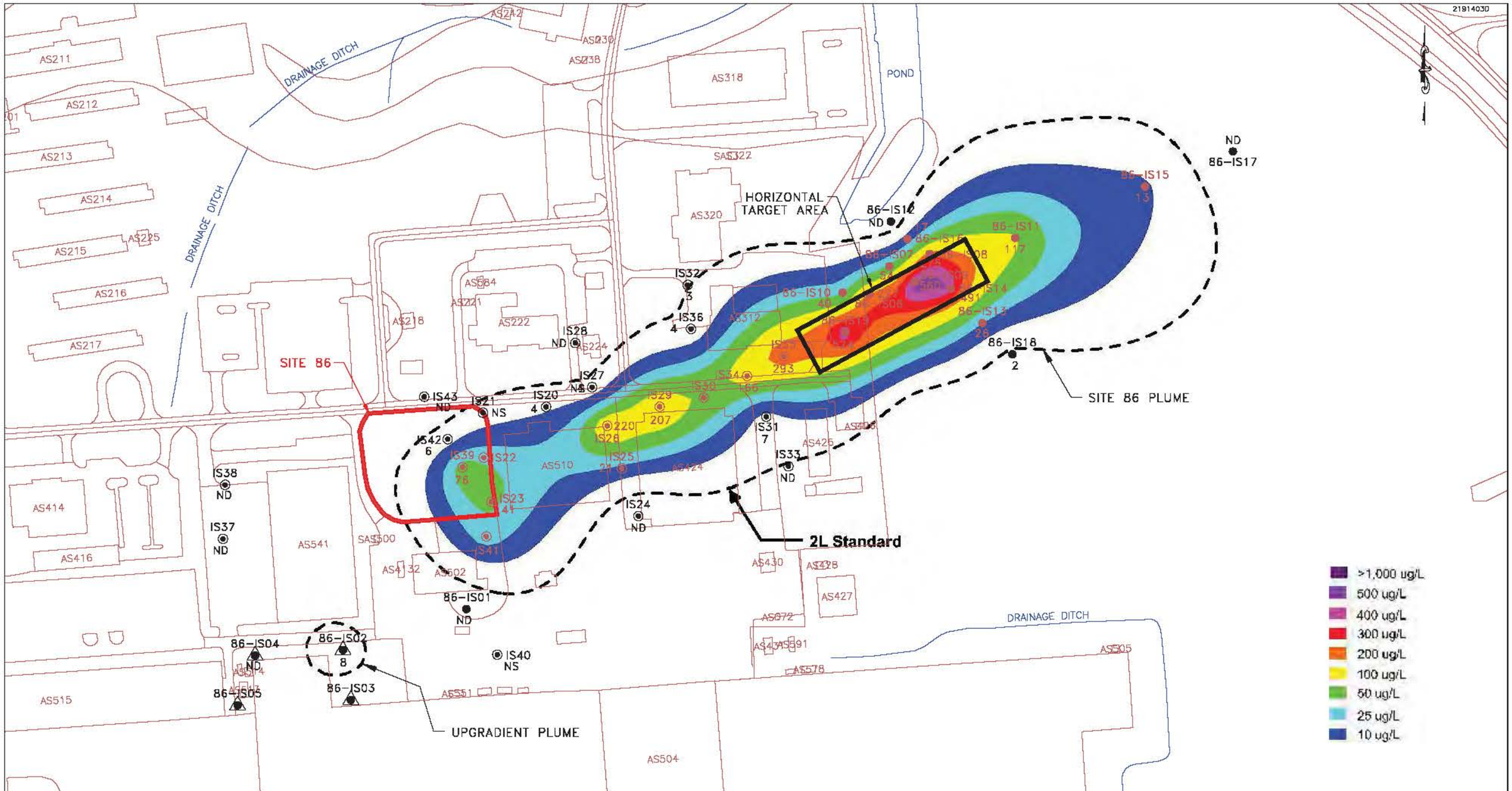
- Site 86 Boundary
- Shallow Monitoring Well
- Intermediate Monitoring Well
- Deep Monitoring Well
- Road
- Airfield Surface Area
- Surface Water
- Horizontal Well

N W E S

0 150 300 Feet

Figure 2-1
Horizontal Well Layout Map
Operable Unit No. 20 - Site 86
Pilot Study Report
MCB Camp Lejeune, North Carolina

AGVIQ AGVIQ ENVIRONMENTAL SERVICES CH2M HILL JOINT VENTURE



LEGEND

- ● – AUGUST 2001 GROUNDWATER SAMPLING LOCATION
- ▲ – SUBSURFACE SOIL AND GROUNDWATER SAMPLING LOCATION
- ◉ – JANUARY 2002 GROUNDWATER SAMPLING LOCATION
- ND – COMPOUND NOT DETECTED
- NS – INTERVAL NOT SAMPLED

200 0 100 200
1 inch = 200 ft.

FIGURE 3-1
HORIZONTAL WELL TARGET AREA
TCE PLUME (40 TO 44 FEET BGS)
OPERABLE UNIT No. 20 - SITE 86
TECHNOLOGY EVALUATION REPORT
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CH2MHILL

P:/PROJ/EBT/NAVY CLEAN/CTO 253/SITE 86/86 TECH EVALUATION /CADD FILES

SOURCE: Amended Remedial Investigation, Operable Unit No. 20, Site 86 – Tank Area AS419 – AS421, BAKER ENVIRONMENTAL, Inc. May, 2000.

CH2MHILL Passive Soil Gas

CH2MHILL Phase I SRI

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\SITE_86\ESRI\APPENDIX\FIGURE_E2-1_PASSIVESOILGASSURVEYRESULTS_TOTAL_CHLORINATED_SOLVENTS.MXD MRISSING 7/21/2010 12:02:38

Legend

- Passive Soil Gas Locations
- 1 - 10
- 10 - 100
- 100 - 1,000
- 1000 - 7,000
- > 7,000
- August 2006 Site 86 Boundary
- Original Site 86 Boundary

The following locations were eliminated in the field and are not shown on the figure: IR86-SG015, IR86-SG064, IR86-SG100, IR86-SG113, IR86-SG124, and IR86-SG139

N

0 110 220 Feet

Figure E2-1
Passive Soil Gas Survey Results- Total Chlorinated Solvents
Expanded Supplemental Remedial Investigation
Operable Unit 20 (Site 86)
MCB CamLej
North Carolina

CH2MHILL

Generated By: K. Howell/CLT Checked by: T. Grim/CLT

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\SITE_86\ESRI\APPENDIX\FIGURE_E2-2_PASSIVESOILGASSURVEYRESULTS_TOTAL_PETROLEUM_HYDROCARBONS.MXD MRISSING 7/21/2010 12:07:26

Legend

- Passive Soil Gas Survey Locations
- 100 - 1,000
- 1,000 - 10,000
- > 10,000
- August 2006 Site 86 Boundary
- Original Site 86 Boundary

The following locations were eliminated in the field and are not shown on the figure: IR86-SG015, IR86-SG064, IR86-SG100, IR86-SG113, IR86-SG124, and IR86-SG139

N

0 110 220 Feet

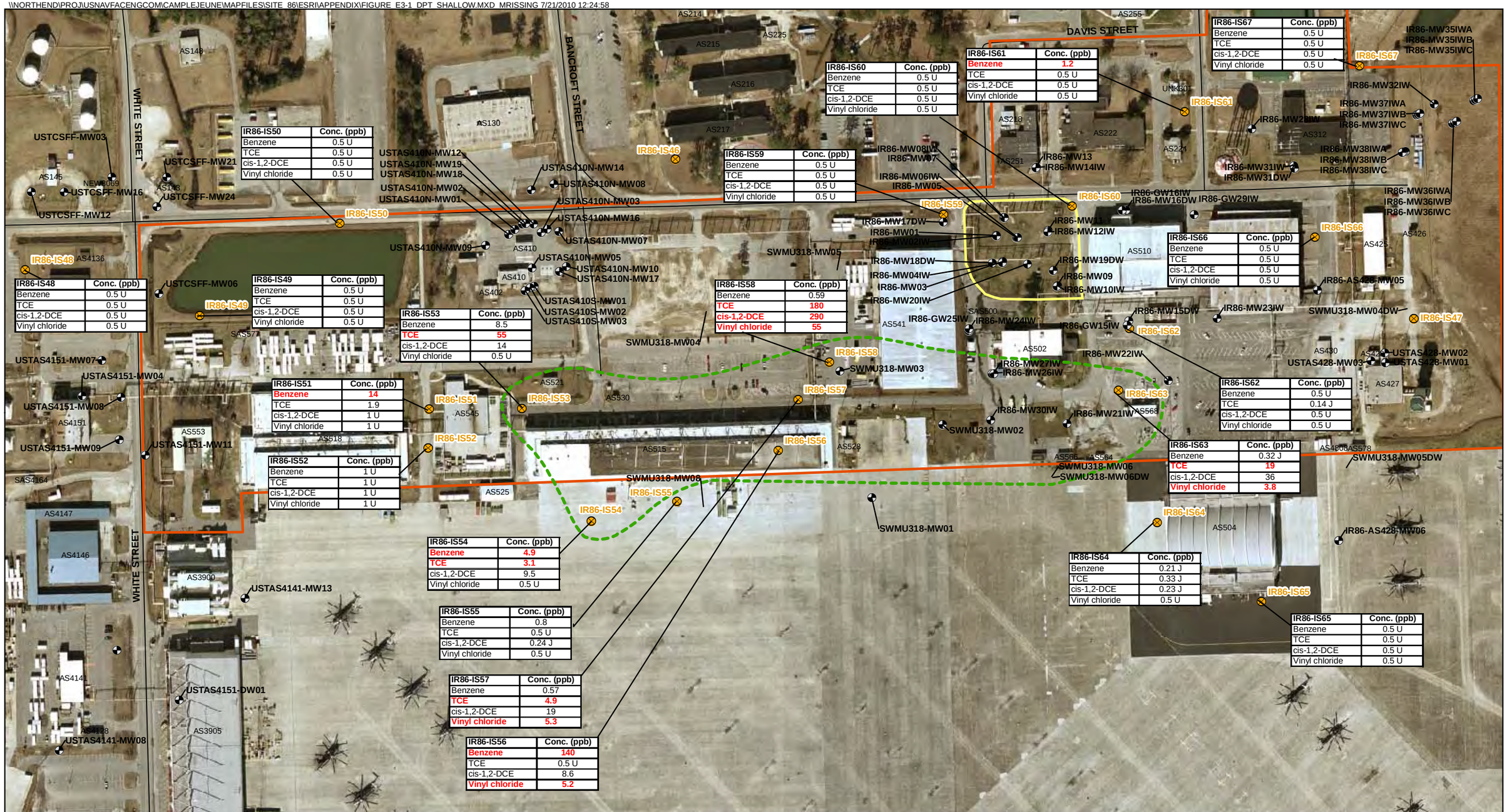
Figure E2-2
Passive Soil Gas Survey Results- Total Petroleum Hydrocarbons
Expanded Supplemental Remedial Investigation
Operable Unit 20 (Site 86)
MCB CamLej
North Carolina

CH2MHILL

Generated By: K. Howell/CLT Checked by: T. Grim/CLT

CH2MHILL Phase I SRI

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\SITE_86\ESRI\APPENDIX\FIGURE_E3-1_DPT_SHALLOW.MXD MRISSING 7/21/2010 12:24:58



IR86-IS67	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS61	Conc. (ppb)
Benzene	**1.2**
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS60	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS50	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS59	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS66	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS48	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS49	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS58	Conc. (ppb)
Benzene	0.59
TCE	**180**
cis-1,2-DCE	**290**
Vinyl chloride	**55**

IR86-IS53	Conc. (ppb)
Benzene	8.5
TCE	**55**
cis-1,2-DCE	14
Vinyl chloride	0.5 U

IR86-IS62	Conc. (ppb)
Benzene	0.5 U
TCE	0.14 J
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS51	Conc. (ppb)
Benzene	**14**
TCE	1.9
cis-1,2-DCE	1 U
Vinyl chloride	1 U

IR86-IS63	Conc. (ppb)
Benzene	0.32 J
TCE	**19**
cis-1,2-DCE	36
Vinyl chloride	**3.8**

IR86-IS52	Conc. (ppb)
Benzene	1 U
TCE	1 U
cis-1,2-DCE	1 U
Vinyl chloride	1 U

IR86-IS54	Conc. (ppb)
Benzene	**4.9**
TCE	**3.1**
cis-1,2-DCE	9.5
Vinyl chloride	0.5 U

IR86-IS64	Conc. (ppb)
Benzene	0.21 J
TCE	0.33 J
cis-1,2-DCE	0.23 J
Vinyl chloride	0.5 U

IR86-IS55	Conc. (ppb)
Benzene	0.8
TCE	0.5 U
cis-1,2-DCE	0.24 J
Vinyl chloride	0.5 U

IR86-IS65	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS57	Conc. (ppb)
Benzene	0.57
TCE	**4.9**
cis-1,2-DCE	19
Vinyl chloride	**5.3**

IR86-IS56	Conc. (ppb)
Benzene	**140**
TCE	0.5 U
cis-1,2-DCE	8.6
Vinyl chloride	**5.2**

Legend

- Monitoring Wells
- DPT Locations
- Estimate of 2L Exceedance for any Chlorinated VOC - Shallow
- August 2006 Site 86 Boundary
- Original Site 86 Boundary

Note:
TCE - Trichloroethene
DCE - Dichloroethene
ppb - parts per billion
U - Analyte not detected
J - Estimated value
Concentrations in **red bold** text exceed the NCGWQS for the respective analyte

N

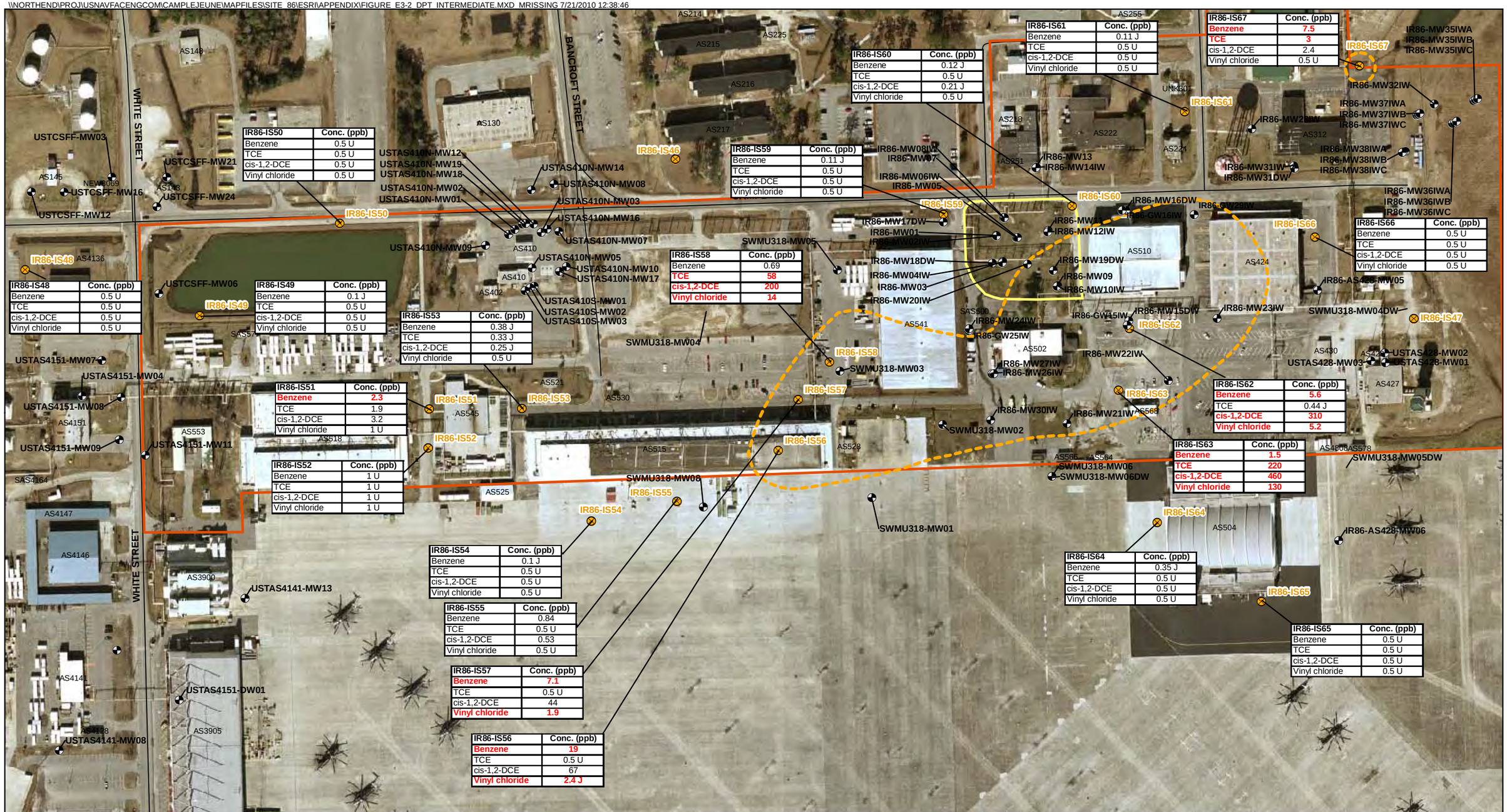
0 110 220 440 Feet

Figure E3-1
DPT Results - Shallow Interval (22-27 feet bgs)
Expanded Supplemental Remedial Investigation
Operable Unit 20 (Site 86)
MCB CamLej
North Carolina

CH2MHILL

Generated By: K. Howell/CLT Checked by: T. Grim/CLT

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\SITE_86\ESRI\APPENDIX\FIGURE_E3-2_DPT_INTERMEDIATE.MXD MRISSING 7/21/2010 12:38:46



IR86-IS50	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS48	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS49	Conc. (ppb)
Benzene	0.1 J
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS53	Conc. (ppb)
Benzene	0.38 J
TCE	0.33 J
cis-1,2-DCE	0.25 J
Vinyl chloride	0.5 U

IR86-IS51	Conc. (ppb)
Benzene	**2.3**
TCE	1.9
cis-1,2-DCE	3.2
Vinyl chloride	1 U

IR86-IS52	Conc. (ppb)
Benzene	1 U
TCE	1 U
cis-1,2-DCE	1 U
Vinyl chloride	1 U

IR86-IS54	Conc. (ppb)
Benzene	0.1 J
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS55	Conc. (ppb)
Benzene	0.84
TCE	0.5 U
cis-1,2-DCE	0.53
Vinyl chloride	0.5 U

IR86-IS57	Conc. (ppb)
Benzene	**7.1**
TCE	0.5 U
cis-1,2-DCE	44
Vinyl chloride	**1.9**

IR86-IS56	Conc. (ppb)
Benzene	**19**
TCE	0.5 U
cis-1,2-DCE	67
Vinyl chloride	**2.4 J**

IR86-IS58	Conc. (ppb)
Benzene	0.69
TCE	**58**
cis-1,2-DCE	**200**
Vinyl chloride	**14**

IR86-IS59	Conc. (ppb)
Benzene	0.11 J
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS60	Conc. (ppb)
Benzene	0.12 J
TCE	0.5 U
cis-1,2-DCE	0.21 J
Vinyl chloride	0.5 U

IR86-IS61	Conc. (ppb)
Benzene	0.11 J
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS67	Conc. (ppb)
Benzene	**7.5**
TCE	**3**
cis-1,2-DCE	2.4
Vinyl chloride	0.5 U

IR86-IS66	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS62	Conc. (ppb)
Benzene	**5.6**
TCE	0.44 J
cis-1,2-DCE	**310**
Vinyl chloride	**5.2**

IR86-IS63	Conc. (ppb)
Benzene	**1.5**
TCE	**220**
cis-1,2-DCE	**460**
Vinyl chloride	**130**

IR86-IS64	Conc. (ppb)
Benzene	0.35 J
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS65	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

Legend

- Monitoring Wells
- DPT Locations
- Estimate of 2L Exceedance for any Chlorinated VOC - Intermediate
- August 2006 Site 86 Boundary
- Original Site 86 Boundary

Note:
TCE - Trichloroethene
DCE - Dichloroethene
ppb - parts per billion
U - Analyte not detected
J - Estimated value
Concentrations in **red bold** text exceed the NCGWQS for the respective analyte

N

0 110 220 440 Feet

Figure E3-2
DPT Results - Intermediate Interval (47-53 feet bgs)
Expanded Supplemental Remedial Investigation
Operable Unit 20 (Site 86)
MCB CamLej
North Carolina

CH2MHILL

Generated By: K. Howell/CLT Checked by: T. Grim/CLT

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\SITE_86\ESRI\APPENDIX\FIGURE_E3-3_DPT_DEEP.MXD MRISSING 7/21/2010 12:47:36

IR86-IS48	Conc. (ppb)
Benzene	0.11 J
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS49	Conc. (ppb)
Benzene	0.14 J
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS50	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS51	Conc. (ppb)
Benzene	1 U
TCE	1 U
cis-1,2-DCE	1 U
Vinyl chloride	1 U

IR86-IS52	Conc. (ppb)
Benzene	1 U
TCE	1 U
cis-1,2-DCE	1 U
Vinyl chloride	1 U

IR86-IS53	Conc. (ppb)
Benzene	0.21 J
TCE	0.17 J
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS54	Conc. (ppb)
Benzene	0.19 J
TCE	0.18 J
cis-1,2-DCE	0.2 J
Vinyl chloride	0.5 U

IR86-IS55	Conc. (ppb)
Benzene	0.26 J
TCE	0.21 J
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS56	Conc. (ppb)
Benzene	0.23 J
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS57	Conc. (ppb)
Benzene	0.24 J
TCE	0.27 J
cis-1,2-DCE	0.68
Vinyl chloride	0.5 U

IR86-IS58	Conc. (ppb)
Benzene	0.32 J
TCE	1.5
cis-1,2-DCE	16
Vinyl chloride	**1.8**

IR86-IS59	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS60	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS61	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS62	Conc. (ppb)
Benzene	0.89
TCE	0.5 U
cis-1,2-DCE	57
Vinyl chloride	**0.87**

IR86-IS63	Conc. (ppb)
Benzene	**1.3 J**
TCE	1 J
cis-1,2-DCE	46
Vinyl chloride	**72**

IR86-IS64	Conc. (ppb)
Benzene	0.12 J
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS65	Conc. (ppb)
Benzene	0.5 U
TCE	0.5 U
cis-1,2-DCE	0.5 U
Vinyl chloride	0.5 U

IR86-IS66	Conc. (ppb)
Benzene	0.21 J
TCE	0.5 U
cis-1,2-DCE	3
Vinyl chloride	0.5 U

IR86-IS67	Conc. (ppb)
Benzene	0.37 J
TCE	0.5 U
cis-1,2-DCE	0.48 J
Vinyl chloride	0.5 U

Legend

- Monitoring Wells
- DPT Locations
- Estimate of 2L Exceedance for any Chlorinated VOC - Deep
- August 2006 Site 86 Boundary
- Original Site 86 Boundary

Note:
TCE - Trichloroethene
DCE - Dichloroethene
ppb - parts per billion
U - Analyte not detected
J - Estimated value
Concentrations in **red bold** text exceed the NCGWQS for the respective analyte

N

0 110 220 440 Feet

Figure E3-3
DPT Results - Intermediate Interval (55-60 feet bgs)
Expanded Supplemental Remedial Investigation
Operable Unit 20 (Site 86)
MCB CamLej
North Carolina

CH2MHILL

Generated By: K. Howell/CLT Checked by: T. Grim/CLT

TABLE E3
Supplemental Remedial Investigation Phase I (2007) Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 2(
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NC2LGW (January 2010)*	Adjusted Tap Water RSLs	IR86-IS48				IR86-IS49			IR86-IS50		
Sample ID				IR86-GW-IS48-22-27-07B	IR86-GW-IS48-47-53-07B	IR86-GW-IS48D-47-53-07B	IR86-GW-IS48-55-60-07B	IR86-GW-IS49-22-27-07B	IR86-GW-IS49-47-53-07B	IR86-GW-IS49-55-60-07B	IR86-GW-IS50-22-27-07B	IR86-GW-IS50-47-53-07B	IR86-GW-IS50-55-60-07B
Sample Date				06/28/07	06/28/07	06/28/07	06/28/07	06/28/07	06/28/07	06/28/07	06/27/07	06/27/07	06/27/07
Chemical Name													
Volatile Organic Compounds (µg/L)													
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	200,000	5,900	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	--	6	2.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	--	7	34	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	--	20	37	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	--	4,000	710	2.5 U	2.5 U	2.5 U	1.8 J	2.5 U	2.5 U	2.6	1.6 J	2.5 U	2.5 U
2-Hexanone	--	--	4.7	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-Methyl-2-pentanone	--	--	200	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
Benzene	--	1	0.41	0.5 U	0.5 U	0.11 J	0.11 J	0.5 U	0.1 J	0.14 J	0.5 U	0.5 U	0.5 U
Carbon disulfide	--	700	100	0.31 J	0.14 J	0.23 J	0.5 U	0.14 J	0.13 J	0.17 J	0.52	0.23 J	0.58
Chlorobenzene	--	50	9.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	--	3	19	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	--	70	37	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane	--	--	1,300	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	--	1,000	40	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	--	600	1.5	0.5 U	0.2 J	0.27 J	0.25 J	0.5 U	0.64	0.29 J	0.5 U	0.13 J	0.31 J
Isopropylbenzene	--	70	68	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene chloride	--	5	4.8	0.26 J	0.24 J	0.25 J	0.32 J	0.27 J	0.23 J	0.25 J	0.13 J	0.5 U	0.5 U
Methyl-tert-butyl ether (MTBE)	--	20	13	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
m-Xylene	--	500	120	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	--	500	120	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	--	70	160	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	--	0.7	0.11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	--	600	230	0.5	0.34 J	0.55	0.37 J	0.43 J	0.62	0.44 J	0.47 J	0.34 J	0.45 J
trans-1,2-Dichloroethene	--	100	11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	--	3	2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	--	0.03	0.016	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Xylene, total	--	500	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Total Metals (µg/L)													
Iron	5,999	300	2,600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	214	50	88	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry													
Alkalinity (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethane (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethene (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ferric iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ferrous iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methane (ug/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/L)	--	10	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfide (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Shading indicates exceedance of two times the mean base background concentration for Groundwater
Bold box indicates exceedance of NCGWQS or the more conservative MCL
Bold text indicates exceedance of Adjusted Tap Water RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more conservative.

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
mg/L - Milligrams per liter
NA - Not analyzed
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: *K.Ramsey/CLT*

TABLE E3
Supplemental Remedial Investigation Phase I (2007) Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 2(
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NC2LGW (January 2010)*	Adjusted Tap Water RSLs	IR86-IS53			IR86-IS54			IR86-IS55		
Sample ID				IR86-GW-IS53-20-24-07B	IR86-GW-IS53-47-53-07B	IR86-GW-IS53-55-60-07B	IR86-GW-IS54-22-27-07B	IR86-GW-IS54-47-53-07B	IR86-GW-IS54-55-60-07B	IR86-GW-IS55-22-27-07B	IR86-GW-IS55-47-53-07B	IR86-GW-IS55-55-60-07B
Sample Date				06/12/07	06/12/07	06/12/07	06/12/07	06/12/07	06/13/07	06/11/07	06/11/07	06/11/07
Chemical Name												
Volatile Organic Compounds (µg/L)												
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	200,000	5,900	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.25 J	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	--	6	2.4	0.99	0.5 U	0.5 U	0.9	0.5 U	0.5 U	0.5 U	0.5 U	0.17 J
1,1-Dichloroethene	--	7	34	1.6	0.5 U	0.5 U	1.6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	--	20	37	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	--	4,000	710	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	--	--	4.7	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-Methyl-2-pentanone	--	--	200	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
Benzene	--	1	0.41	8.5	0.38 J	0.21 J	4.9	0.1 J	0.19 J	0.8	0.84	0.26 J
Carbon disulfide	--	700	100	0.1 J	0.5 U	0.5 U	0.5 U	0.15 J	0.16 J	0.15 J	0.5 U	0.5 U
Chlorobenzene	--	50	9.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	--	3	19	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.1	0.5 U	0.5 U
cis-1,2-Dichloroethene	--	70	37	14	0.25 J	0.5 U	9.5	0.5 U	0.2 J	0.24 J	0.53	0.5 U
Cyclohexane	--	--	1,300	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	--	1,000	40	0.12 JB	0.11 JB	0.14 JB	0.13 JB	0.14 JB	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	--	600	1.5	0.17 J	0.34 J	0.15 J	0.5 U	0.89	0.43 J	0.5 U	0.5 U	0.22 J
Isopropylbenzene	--	70	68	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene chloride	--	5	4.8	0.32 JB	0.4 JB	0.38 JB	0.36 JB	0.45 JB	0.37 JB	0.4 JB	0.41 JB	0.59 B
Methyl-tert-butyl ether (MTBE)	--	20	13	0.95	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.11 J	0.5 U	0.5 U
m-Xylene	--	500	120	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	--	500	120	0.21 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	--	70	160	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	--	0.7	0.11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	--	600	230	0.26 J	0.26 J	0.14 J	0.17 J	0.42 J	0.29 J	0.1 J	0.5 U	0.12 J
trans-1,2-Dichloroethene	--	100	11	0.14 J	0.5 U	0.5 U	0.15 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	--	3	2	55	0.33 J	0.17 J	3.1	0.5 U	0.18 J	0.5 U	0.5 U	0.21 J
Vinyl chloride	--	0.03	0.016	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Xylene, total	--	500	20	0.21 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Total Metals (µg/L)												
Iron	5,999	300	2,600	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	214	50	88	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry												
Alkalinity (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethane (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethene (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ferric iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ferrous iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methane (ug/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/L)	--	10	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfide (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Shading indicates exceedance of two times the mean base background concentration for Groundwater
Bold box indicates exceedance of NCGWQS or the more conservative MCL
Bold text indicates exceedance of Adjusted Tap Water RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more cons

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
mg/L - Milligrams per liter
NA - Not analyzed
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: *K.Ramsey/CLT*

TABLE E3
Supplemental Remedial Investigation Phase I (2007) Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 2(
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NC2LGW (January 2010)*	Adjusted Tap Water RSLs	IR86-IS56			IR86-IS57			IR86-IS58		
Sample ID				IR86-GW-IS56-22-27-07B	IR86-GW-IS56-47-53-07B	IR86-GW-IS56-55-60-07B	IR86-GW-IS57-22-27-07B	IR86-GW-IS57-47-53-07B	IR86-GW-IS57-55-60-07B	IR86-GW-IS58-22-27-07B	IR86-GW-IS58-47-53-07B	IR86-GW-IS58-55-60-07B
Sample Date				06/29/07	06/29/07	06/29/07	06/29/07	06/29/07	06/29/07	06/27/07	06/27/07	06/27/07
Chemical Name												
Volatile Organic Compounds (µg/L)												
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	200,000	5,900	1.7 J	2.5 U	0.5 U	42	7.4	0.5 U	310	0.5 U	0.3 J
1,1-Dichloroethane	--	6	2.4	3.1 J	2.5 U	0.5 U	3	0.5 U	0.5 U	0.27 J	0.5 U	0.5 U
1,1-Dichloroethene	--	7	34	5 U	2.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3	1.6	0.5 U
1,2-Dichlorobenzene	--	20	37	5 U	2.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	--	4,000	710	25 U	13 U	3.7	1.1 J	0.86 J	3	2.5 U	1.6 J	3.1
2-Hexanone	--	--	4.7	25 U	13 U	2.5 U	2.5 U	2.5 U	1.2 J	2.5 U	2.5 U	2.5 U
4-Methyl-2-pentanone	--	--	200	25 U	13 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Benzene	--	1	0.41	140	19	0.23 J	0.57	7.1	0.24 J	0.59	0.69	0.32 J
Carbon disulfide	--	700	100	1.6 J	2.5 U	0.5 U	0.5 U	0.12 J	0.5 U	1	0.29 J	0.27 J
Chlorobenzene	--	50	9.1	5 U	2.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	--	3	19	5 U	2.5 U	1.2	0.5 U	0.5 U	0.89	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	--	70	37	8.6	67	0.5 U	19	44	0.68	290	200	16
Cyclohexane	--	--	1,300	5 U	2.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	--	1,000	40	5 U	2.5 U	0.5 U	1.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	--	600	1.5	86	0.66 J	0.31 J	1.1	1.4	0.32 J	1.5	0.5	0.34 J
Isopropylbenzene	--	70	68	3.6 J	2.5 U	0.5 U	0.31 J	0.5 U	0.5 U	0.11 J	0.5 U	0.5 U
Methylene chloride	--	5	4.8	2.2 J	0.7 J	0.26 J	0.15 J	0.23 J	0.5 U	0.14 J	0.5 U	0.15 J
Methyl-tert-butyl ether (MTBE)	--	20	13	5 U	2.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
m-Xylene	--	500	120	150	5 U	0.37 J	0.63 J	0.79 J	0.32 J	3.3	1 U	0.35 J
o-Xylene	--	500	120	96	2.5 U	0.2 J	1.2	0.43 J	0.17 J	2.1	0.5 U	0.1 J
Styrene	--	70	160	2.2 J	2.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	--	0.7	0.11	5 U	2.5 U	0.5 U	0.74	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	--	600	230	200	0.95 J	0.71	2.3 B	0.5	0.5	15	0.55	0.65
trans-1,2-Dichloroethene	--	100	11	5 U	2.5 U	0.5 U	0.21 J	0.5 U	0.5 U	0.23 J	0.18 J	0.5 U
Trichloroethene	--	3	2	5 U	2.5 U	0.5 U	4.9	0.5 U	0.27 JB	180	58	1.5
Vinyl chloride	--	0.03	0.016	5.2	2.4 J	0.5 U	5.3	1.9	0.5 U	55	14	1.8
Xylene, total	--	500	20	250	2.5 U	0.58	1.9	1.3	0.51	5.6	0.5 U	0.47 J
Total Metals (µg/L)												
Iron	5,999	300	2,600	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	214	50	88	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry												
Alkalinity (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethane (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethene (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ferric iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ferrous iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methane (ug/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/L)	--	10	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfide (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Shading indicates exceedance of two times the mean base background concentration for Groundwater
Bold box indicates exceedance of NCGWQS or the more conservative MCL
Bold text indicates exceedance of Adjusted Tap Water RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more cons
µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
mg/L - Milligrams per liter
NA - Not analyzed
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
Generated By: K.Ramsey/CLT

TABLE E3
Supplemental Remedial Investigation Phase I (2007) Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 2(
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NC2LGW (January 2010)*	Adjusted Tap Water RSLs	IR86-IS59				IR86-IS60			IR86-IS61		
Sample ID				IR86-GW-IS59-22-27-07B	IR86-GW-IS59-47-53-07B	IR86-GW-IS59D-47-53-07B	IR86-GW-IS59-55-60-07B	IR86-GW-IS60-22-27-07B	IR86-GW-IS60-47-53-07B	IR86-GW-IS60-55-60-07B	IR86-GW-IS61-22-27-07B	IR86-GW-IS61-47-53-07B	IR86-GW-IS61-55-60-07B
Sample Date				06/27/07	06/27/07	06/27/07	06/27/07	06/26/07	06/26/07	06/26/07	06/26/07	06/26/07	06/26/07
Chemical Name													
Volatile Organic Compounds (µg/L)													
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	200,000	5,900	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	--	6	2.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	--	7	34	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	--	20	37	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	--	4,000	710	1.5 J	1.5 J	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	1.3 J
2-Hexanone	--	--	4.7	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-Methyl-2-pentanone	--	--	200	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
Benzene	--	1	0.41	0.5 U	0.11 J	0.1 J	0.5 U	0.5 U	0.12 J	0.5 U	1.2	0.11 J	0.5 U
Carbon disulfide	--	700	100	0.58	0.26 J	0.3 J	0.13 J	0.86	0.36 J	0.5 U	0.82	0.3 J	0.32 J
Chlorobenzene	--	50	9.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	--	3	19	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	--	70	37	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.21 J	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane	--	--	1,300	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	--	1,000	40	0.21 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	--	600	1.5	0.5 U	0.25 J	0.23 J	0.62	0.5 U	0.17 J	0.78	0.65	0.31 J	0.36 J
Isopropylbenzene	--	70	68	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene chloride	--	5	4.8	0.5 U	0.13 J	0.5 U	0.14 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.14 J
Methyl-tert-butyl ether (MTBE)	--	20	13	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
m-Xylene	--	500	120	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	--	500	120	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.17 J	0.5 U	0.5 U
Styrene	--	70	160	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	--	0.7	0.11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	--	600	230	0.4 J	0.61	0.39 J	0.63	0.33 J	0.38 J	0.59	0.62	0.33 J	0.38 J
trans-1,2-Dichloroethene	--	100	11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	--	3	2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	--	0.03	0.016	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Xylene, total	--	500	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.17 J	0.5 U	0.5 U
Total Metals (µg/L)													
Iron	5,999	300	2,600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	214	50	88	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry													
Alkalinity (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethane (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethene (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ferric iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ferrous iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methane (ug/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/L)	--	10	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfide (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

Bold text indicates exceedance of Adjusted Tap Water RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more cons

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
mg/L - Milligrams per liter
NA - Not analyzed
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: K.Ramsey/CLT

TABLE E3
Supplemental Remedial Investigation Phase I (2007) Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 2(
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NC2LGW (January 2010)*	Adjusted Tap Water RSLs	IR86-IS62			IR86-IS63			
Sample ID				IR86-GW-IS62-22-27-07B	IR86-GW-IS62-47-53-07B	IR86-GW-IS62-55-60-07B	IR86-GW-IS63-22-27-07B	IR86-GW-IS63D-22-27-07B	IR86-GW-IS63-47-53-07B	IR86-GW-IS63-55-60-07B
Sample Date				06/27/07	06/27/07	06/27/07	06/29/07	06/29/07	06/29/07	06/29/07
Chemical Name										
Volatile Organic Compounds (µg/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	200,000	5,900	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	1.6 U
1,1-Dichloroethane	--	6	2.4	0.5 U	0.5 U	0.5 U	1.1	0.91 J	0.5 U	1.6 U
1,1-Dichloroethene	--	7	34	0.5 U	1.3	0.17 J	0.43 J	0.34 J	42	0.51 J
1,2-Dichlorobenzene	--	20	37	0.5 U	0.5 U	0.5 U	0.29 J	0.27 J	0.1 J	1.6 U
2-Butanone	--	4,000	710	2.5 U	1.9 J	2.5 U	5 U	5 U	2.3 J	6.6 J
2-Hexanone	--	--	4.7	2.5 U	2.5 U	2.5 U	5 U	1 J	2.5 U	2.2 J
4-Methyl-2-pentanone	--	--	200	2.5 U	2.5 U	2.5 U	5 U	5 U	0.64 J	7.8 U
Benzene	--	1	0.41	0.5 U	5.6	0.89	0.32 J	0.28 J	1.5	1.3 J
Carbon disulfide	--	700	100	0.42 J	0.36 J	0.14 J	0.44 J	0.37 J	0.69	1.6 U
Chlorobenzene	--	50	9.1	0.5 U	0.5 U	0.5 U	0.23 J	1 U	0.5 U	1.6 U
Chloromethane	--	3	19	0.5 U	0.5 U	0.5 U	1 U	1 U	0.28 J	1.4 J
cis-1,2-Dichloroethene	--	70	37	0.5 U	310	57	36	31	460	46
Cyclohexane	--	--	1,300	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	1.6 U
Dichlorodifluoromethane (Freon-12)	--	1,000	40	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	1.6 U
Ethylbenzene	--	600	1.5	0.5 U	0.15 J	0.31 J	1 U	1 U	0.15 J	1.6 U
Isopropylbenzene	--	70	68	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	1.6 U
Methylene chloride	--	5	4.8	0.5 U	0.25 J	0.25 J	0.6 J	0.67 J	0.2 J	1.1 J
Methyl-tert-butyl ether (MTBE)	--	20	13	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	1.6 U
m-Xylene	--	500	120	1 U	1 U	1 U	2 U	2 U	1 U	3.1 U
o-Xylene	--	500	120	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	1.6 U
Styrene	--	70	160	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	1.6 U
Tetrachloroethene	--	0.7	0.11	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	1.6 U
Toluene	--	600	230	0.25 J	0.39 J	0.29 J	0.67 J	0.63 J	0.81 B	0.63 J
trans-1,2-Dichloroethene	--	100	11	0.5 U	5.1	0.15 J	0.5 J	0.42 J	170 R	1.1 J
Trichloroethene	--	3	2	0.14 J	0.44 J	0.5 U	19	15	220	1 J
Vinyl chloride	--	0.03	0.016	0.5 U	5.2	0.87	3.8	2.9	130	72
Xylene, total	--	500	20	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	1.6 U
Total Metals (µg/L)										
Iron	5,999	300	2,600	NA	NA	NA	NA	NA	NA	NA
Manganese	214	50	88	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry										
Alkalinity (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA
Ethane (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA
Ethene (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA
Ferric iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA
Ferrous iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA
Methane (ug/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/L)	--	10	--	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA
Sulfide (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA

Notes:
Shading indicates exceedance of two times the mean base background concentration for Groundwater
Bold box indicates exceedance of NCGWQS or the more conservative MCL
Bold text indicates exceedance of Adjusted Tap Water RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more cons
µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
mg/L - Milligrams per liter
NA - Not analyzed
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
Generated By: K.Ramsey/CLT

TABLE E3
Supplemental Remedial Investigation Phase I (2007) Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 2(
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NC2LGW (January 2010)*	Adjusted Tap Water RSLs	IR86-IS64				IR86-IS65			
Sample ID				IR86-GW-IS64-22-27-07B	IR86-GW-IS64-47-53-07B	IR86-GW-IS64-55-60-07B	IR86-GW-IS64D-47-53-07B	IR86-GW-IS65-22-27-07B	IR86-GW-IS65-47-53-07B	IR86-GW-IS65-55-60-07B	IR86-GW-IS65D-55-60-07B
Sample Date				06/11/07	06/12/07	06/12/07	06/12/07	06/13/07	06/13/07	06/13/07	06/13/07
Chemical Name											
Volatile Organic Compounds (µg/L)											
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	200,000	5,900	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	--	6	2.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	--	7	34	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	--	20	37	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	--	4,000	710	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	--	--	4.7	2.5 U	2.5 U	2.5 U	2.5 U	0.75 J	2.5 U	2.5 U	2.5 U
4-Methyl-2-pentanone	--	--	200	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Benzene	--	1	0.41	0.21 J	0.35 J	0.12 J	0.35 J	0.5 U	0.5 U	0.5 U	0.5 U
Carbon disulfide	--	700	100	0.66	0.42 J	0.23 J	0.45 J	0.74	0.62	0.12 J	0.12 J
Chlorobenzene	--	50	9.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	--	3	19	0.2 J	0.28 J	0.12 J	0.23 J	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	--	70	37	0.23 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane	--	--	1,300	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	--	1,000	40	0.5 U	0.5 U	0.12 JB	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	--	600	1.5	0.5 U	0.49 J	0.55	0.52	0.5 U	0.24 J	0.27 J	0.25 J
Isopropylbenzene	--	70	68	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene chloride	--	5	4.8	0.45 JB	0.5 B	0.44 JB	0.46 JB	0.4 JB	0.35 JB	0.45 JB	0.44 JB
Methyl-tert-butyl ether (MTBE)	--	20	13	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
m-Xylene	--	500	120	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	--	500	120	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	--	70	160	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	--	0.7	0.11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	--	600	230	0.5 U	0.27 J	0.29 J	0.3 J	0.12 J	0.2 J	0.24 J	0.27 J
trans-1,2-Dichloroethene	--	100	11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	--	3	2	0.33 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	--	0.03	0.016	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Xylene, total	--	500	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Total Metals (µg/L)											
Iron	5,999	300	2,600	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	214	50	88	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry											
Alkalinity (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA	NA
Ethane (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Ethene (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Ferric iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Ferrous iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Methane (ug/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/L)	--	10	--	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA	NA
Sulfide (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Shading indicates exceedance of two times the mean base background concentration for Groundwater
Bold box indicates exceedance of NCGWQS or the more conservative MCL
Bold text indicates exceedance of Adjusted Tap Water RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more cons
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U - The material was analyzed for, but not detected
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Generated By: *K.Ramsey/CLT*

TABLE E3
Supplemental Remedial Investigation Phase I (2007) Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 2(
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NC2LGW (January 2010)*	Adjusted Tap Water RSLs	IR86-IS66			IR86-IS67				IR86-GW15IW	IR86-MW15DW	IR86-GW16IW
Sample ID				IR86-GW-IS66-22-27-07B	IR86-GW-IS66-47-53-07B	IR86-GW-IS66-55-60-07B	IR86-GW-IS67-22-27-07B	IR86-GW-IS67D-22-27-07B	IR86-GW-IS67-47-53-07B	IR86-GW-IS67-55-60-07B	IR86-GW15IW-07D	IR86-GW15DW-07D	IR86-GW16IW-07D
Sample Date				06/26/07	06/26/07	06/26/07	06/28/07	06/28/07	06/28/07	06/28/07	12/05/07	12/05/07	12/05/07
Chemical Name													
Volatile Organic Compounds (µg/L)													
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	200,000	5,900	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	50 U	10 U	10 U
1,1-Dichloroethane	--	6	2.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	50 U	10 U	10 U
1,1-Dichloroethene	--	7	34	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	50 U	10 U	10 U
1,2-Dichlorobenzene	--	20	37	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	50 U	10 U	10 U
2-Butanone	--	4,000	710	2.5 U	2.5 U	1.4 J	2.5 U	2.5 U	2 J	3.7	50 U	10 U	10 U
2-Hexanone	--	--	4.7	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	50 U	10 U	10 U
4-Methyl-2-pentanone	--	--	200	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	50 U	10 U	10 U
Benzene	--	1	0.41	0.5 U	0.5 U	0.21 J	0.5 U	0.5 U	7.5	0.37 J	50 U	10 U	10 U
Carbon disulfide	--	700	100	0.36 J	0.27 J	0.23 J	0.3 J	0.34 J	0.18 J	0.5 U	50 U	10 U	10 U
Chlorobenzene	--	50	9.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	50 U	10 U	10 U
Chloromethane	--	3	19	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	50 U	10 U	10 U
cis-1,2-Dichloroethene	--	70	37	0.5 U	0.5 U	3	0.5 U	0.5 U	2.4	0.48 J	440	10 U	3 J
Cyclohexane	--	--	1,300	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	50 U	10 U	10 U
Dichlorodifluoromethane (Freon-12)	--	1,000	40	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	50 U	10 U	10 U
Ethylbenzene	--	600	1.5	0.5 U	0.41 J	0.21 J	0.5 U	0.5 U	0.37 J	0.44 J	50 U	10 U	10 U
Isopropylbenzene	--	70	68	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	50 U	10 U	10 U
Methylene chloride	--	5	4.8	0.5 U	0.5 U	0.5 U	0.23 J	0.34 J	0.24 J	0.37 J	50 U	10 U	10 U
Methyl-tert-butyl ether (MTBE)	--	20	13	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	50 U	10 U	10 U
m-Xylene	--	500	120	1 U	1 U	1 U	1 U	1 U	1 U	0.21 J	NA	NA	NA
o-Xylene	--	500	120	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	NA	NA	NA
Styrene	--	70	160	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	50 U	10 U	10 U
Tetrachloroethene	--	0.7	0.11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	50 U	10 U	10 U
Toluene	--	600	230	0.47 J	0.47 J	0.47 J	0.49 J	0.64	0.83	0.67	50 U	10 U	10 U
trans-1,2-Dichloroethene	--	100	11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	14 J	10 U	10 U
Trichloroethene	--	3	2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	3	0.5 U	50 U	10 U	3 J
Vinyl chloride	--	0.03	0.016	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	25 J	10 U	10 U
Xylene, total	--	500	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.34 J	50 U	10 U	10 U
Total Metals (µg/L)													
Iron	5,999	300	2,600	NA	NA	NA	NA	NA	NA	NA	4,210	647	4,240
Manganese	214	50	88	NA	NA	NA	NA	NA	NA	NA	50.9	51.9	57.1
Wet Chemistry													
Alkalinity (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	230	163	183
Chloride (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA	10.8	14.6	11.8
Ethane (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	2 U	2 U	2 U
Ethene (µg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	2 U	2 U	2 U
Ferric iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	0.5 J	0.4 UJ	0.27 J
Ferrous iron (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	3.71 J	0.81 J	3.97 J
Methane (ug/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	34	4	26
Nitrate (mg/L)	--	10	--	NA	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U
Sulfate (mg/L)	--	250	--	NA	NA	NA	NA	NA	NA	NA	3.44 J	3.75 J	9.09
Sulfide (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	1 U
Total organic carbon (TOC) (mg/L)	--	--	--	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	5 U

Notes:
Shading indicates exceedance of two times the mean base background concentration for Groundwater
Bold box indicates exceedance of NCGWQS or the more conservative MCL
Bold text indicates exceedance of Adjusted Tap Water RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more cons
µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
mg/L - Milligrams per liter
NA - Not analyzed
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
Generated By: *K.Ramsey/CLT*

TABLE E3
Supplemental Remedial Investigation Phase I (2007) Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 2(
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NC2LGW (January 2010)*	Adjusted Tap Water RSLs	IR86-MW16DW		IR86-MW17DW	IR86-MW18DW	IR86-MW19DW	IR86-MW20IW	IR86-MW22IW	IR86-MW23IW	IR86-MW24IW	IR86-GW25IW	IR86-MW26IW	IR86-MW27IW	IR86-GW2
Sample ID				IR86-GW16DW-07D	IR86-GW16DWD-07D	IR86-GW17DW-07D	IR86-GW18DW-07D	IR86-GW19DW-07D	IR86-GW20IW-07D	IR86-GW22IW-07D	IR86-GW23IW-07D	IR86-GW24IW-07D	IR86-GW25IW-07D	IR86-GW26IW-07D	IR86-GW27IW-07D	IR86-GW29I
Sample Date				12/05/07	12/08/07	12/09/07	12/06/07	12/08/07	12/06/07	12/04/07	12/09/07	12/07/07	12/07/07	12/07/07	12/07/07	12/05/0
Chemical Name																
Volatile Organic Compounds (µg/L)																
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	200,000	5,900	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	140 J	10 UJ	6 J	10
1,1-Dichloroethane	--	6	2.4	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	4 J	10 U	10 U	10
1,1-Dichloroethene	--	7	34	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	30	10 U	10 U	10
1,2-Dichlorobenzene	--	20	37	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	3 J	10 U	10 U	10
2-Butanone	--	4,000	710	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
2-Hexanone	--	--	4.7	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
4-Methyl-2-pentanone	--	--	200	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Benzene	--	1	0.41	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	3 J	10 U	10 U	10 U	10
Carbon disulfide	--	700	100	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Chlorobenzene	--	50	9.1	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Chloromethane	--	3	19	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
cis-1,2-Dichloroethene	--	70	37	10 U	10 U	10 U	10 U	10 U	25	3 J	89	2 J	38	10 U	42	53
Cyclohexane	--	--	1,300	10 U	10 U	10 U	10 U	10 U	10 U	3 J	10 U	10 U	10 U	10 U	40	10
Dichlorodifluoromethane (Freon-12)	--	1,000	40	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	6 J	10 U	10 U	10
Ethylbenzene	--	600	1.5	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Isopropylbenzene	--	70	68	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Methylene chloride	--	5	4.8	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Methyl-tert-butyl ether (MTBE)	--	20	13	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
m-Xylene	--	500	120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	--	500	120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	--	70	160	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Tetrachloroethene	--	0.7	0.11	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Toluene	--	600	230	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
trans-1,2-Dichloroethene	--	100	11	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Trichloroethene	--	3	2	10 U	10 U	10 U	10 U	10 U	57	10 U	10 U	10 U	40	10 U	51	280
Vinyl chloride	--	0.03	0.016	10 U	10 U	10 U	10 U	10 U	10 U	10 U	13	10 U	6 J	10 U	7 J	10
Xylene, total	--	500	20	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Total Metals (µg/L)																
Iron	5,999	300	2,600	1,070	920	108	164 J	326	4,390 J	3,360	3,040	3,510 J	2,980 J	1,960 J	4,360 J	4,680
Manganese	214	50	88	61.6	61.3	9.1 U	12.3 J	28.1	56.4 J	42.1	44.4	59.4 J	58.9 J	46 J	74.7 J	67.7
Wet Chemistry																
Alkalinity (mg/L)	--	--	--	198	176	264 J	229 J	189 J	164 J	190	189 J	197 J	12.6 J	197 J	89.2 J	285
Chloride (mg/L)	--	250	--	36.1	34	88	71.8	50.1	9.81	11.9	8.14	9.34	15.1	10.3	18.7	17.1
Ethane (µg/L)	--	--	--	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2
Ethene (µg/L)	--	--	--	2 U	2 U	2 U	2 U	2 U	2 U	0.3 J	2 U	2 U	2 U	2 U	2 U	2
Ferric iron (mg/L)	--	--	--	0.57 J	0.42 J	0.4 UJ	0.164 J	0.4 UJ	0.15 J	0.4 UJ	0.35 J	3.51 J	0.15 J	0.4 UJ	0.4 UJ	0.44
Ferrous iron (mg/L)	--	--	--	0.5 J	0.5 J	0.15 J	0.4 UJ	0.4 UJ	4.24 J	3.31 J	2.69 J	0.4 UJ	2.83 J	1.85 J	4.49 UJ	4.24
Methane (ug/L)	--	--	--	5	6	3 J	7	7	57	100	11 J	85	33	140	59	73
Nitrate (mg/L)	--	10	--	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05
Sulfate (mg/L)	--	250	--	6.81	6.78	12.7	11.3	93.3	2.01 J	1.15 J	1.78 J	0.94 J	22.8	1.87 J	37	15.6
Sulfide (mg/L)	--	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.8	1 U	1 U	1
Total organic carbon (TOC) (mg/L)	--	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2.39 J	5 U	4.18 J	5

Notes:
Shading indicates exceedance of two times the mean base background concentration for Groundwater
Bold box indicates exceedance of NCGWQS or the more conservative MCL
Bold text indicates exceedance of Adjusted Tap Water RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more cons
µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
mg/L - Milligrams per liter
NA - Not analyzed
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
Generated By: K.Ramsey/CLT

TABLE E3
Supplemental Remedial Investigation Phase I (2007) Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 2(
MCB CamLej, Jacksonville, North Carolina

Station ID	**Camp Lejeune Background GW 2× Mean**	**NC2LGW (January 2010)***	**Adjusted Tap Water RSLs**	IW	IR86-MW30IW	IR86-GW31DW	IR86-MW31IW		IR86-MW34IW	IR86-MW39	IR86-MW40	IR86-MW41	IR86-MW42DW
Sample ID				V-07D	IR86-GW30IW-07D	IR86-GW31DW-07D	IR86-GW31IW-07D	IR86-GW31IWD-07D	IR86-GW34IW-07D	IR86-GW39-07D	IR86-GW40-07D	IR86-GW41-07D	IR86-GW42DW-07D
Sample Date					12/09/07	12/04/07	12/05/07	12/05/07	12/09/07	12/08/07	12/08/07	12/07/07	12/06/07
Chemical Name													
Volatile Organic Compounds (µg/L)													
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	200,000	5,900	U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	54	10 U
1,1-Dichloroethane	--	6	2.4	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	--	7	34	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	--	20	37	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Butanone	--	4,000	710	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ
2-Hexanone	--	--	4.7	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ
4-Methyl-2-pentanone	--	--	200	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ
Benzene	--	1	0.41	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	--	700	100	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chlorobenzene	--	50	9.1	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloromethane	--	3	19	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	--	70	37		81	10 U	3 J	6 J	5 J	10 U	12	5 J	10 U
Cyclohexane	--	--	1,300	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dichlorodifluoromethane (Freon-12)	--	1,000	40	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	--	600	1.5	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Isopropylbenzene	--	70	68	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene chloride	--	5	4.8	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methyl-tert-butyl ether (MTBE)	--	20	13	U	10 U	10 U	10 U	10 U	10 U	22	10 U	10 U	10 U
m-Xylene	--	500	120		NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	--	500	120		NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	--	70	160	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	--	0.7	0.11	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	--	600	230	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
trans-1,2-Dichloroethene	--	100	11	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	--	3	2	J	9 J	10 U	5 J	8 J	11	10 U	29	10	10 U
Vinyl chloride	--	0.03	0.016	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Xylene, total	--	500	20	U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Total Metals (µg/L)													
Iron	5,999	300	2,600		3,350	259	2,430	2,130	2,820	5,800	8,170	14,300 J	308 J
Manganese	214	50	88		52.3	38.8	101	98.5	63.3	30.2	108	176 J	54.6 J
Wet Chemistry													
Alkalinity (mg/L)	--	--	--		197 J	183	237	240	311 J	78 J	10 UJ	342 J	48.2 J
Chloride (mg/L)	--	250	--		7.74	41.2	28	32.8	14.6	25.5	69.5	11.7	8.32
Ethane (µg/L)	--	--	--	U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.05 J	2 U
Ethene (µg/L)	--	--	--	U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ferric iron (mg/L)	--	--	--	J	0.22 J	0.4 UJ	1.93 J	1.63 J	2.15 J	0.51 J	0.59 J	7.51 J	0.4 UJ
Ferrous iron (mg/L)	--	--	--	J	3.13 J	0.25 J	0.5 J	0.5 J	0.67 J	5.29 J	7.58 J	6.79 J	0.2 J
Methane (ug/L)	--	--	--		26 J	2	24	28	4 J	38	18	56	4
Nitrate (mg/L)	--	10	--	U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.645
Sulfate (mg/L)	--	250	--		3.23 J	8.36	127	105	220	43.6	53	136	12.7
Sulfide (mg/L)	--	--	--	U	1 U	1 U	1 U	1 U	1 U	0.6 J	1 U	1 U	1 U
Total organic carbon (TOC) (mg/L)	--	--	--	U	5 U	5 U	5 U	5 U	2 J	2.08 J	2.14 J	5 U	5 U

Notes:
Shading indicates exceedance of two times the mean base background concentration for Groundwater
Bold box indicates exceedance of NCGWQS or the more conservative MCL
Bold text indicates exceedance of Adjusted Tap Water RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more cons

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
mg/L - Milligrams per liter
NA - Not analyzed
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: K.Ramsey/CLT

TABLE E3
Supplemental Remedial Investigation Phase I (2007) Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 2(
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NC2LGW (January 2010)*	Adjusted Tap Water RSLs	IR86-MW42IW				IR86-MW43IW	IR86-MW44DW	IR86-MW44IW				IR86-MW45DW	IR86-MW46IW
Sample ID				IR86-GW42IW-07D-X	IR86-GW42IWD-07D-X	IR86-GW42IW-08A	IR86-GW42IWD-08A	IR86-GW43IW-07D	IR86-GW44DW-07D	IR86-GW44IW-07D-X	IR86-GW44IWD-07D-X	IR86-GW44IW-08A	IR86-GW44IWD-08A	IR86-GW45DW-07D	IR86-GW46IW-07D
Sample Date				12/06/07	12/06/07	02/05/08	02/05/08	12/04/07	12/08/07	12/04/07	12/04/07	02/05/08	02/05/08	12/09/07	12/08/07
Chemical Name															
Volatile Organic Compounds (µg/L)															
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	200,000	5,900	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	--	6	2.4	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	--	7	34	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	--	20	37	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Butanone	--	4,000	710	10 UJ	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	--	--	4.7	10 UJ	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	--	--	200	10 UJ	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	--	1	0.41	9 J	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	--	700	100	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chlorobenzene	--	50	9.1	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloromethane	--	3	19	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	--	70	37	10 UJ	65 J	70	65	10 U	10 U	10 UJ	150 J	120	110	10 U	10 U
Cyclohexane	--	--	1,300	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dichlorodifluoromethane (Freon-12)	--	1,000	40	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	--	600	1.5	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Isopropylbenzene	--	70	68	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene chloride	--	5	4.8	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methyl-tert-butyl ether (MTBE)	--	20	13	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
m-Xylene	--	500	120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	--	500	120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	--	70	160	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	--	0.7	0.11	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	--	600	230	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
trans-1,2-Dichloroethene	--	100	11	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	--	3	2	6 J	250 J	280	280	10 U	10 U	10 UJ	29 J	30	24	10 U	10 U
Vinyl chloride	--	0.03	0.016	10 U	25 UJ	5 J	4 J	10 U	10 U	10 UJ	21 J	22	18	10 U	10 U
Xylene, total	--	500	20	10 U	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Total Metals (µg/L)															
Iron	5,999	300	2,600	8,830 J	6,910 J	7,960 J	7,830 J	5,760	76 U	6,470	5,190	4,740 J	5,090 J	46.4 U	2,320
Manganese	214	50	88	89.1 J	76 J	81.7 J	81.3 J	71.1	35	72.9	63.3	58.4 J	60.8 J	7.1 U	27.6
Wet Chemistry															
Alkalinity (mg/L)	--	--	--	85.9 J	227 J	221	224	260	213 J	176	177	192	195	186 J	169 J
Chloride (mg/L)	--	250	--	6.65 J	21.1 J	18.9	18.5	11.1	57	11.3	11	10.4	9.02	30.6	7.92
Ethane (µg/L)	--	--	--	0.06 J	2 U	2 U	2 U	0.04 J	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ethene (µg/L)	--	--	--	2 U	2 U	2 U	0.2 J	2 U	2 U	0.4 J	0.4 J	0.4 J	0.3 J	2 U	2 U
Ferric iron (mg/L)	--	--	--	0.12 J	3.28 J	2.16 J	0.88 J	0.67 J	0.4 UJ	6.47 J	1.78 J	1.48 J	1.97 J	0.4 UJ	0.4 UJ
Ferrous iron (mg/L)	--	--	--	8.68 J	3.63 J	5.8 J	6.95 J	5.09 J	0.4 UJ	0.4 UJ	3.41 J	3.26 J	3.12 J	0.4 UJ	2.26 UJ
Methane (ug/L)	--	--	--	37 J	3 J	14	20	10	6	67	86	38	43	4 J	7
Nitrate (mg/L)	--	10	--	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Sulfate (mg/L)	--	250	--	39 J	3.73 J	0.99 J	0.825 J	9.44	5 U	0.835 J	0.92 J	0.945 J	0.96 J	9.73	18.4
Sulfide (mg/L)	--	--	--	1 U	1 U	1 U	1 U	0.8 J	1 U	0.8 J	0.6 J	1 U	0.6 J	1 U	1 U
Total organic carbon (TOC) (mg/L)	--	--	--	1.74 J	5 U	5 U	5 U	3.73 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U

Notes:
Shading indicates exceedance of two times the mean base background concentration for Groundwater
Bold box indicates exceedance of NCGWQS or the more conservative MCL
Bold text indicates exceedance of Adjusted Tap Water RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more cons
µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
mg/L - Milligrams per liter
NA - Not analyzed
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
Generated By: K.Ramsey/CLT

TABLE E3
Supplemental Remedial Investigation Phase I (2007) Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 2(
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NC2LGW (January 2010)*	Adjusted Tap Water RSLs	IR86-MW47		IR86-MW47IW		IR86-MW48	IR86-MW48IW	IR86-MW49DW	IR86-MW50IW	IR86-MW51DW	IR86-AS428-MW05
Sample ID				IR86-GW47-07D-X	IR86-GW47-08A	IR86-GW47IW-07D	IR86-GW47IWD-07D	IR86-GW48-07D	IR86-GW48IW-07D	IR86-GW49DW-07D	IR86-GW50IW-07D	IR86-GW51DW-07D	IR86-AS428-GW05-07D
Sample Date				12/06/07	02/05/08	12/06/07	12/06/07	12/04/07	12/04/07	12/04/07	12/08/07	12/05/07	12/09/07
Chemical Name													
Volatile Organic Compounds (µg/L)													
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	200,000	5,900	25 UJ	10 U	10 U	10 U	10 U	75	10 U	10 U	10 U	10 UJ
1,1-Dichloroethane	--	6	2.4	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	--	7	34	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	--	20	37	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Butanone	--	4,000	710	25 UJ	10 U	10 UJ	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 U
2-Hexanone	--	--	4.7	25 UJ	10 U	10 UJ	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 U
4-Methyl-2-pentanone	--	--	200	25 UJ	10 U	10 UJ	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 U
Benzene	--	1	0.41	25 UJ	7 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	--	700	100	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chlorobenzene	--	50	9.1	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloromethane	--	3	19	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	--	70	37	65 J	10 U	10 U	10 U	2 J	94	10 U	10 U	10 U	6 J
Cyclohexane	--	--	1,300	25 UJ	2 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dichlorodifluoromethane (Freon-12)	--	1,000	40	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	--	600	1.5	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Isopropylbenzene	--	70	68	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene chloride	--	5	4.8	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methyl-tert-butyl ether (MTBE)	--	20	13	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
m-Xylene	--	500	120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	--	500	120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	--	70	160	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	--	0.7	0.11	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	--	600	230	25 UJ	10 U	10 U	10 U	10 U	19	10 U	10 U	10 U	10 U
trans-1,2-Dichloroethene	--	100	11	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	--	3	2	250 J	5 J	10 U	10 U	10 U	270 J	10 U	10 U	10 U	10 U
Vinyl chloride	--	0.03	0.016	25 UJ	10 U	10 U	10 U	10 U	81	16	10 U	10 U	10 U
Xylene, total	--	500	20	25 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Total Metals (µg/L)													
Iron	5,999	300	2,600	7,240 J	6,690 J	2,940 J	2,820 J	7,390	4,630	44.5 U	5,380	142 J	3,520 J
Manganese	214	50	88	80 J	58.9 J	32.5 J	30.9 J	67.6	68.1	59.3	77.4	31.2 J	44.8 J
Wet Chemistry													
Alkalinity (mg/L)	--	--	--	229 J	90.2	177 J	176 J	30.3	222	185	269 J	227 J	284 J
Chloride (mg/L)	--	250	--	20.9	5.31	7.87	8.03	13.8	17	19.6	11.3	87.8	12
Ethane (µg/L)	--	--	--	2 U	2 U	2 U	0.2 J	0.1 J	0.5 J	2 U	0.3 J	2 U	2 U
Ethene (µg/L)	--	--	--	0.2 J	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ferric iron (mg/L)	--	--	--	2.75 J	0.69 J	0.4 UJ	0.4 UJ	0.51 J	2.65 J	0.4 UJ	5.38 J	0.4 UJ	0.4 UJ
Ferrous iron (mg/L)	--	--	--	4.49 J	6 J	2.97 J	3.07 J	6.88 J	1.98 J	0.4 UJ	0.4 UJ	0.4 UJ	8.73 J
Methane (ug/L)	--	--	--	22	22	3 J	25 J	160	230	2	21	6	24 J
Nitrate (mg/L)	--	10	--	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Sulfate (mg/L)	--	250	--	4.01 J	42.4	3.65 J	2.79 J	1.93 J	6.76	5	16.8	17.1	2.45 J
Sulfide (mg/L)	--	--	--	1 U	1 U	1 U	1 U	1 U	0.6 J	1 U	1 U	1 U	1 U
Total organic carbon (TOC) (mg/L)	--	--	--	1.83 J	5 U	5 U	5 U	3.81 J	2.25 J	5 U	3.8 J	5 U	5 U

Notes:
Shading indicates exceedance of two times the mean base background concentration for Groundwater
Bold box indicates exceedance of NCGWQS or the more conservative MCL
Bold text indicates exceedance of Adjusted Tap Water RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more cons

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
mg/L - Milligrams per liter
NA - Not analyzed
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: *K.Ramsey/CLT*

CH2MHILL Phase II SRI

TABLE E4

Supplemental Remedial Investigation Phase II (June 2008) Groundwater Analytical Data

Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20

MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NC2LGW (January, 2010)*	Adjusted Tap Water RSLs	IR86-MW09		IR86-MW28IW	IR86-MW33IW	IR86-MW34IW	IR86-MW38IWA	IR86-MW38IWB		IR86-MW38IWC	IR86-MW47	IR86-MW49DW	IR86-MW52	IR86-MW53	IR86-MW54IW	IR86-MW55IW	IR86-MW56IW
Sample ID				IR86-MW09-08B	IR86-MW09D-08B	IR86-MW28IW-08B	IR86-MW33IW-08B	IR86-MW34IW-08B	IR86-MW38IWA-08B	IR86-MW38IWB-08B	IR86-MW38IWBD-08B	IR86-MW38IWC-08B	IR86-MW47-08B	IR86-MW49DW-08B	IR86-MW52-08B	IR86-MW53-08B	IR86-MW54IW-08B	IR86-MW55IW-08B	IR86-MW56IW-08B
Sample Date				06/12/08	06/12/08	06/12/08	06/13/08	06/13/08	06/10/08	06/10/08	06/10/08	06/10/08	06/09/08	06/12/08	06/10/08	06/09/08	06/11/08	06/12/08	06/10/08
Chemical Name																			
Volatile Organic Compounds (µg/L)																			
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	200,000	5,900	0.49 J	0.4 J	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	--	6	2.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	4.1	0.15 J	0.5 U	0.2 J	0.5 U	0.5 U	0.25 J	0.5 U	0.2 J	0.12 J
1,1-Dichloroethene	--	7	34	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 J	0.17 J	0.5 U	0.5 U	2.1	0.5 U	0.5 U	4.7	16	1.4
Acetone	--	6,000	2,200	5 U	5 U	5 U	5 U	5 U	5.7 U	25 U	11 UJ	7 U	5 U	5 U	5 U	14 U	5 U	5 U	5 U
Benzene	--	1	0.41	0.5 U	0.5 U	0.32 J	0.5 U	0.5 U	0.32 J	0.51 J	0.5 UJ	0.5 U	6.3 J	0.46 J	2.7	0.5 U	1	2.4	1.5
Carbon disulfide	--	700	100	0.15 J	0.5 U	0.5 U	0.5 U	0.5	0.5 U	2.5 U	0.52 J	0.5 U	0.2 J	0.5 U	0.5 U	0.48 J	0.39 J	0.17 J	0.5 U
Chloroethane	--	3,000	2,100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	1.2 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	--	3	19	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	1.8 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.16 J	0.5 U	0.5 U
cis-1,2-Dichloroethene	--	70	37	0.5 U	0.5 U	1	4.3	0.39 J	0.85	99 J	15 J	3.6	0.43 J	35	0.5 U	0.5 U	160 J	170	11
cis-1,3-Dichloropropene	--	0.4	0.43	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.41 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane	--	--	1,300	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	2.5 J	0.5 U	2.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	--	600	1.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	1.3	0.5 U	0.5 U	0.5 U	0.5 U
Isopropylbenzene	--	70	68	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.5 UJ	0.5 U	0.15 J	0.5 U	0.14 J	0.5 U	0.5 U	0.5 U	0.5 U
m- and p-Xylene	--	500	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	1.7	0.5 U	0.5 U	0.5 U	0.5 U
Methyl acetate	--	--	3,700	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylcyclohexane	--	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene chloride	--	5	4.8	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.21 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methyl-tert-butyl ether (MTBE)	--	20	13	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
o-Xylene	--	500	120	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.94	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	--	0.7	0.11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	--	600	230	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	1.1 U	0.5 U	7.9	0.61 U	0.5 U
trans-1,2-Dichloroethene	--	100	11	0.5 U	0.5 U	0.19 J	0.15 J	0.5 U	0.5 U	0.65 J	0.14 J	0.48 J	0.5 U	1	0.5 U	0.5 U	0.38 J	6.8 J	0.81
trans-1,3-Dichloropropene	--	0.4	0.43	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	0.22 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	--	3	2	0.5 U	0.5 U	1	1.9	2.1	1.5	48	13 J	0.64 U	5 J	0.27 J	0.5 U	0.5 U	140	1	0.68 U
Vinyl chloride	--	0.03	0.016	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.2 J	0.5 UJ	0.5 U	0.5 U	29	0.5 U	0.5 U	2.3	210	11
Total Metals (µg/L)																			
Iron	5,999	300	2,600	NA	NA	4,230	7,380	NA	74,900	2,530	NA	4,790	NA	NA	NA	NA	NA	NA	NA
Manganese	214	50	88	NA	NA	59.9	160	NA	760	114	NA	419	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry																			
Alkalinity (mg/L)	--	--	--	NA	NA	294	277	NA	6.56 B	353	NA	221	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/L)	--	250	--	NA	NA	39.5	28.7	NA	18.3	31.1	NA	28	NA	NA	NA	NA	NA	NA	NA
Ethane (µg/L)	--	--	--	NA	NA	2 U	2 U	NA	0.1 J	2 U	NA	2 U	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/L)	--	250	--	NA	NA	31.5	1,730	NA	3,040	255	NA	1,550	NA	NA	NA	NA	NA	NA	NA
Sulfide (mg/L)	--	--	--	NA	NA	1 U	1 U	NA	1.2	1 U	NA	1 U	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/L)	--	--	--	NA	NA	5 U	5.05	NA	10.7	3.84 B	NA	7.12	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

Bold text indicates exceedance of Adjusted Tap Water RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more conservative.

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
mg/L - Milligrams per liter
NA - Not analyzed
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: *K.Ramsey/CLT*
Checked By: *T.Grim/CLT*

TABLE E5

Supplemental Remedial Investigation Phase II (October 2008) DPT Groundwater Analytical Data

Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20

MCB CamLej, Jacksonville, North Carolina

Sample ID	Volatile Organic Compounds (µg/L)							
	Benzene	Ethylbenzene	Toluene	PCE	TCE	1,1-DCE	cis-1,2-DCE	VC
IR86-IS50-GW-41-45	0.68 JD	2 UD	0.56 JD	2 UD	390 D	2.7 D	53 D	1.4 JD
IR86-IS50-GW-46-50	1.7 JD	3 JD	11 D	5 UD	680 D	9.7 D	200 D	5 UD
IR86-IS50-GW-51-55	0.15 J	0.68	0.64	0.5 U	16	1.5	45	0.46 J
IR86-IS51-GW-41-45	0.14 J	0.29 J	0.79	0.5 U	0.13 J	0.5 U	0.5 U	0.5 U
IR86-IS51-GW-46-50	0.16 J	0.35 J	0.47 J	2.5	0.23 J	0.5 U	0.5 U	0.5 U
IR86-IS51-GW-51-55	0.13 J	0.25 J	0.49 J	0.81	0.5 U	0.5 U	0.5 U	0.5 U
IR86-IS51-GW-56-60	0.16 J	0.55	0.7	0.49 J	0.5 U	0.5 U	0.5 U	0.5 U
IR86-IS52-GW-41-45	4.3	0.88	2.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
IR86-IS52-GW-46-50	0.24 J	0.91	0.75	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
IR86-IS52-GW-51-55	0.32 J	0.73	0.72	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
IR86-IS52-GW-56-60	0.15 J	0.26 J	0.26 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
IR86-IS53-GW-41-45	0.43 J	0.37 J	0.82	0.5 U	0.5 U	0.5 U	2.2	1.2
IR86-IS53-GW-46-50	0.31 J	0.64	0.48 J	0.5 U	0.5 U	0.5 U	3.5	1.2
IR86-IS53-GW-51-55	0.38 J	0.3 J	0.78	0.5 U	0.5 U	0.5 U	0.89	0.5 U
IR86-IS53-GW-56-60	0.33 J	0.42 J	0.66	0.5 U	0.5 U	0.5 U	0.2 J	0.5 U
IR86-IS54-GW-41-45	12 D	3.4 D	6.3 D	1 UD	66 D	2.8 D	110 D	1.4 D
IR86-IS54-GW-46-50	0.26 J	0.48 J	0.61	0.5 U	5.9	1.2	53	0.6
IR86-IS55-GW-46-50	0.18 J	1.0	0.75	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
IR86-IS55-GW-41-45	0.13 J	0.35 J	0.35 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
IR86-IS55-GW-51-55	0.48 J	0.51	0.82	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Notes:

µg/L - Micrograms per liter
D - Sample dilution required
DCE - Dichloroethene
J - Estimated value
MC - Methylene chloride
PCE - Tetrachloroethane
TCE - trichloroethene
U - Not detected above laboratroy reporting limit
VC - Vinyl chloride

Generated By: *K.Ramsey/CLT*
Checked By: *T.Grim/CLT*

TABLE E6

Supplemental Remedial Investigation Phase II (October 2008) Groundwater Analytical Data

Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20

MCB CamLej, Jacksonville, North Carolina

Station ID	**Camp Lejeune Background GW 2× Mean**	**NC2LGW (January 2010)***	**Adjusted Tap Water RSLs**	IR86-MW15DW	IR86-MW40IW	IR86-MW44DW		IR86-MW45DW	IR86-MW46IW	IR86-MW47IW	IR86-MW48	IR86-MW50IW
Sample ID				IR86-MW15DW-08D	IR86-MW40IW-08D	IR86-MW44DW-08D	IR86-MW44DWD-08D	IR86-MW45DW-08D	IR86-MW46IW-08D	IR86-MW47IW-08D	IR86-MW48-08D	IR86-MW50IW-08D
Sample Date				10/27/08	10/28/08	10/28/08	10/28/08	10/28/08	10/26/08	10/26/08	10/27/08	10/26/08
Chemical Name												
Volatile Organic Compounds (µg/L)												
1,1-Dichloroethane	--	6	2.4	0.5 U	0.88	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	--	7	34	0.5 U	0.72	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Benzene	--	1	0.41	0.5 U	14	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.5	0.5 U
cis-1,2-Dichloroethene	--	70	37	0.5 U	14	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.9	0.5 U
Cyclohexane	--	--	1,300	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.5	0.5 U
Ethylbenzene	--	600	1.5	0.5 U	0.23 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylcyclohexane	--	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.37 J	0.5 U
o-Xylene	--	500	120	0.5 U	0.16 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	--	0.7	0.11	0.5 U	17	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	--	600	230	0.5 U	0.53	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	--	3	2	0.5 U	3.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.98	0.5 U
Total Metals (µg/L)												
Iron	5,999	300	2,600	NA	3,210	NA	NA	NA	NA	NA	NA	NA
Manganese	214	50	88	NA	45.1	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry												
Alkalinity (mg/L)	--	--	--	NA	251	NA	NA	NA	NA	NA	NA	NA
Carbon (mg/L)	--	--	--	NA	2	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/L)	--	250	--	NA	10.2	NA	NA	NA	NA	NA	NA	NA
Ethane (µg/L)	--	--	--	NA	1	NA	NA	NA	NA	NA	NA	NA
Ethene (µg/L)	--	--	--	NA	1	NA	NA	NA	NA	NA	NA	NA
Methane (µg/L)	--	--	--	NA	330	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/L)	--	10	--	NA	0.15	NA	NA	NA	NA	NA	NA	NA
Nitrite (mg/L)	--	1	--	NA	0.25	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/L)	--	250	--	NA	2	NA	NA	NA	NA	NA	NA	NA
Sulfide (mg/L)	--	--	--	NA	2.1	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

Bold text indicates exceedance of Adjusted Tap Water RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

* The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more conservative.

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
mg/L - Milligrams per liter
NA - Not analyzed
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

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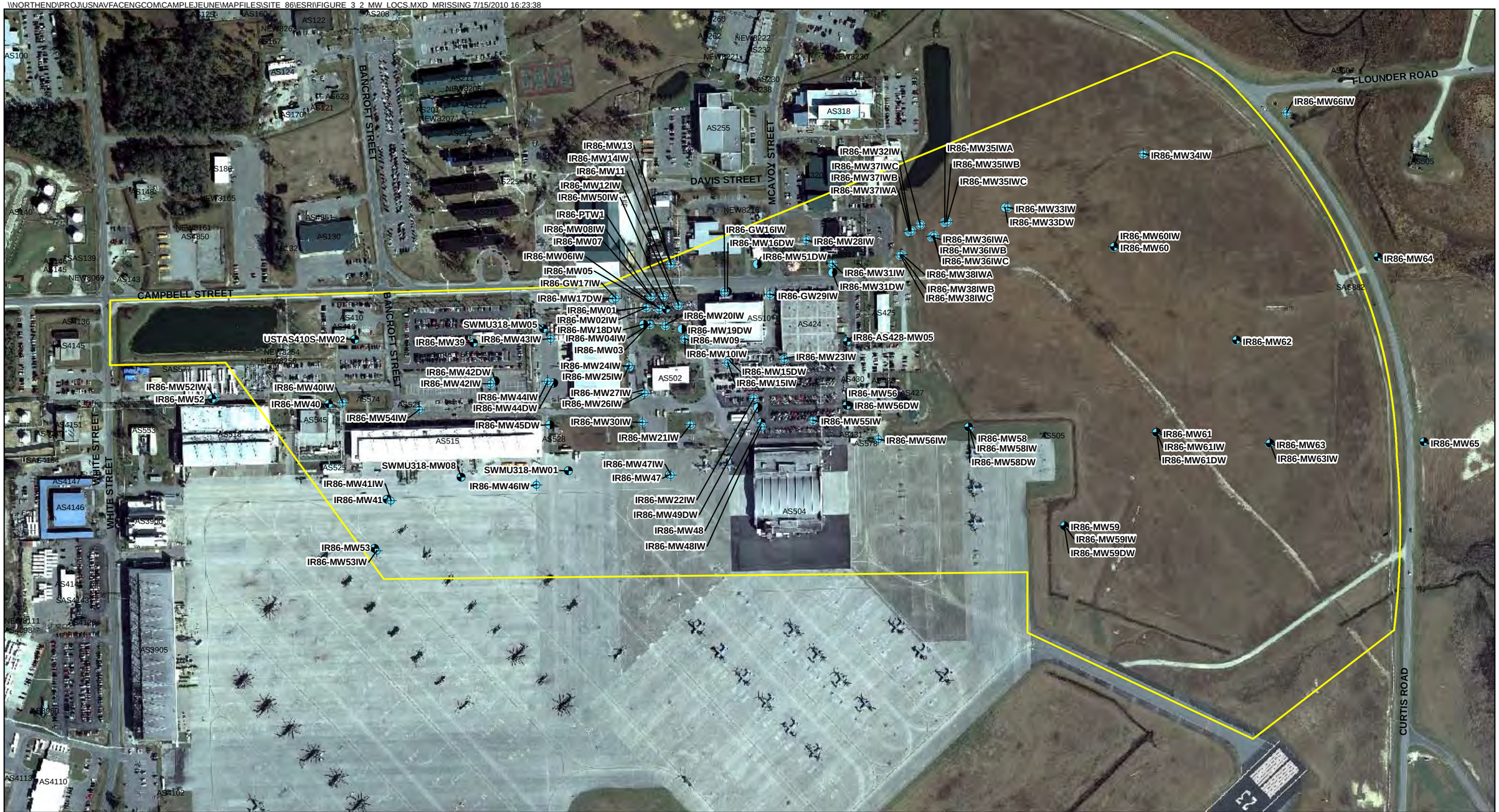
Checked By: *T.Grim/CLT*

CH2MHILL ESRI

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\SITE_86\ESRI\FIGURE_3_2_MW_LOCS.MXD MRISSING 7/15/2010 16:23:38



Legend

Monitoring Wells

- Surficial Aquifer
- Upper Castle Hayne Aquifer
- Middle Castle Hayne Aquifer
- Expanded Site 86 Boundary (March 2010)

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 3-2
Monitoring Well Locations
Expanded Supplemental Remedial Investigation
Operable Unit 20 (Site 86)
MCB CamLej
North Carolina

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\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\SITE_86\ESRI\FIGURE_3_4_DPT_SAMPLING_LOCS.MXD MARTESE 6/28/2010 12:59:17

Legend

- Direct Push Groundwater Sampling Locations 2007
- Direct Push Groundwater Sampling Locations 2008
- Direct Push Groundwater Sampling Locations 2009
- Expanded Site 86 Boundary (March 2010)

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 3-4
DPT Groundwater Sampling Locations
Expanded Supplemental Remedial Investigation
Operable Unit 20 (Site 86)
MCB CamLej
North Carolina

Notes:
IR86-IS46 and IR86-IS47 collected for lithology only.

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\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\SITE_86\ESRI\FIGURE_3_5_SW_SD_SOIL_SAMPLE_LOCS.MXD MARTESE 6/28/2010 14:37:04

Legend

- Surface/Subsurface Soil Sample Locations (2009)
- Surface Soil Sample Locations (2007)
- Surface Water and Sediment Sampling Locations
- Expanded Site 86 Boundary (March 2010)

N

0 175 350 700 Feet

1 inch = 350 feet

Figure 3-5
Surface Water, Sediment, and Soil Sample Locations
Expanded Supplemental Remedial Investigation
Operable Unit 20 (Site 86)
MCB CamLej
North Carolina

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TABLE 5-1
Surface Water Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	NC2B-SW-Human Health & Water Supply[1]	Other Applicable Federal Criteria	Other Applicable Federal Criteria Reference	IR86-SW01	IR86-SW02		IR86-SW105		IR86-SW106	IR86-SW108	IR86-SW110	IR86-SW112	IR86-SW113
Sample ID				IR86-SW01-08B	IR86-SW02-08B	IR86-SW02-08B	IR86-SW105-09D	IR86-SW105D-09D	IR86-SW106-09D	IR86-SW108-09D	IR86-SW110-09D	IR86-SW112-09D	IR86-SW113-09D
Sample Date				06/11/08	06/11/08	06/11/08	11/08/09	11/08/09	11/08/09	11/08/09	11/08/09	11/08/09	11/08/09
Chemical Name													
Volatile Organic Compounds (µg/l)													
Chloromethane	--	2.6	IRIS & RAIS 2/07	0.5 U	0.5 U	0.5 U	1 U	1 U	0.2 J	0.18 J	0.3 J	0.2 J	0.24 J
cis-1,2-Dichloroethene	--	330	ECOTOX & RAIS 1/07	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	1 U	1 U	0.12 J	0.13 J
Tetrachloroethene	0.7	--	--	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	1 U	1 U	0.2 J	0.26 J
Toluene	--	11	NC2B - Freshwater Aquatic Life	0.5 U	0.5 U	0.5 U	0.57 J	0.56 J	1 U	1 U	1 U	1 U	1 U
Trichloroethene	2.5	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.15 J	0.19 J
Semivolatile Organic Compounds (µg/l)													
Benzo(a)anthracene	0.0028	--	--	0.11 U	0.12 U	0.1 UJ	0.14 J	0.14 J	0.2 U	0.14 J	0.15 J	0.2 U	0.21 U
Benzo(a)pyrene	0.0028	--	--	0.11 U	0.12 U	0.1 UJ	0.2 U	0.21 U	0.2 U	0.21 U	0.034 J	0.2 U	0.21 U
Benzo(b)fluoranthene	0.0028	--	--	0.11 U	0.12 U	0.1 UJ	0.046 J	0.21 U	0.2 U	0.21 U	0.083 J	0.2 U	0.21 U
Di-n-butylphthalate	--	9.5	ECOTOX & RAIS 1/07 - Freshwater Aquatic Life	0.11 U	0.12 U	0.1 UJ	0.18 J	0.21 J	0.36 J	5.2 U	5.1 U	5.1 U	5.2 U
Fluoranthene	--	0.11	ECOTOX & RAIS 2/07 - Freshwater Aquatic Life	0.11 U	0.12 U	0.1 UJ	0.043 J	0.035 J	0.03 J	0.025 J	0.092 J	0.2 U	0.21 U
Indeno(1,2,3-cd)pyrene	0.0028	--	--	0.11 U	0.12 U	0.1 UJ	0.2 U	0.21 U	0.068 J	0.21 U	0.2 U	0.2 U	0.21 U
Naphthalene	--	330	ECOTOX/IRIS/RAIS 2/07	0.11 U	0.12 U	0.1 UJ	0.15 J	0.19 J	0.2 U	0.21 U	0.2 U	0.2 U	0.21 U
Phenanthrene	--	--	--	0.11 U	0.12 U	0.1 UJ	0.029 J	0.21 U	0.2 U	0.21 U	0.037 J	0.2 U	0.21 U
Pyrene	--	830	NRWQC 06/ RAIS 2/07	0.11 U	0.12 U	0.1 UJ	0.043 J	0.034 J	0.024 J	0.023 J	0.079 J	0.2 U	0.21 U
Pesticide/Polychlorinated Biphenyls (µg/l)													
delta-BHC	--	--	--	0.056 U	0.051 U	0.056 U	0.025 U	0.026 U	0.026 U	0.014 J	0.026 U	0.026 U	0.026 U
Endosulfan II	--	0.05	NC2B - Freshwater Aquatic Life	0.11 U	0.1 U	0.11 U	0.04	0.039	0.057	0.026 U	0.026 U	0.026 U	0.026 U
Total Metals (µg/l)													
Aluminum	--	6,500	NRWQC 06/RAIS 1/09	200 U	200 U	200 U	240	91 J	200 U	88 J	3,800	200 U	120 J
Barium	1,000	--	--	9.2 J	8.5 J	8.2 J	26	25	21	23	67	9.3 J	8.8 J
Cadmium	--	2	NC2B - Freshwater Aquatic Life (Narrative Standard)	5 U	5 U	5 U	2 U	2 U	2 U	2 U	2.1	2 U	2 U
Calcium	--	--	--	25,500	22,300	21,800	75,000	70,000	73,000	66,000	56,000	33,000	32,000
Chromium	--	50	NC2B - Freshwater Aquatic Life	10 U	10 U	10 U	5 U	5 U	5 U	5 U	12	5 U	5 U
Copper	--	7	NC2B - Freshwater Aquatic Life (Action Level)	25 U	25 U	25 U	1.9 J	1.6 J	1.8 J	5 U	11	5 U	5 U
Iron	--	1,000	NC2B - Freshwater Aquatic Life (Action Level)	688	714	573	630	630	850	1,900	33,000	2,000	1,300
Lead	--	25	NC2B - Freshwater Aquatic Life (Narrative Standard)	10 U	2.7 J	10 U	10 U	10 U	10 U	3.2 J	10	10 U	10 U
Magnesium	--	--	--	5,000 U	5,000 U	5,000 U	3,000 J	2,800 J	2,600 J	3,800 J	2,500 J	2,000 J	4,600 J
Manganese	200	--	--	21.6 UJ	15 UJ	15 UJ	69	65	77	40	410	76	64
Potassium	--	--	--	871 J	830 J	799 J	3,400 J	2,800 J	3,200 J	2,500 J	2,700 J	5,000 U	1,900 J
Sodium	--	--	--	5,000 U	5,000 U	5,000 U	9,700	9,100	14,000	9,300	8,400	5,300	22,000
Vanadium	--	--	--	1.8 J	2.3 J	1.6 J	50 U	50 U	50 U	50 U	22 J	50 U	50 U
Zinc	--	50	NC2B - Freshwater Aquatic Life (Action Level)	60 U	60 U	60 U	6.1 J	20 U	6.7 J	11 J	84	20 U	20 U
Dissolved Metals (µg/l)													
Barium, Dissolved	1,000	--	--	NA	NA	NA	24 J	22 J	15 J	20 J	16 J	8 J	10 J
Calcium, Dissolved	--	--	--	NA	NA	NA	74,000 J	72,000 J	68,000 J	61,000 J	53,000 J	30,000 J	32,000 J
Iron, Dissolved	--	1,000	NC2B - Freshwater Aquatic Life (Action Level)	NA	NA	NA	82 J	100 U	100 U	100 U	100 U	42 J	100 U
Lead, Dissolved	--	25	NC2B - Freshwater Aquatic Life (Narrative Standard)	NA	NA	NA	10 U	10 U	3.3 J	10 U	10 U	10 U	10 U
Magnesium, Dissolved	--	--	--	NA	NA	NA	2,900 J	2,800 J	2,400 J	3,500 J	2,200 J	1,800 J	4,400 J
Manganese, Dissolved	200	--	--	NA	NA	NA	67	64	38	35	30	69	63
Potassium, Dissolved	--	--	--	NA	NA	NA	2,700 J	2,900 J	4,000 J	2,100 J	2,600 J	5,000 U	1,900 J
Sodium, Dissolved	--	--	--	NA	NA	NA	9,800	9,500	13,000	8,900	8,700	5,000 U	21,000
Zinc, Dissolved	--	50	NC2B - Freshwater Aquatic Life (Action Level)	NA	NA	NA	20 U	20 U	20 U	9 J	6 J	20 U	20 U

Notes:

Bold box indicates exceedance of NC2B-SW-Human Health + Water Supply

[1] - NC2B-SW-Human Health and NC2B-SW-Water Supply were combined to show the most conservative criteria.
Shading indicates exceedance of other applicable federal criteria.

ECOTOX - US EPA ECOTOXicology Database
IRIS - EPA's Intigrated Risk Information System
µg/l - Micrograms per liter
J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
NC2B - North Carolina Administrative Code Title 15A, Subchapter 2B, Classifications and Water Quality Standards
NRWQC 06 - EPA's 2006 National Recommended Water Quality Criteria; 11/02 Human Health Calculation Matrix
RAIS - Risk Assessment Information System; Toxicity & Chemical Specific Factors database
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: *K. Howell/CLT*

TABLE 5-2
Sediment Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NC SSLs (January, 2010)	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs	IR86-SD01	IR86-SD02		IR86-SD105		IR86-SD106		IR86-SD107		IR86-SD108		IR86-SD109		IR86-SD110	
Sample ID					IR86-SD01-08B	IR86-SD02-08B	IR86-SD02D-08B	IR86-SD105-0-0_5-09D	IR86-SD105-10A	IR86-SD106-0-0_5-09D	IR86-SD106-10A	IR86-SD107-0-0_5-09D	IR86-SD107D-0-0_5-09D	IR86-SD108-0-0_5-09D	IR86-SD108-10A	IR86-SD109-0-0_5-09D	IR86-SD109-10A	IR86-SD110-0-0_5-09D	IR86-SD110-10A
Sample Date					06/11/08	06/11/08	06/11/08	11/08/09	03/16/10	11/08/09	03/16/10	11/10/09	11/10/09	11/08/09	03/16/10	11/08/09	03/16/10	11/08/09	03/16/10
Chemical Name																			
Volatile Organic Compounds (µg/kg)																			
1,2-Dichlorobenzene	--	240	380,000	190,000	6.9 UJ	11 UJ	11 U	15 UJ	NA	5.9 J	NA	6.3 UJ	4.6 U	2.8 J	NA	15 UJ	NA	11 U	NA
1,3-Dichlorobenzene	--	7,600	--	--	6.9 UJ	11 UJ	11 U	15 UJ	NA	16 UJ	NA	6.3 UJ	4.6 U	2.7 J	NA	15 UJ	NA	11 U	NA
1,4-Dichlorobenzene	--	70	12,000	2,400	6.9 UJ	11 UJ	11 U	15 UJ	NA	16 UJ	NA	6.3 UJ	4.6 U	2.6 J	NA	15 UJ	NA	11 U	NA
Acetone	--	24,000	63,000,000	6,100,000	6.9 UJ	11 UJ	11 U	59 UJ	NA	65 UJ	NA	25 U	18 U	25 J	NA	60 U	NA	50 J	NA
Semivolatile Organic Compounds (µg/kg)																			
Acenaphthylene	--	11,000	3,300,000	340,000				62 U	NA	36 R	NA	3.8 U	3.4 U	230 J	NA	72 U	NA	55 J	NA
Anthracene	--	660,000	17,000,000	1,700,000	4.6 U	3.4 J	3.9 J	93	NA	23 J	NA	4.1	9.3	1,200	NA	99	NA	170	NA
Benzo(a)anthracene	--	180	2,100	150	4.6 U	15	15	580	NA	100 J	NA	36	56	**4,700**	NA	620	NA	530	NA
Benzo(a)pyrene	--	59	210	15	1.7 J	19	16	**1,000**	NA	**240 J**	NA	43	66	**6,200**	NA	**1,100**	NA	**1,100**	NA
Benzo(b)fluoranthene	--	600	2,100	150	2.8 J	34	38	**2,300**	NA	530 J	NA	68	110	**12,000**	NA	**2,300**	NA	**2,500**	NA
Benzo(g,h,i)perylene	--	360,000	1,700,000	170,000	4.6 U	54	37	1,400	NA	320 J	NA	44	67	6,600	NA	1,300	NA	1,500	NA
Benzo(k)fluoranthene	--	5,900	21,000	1,500	2.4 J	31	22	570	NA	170 J	NA	23	38	4,000	NA	550	NA	670	NA
Butylbenzylphthalate	--	150,000	910,000	260,000	240 U	380 U	380 U	110 J	NA	2,700 U	NA	290 UJ	260 U	280 J	NA	2,700 U	NA	2,500 U	NA
Carbazole	--	--	--	--	240 U	380 U	380 U	170 J	NA	2,700 U	NA	290 UJ	260 U	980 J	NA	220 J	NA	240 J	NA
Chrysene	--	18,000	210,000	15,000	4.6 U	38	41	1,200	NA	300 J	NA	40	78	7,000	NA	1,300	NA	1,400	NA
Dibenz(a,h)anthracene	--	190	210	15	4.6 U	7.3 U	7.5	62 U	NA	36 R	NA	13	19	530 U	NA	72 U	NA	120 U	NA
Di-n-butylphthalate	--	19,000	6,200,000	610,000	240 U	380 U	380 U	930 U	NA	2,700 U	NA	290 UJ	30 J	230 J	NA	2,700 U	NA	2,500 U	NA
Fluoranthene	--	330,000	2,200,000	230,000	3 J	36	62	1,700	NA	370 J	NA	61	110	14,000	NA	1,900	NA	2,100	NA
Fluorene	--	56,000	2,200,000	230,000	240 U	380 U	380 U	62 U	NA	36 R	NA	3.8 U	1.5 J	530 U	NA	72 U	NA	120 U	NA
Indeno(1,2,3-cd)pyrene	--	2,000	2,100	150	7.9 J	29	25	1,100	NA	240 J	NA	41	63	**5,700**	NA	1,100	NA	1,200	NA
Naphthalene	--	210	18,000	3,600	240 U	380 U	380 U	62 U	NA	36 R	NA	1.7 J	1.7 J	530 U	NA	72 U	NA	120 U	NA
Phenanthrene	--	57,000	17,000,000	1,700,000	4.6 U	10	13	370	NA	81 J	NA	11	27	3,600	NA	400	NA	440	NA
Pyrene	--	220,000	1,700,000	170,000	4.6 U	38	54	1,100	NA	250 J	NA	47	92	8,100	NA	1,400	NA	1,300	NA
Pesticide/Polychlorinated Biphenyls (µg/kg)																			
4,4'-DDD	--	240	7,200	2,000	1.6 J	16	15	NA	9.1 U	NA	12 U	3.7 U	0.4 J	NA	94 UJ	NA	66 U	NA	61 U
4,4'-DDE	--	--	5,100	1,400	1.3 J	47	45	NA	9.1 U	NA	12 U	0.72 J	0.62 J	NA	94 UJ	NA	66 U	NA	6.8 J
4,4'-DDT	--	340	7,000	1,700	4.6 U	30	8.5 J	NA	7.8 J	NA	9.8 J	2.1 J	2 J	NA	94 UJ	NA	66 UJ	NA	17 J
Endosulfan I	--	5,600	370,000	37,000	2.4 U	3.8 U	3.8 U	NA	4.6 J	NA	6 U	1.9 U	1.8 U	NA	48 UJ	NA	34 U	NA	31 U
Endrin aldehyde	--	810	18,000	1,800	4.6 U	7.3 U	7.3 U	NA	9.1 U	NA	2.4 J	3.7 U	3.6 U	NA	22 J	NA	66 U	NA	61 U
Endrin ketone	--	810	18,000	1,800	4.6 U	7.3 U	7.3 U	NA	4.6 J	NA	6.4 J	3.7 U	3.6 U	NA	67 J	NA	16 J	NA	61 U
gamma-Chlordane	--	68	6,500	1,600	0.86 J	8.6 J	8.5 J	NA	4.7 U	NA	6 U	0.7 J	1.8 U	NA	48 UJ	NA	34 U	NA	31 U
Heptachlor epoxide	--	0.82	190	53	2.4 U	1.6 J	2 J	NA	4.7 U	NA	6 U	1.9 U	1.8 U	NA	48 UJ	NA	34 U	NA	31 U
Total Metals (mg/kg)																			
Aluminum	5,487	--	99,000	7,700	1,570	3,700	5,320	12,000	NA	11,000	NA	9,400	9,500	14,000	NA	17,000	NA	16,000	NA
Antimony	0.447	--	41	3.1	0.86 J	10.3 UJ	1.3 J	0.63 J	NA	0.66 J	NA	0.29 J	0.57 U	5.9	NA	0.66 J	NA	0.61 J	NA
Arsenic	0.626	5.8	1.6	0.39	1.1 J	**1.7 J**	**2.7**	**2.6**	NA	**2.4**	NA	0.85	1.1	0.8 U	NA	**2.8**	NA	**2.9**	NA
Barium	14.5	580	19,000	1,500	4.7 J	12.5 J	18.2 J	57	NA	48	NA	20	20	52	NA	39	NA	40	NA
Beryllium	0.103	--	200	16	0.74 U	0.86 U	1.2 U	0.51	NA	0.19 J	NA	0.036 J	0.059 J	0.23 J	NA	0.2 J	NA	0.27 J	NA
Cadmium	0.033	3	80	7	0.74 U	0.73 J	1.1 J	3.9	NA	3.1	NA	0.56	0.73	7.1	NA	4.7	NA	8.2	NA
Calcium	6,360	--	--	--	736 U	56,100	56,200	13,000	NA	35,000	NA	1,400	1,500	2,400	NA	6,100	NA	5,700	NA
Chromium	6.05	3.8	5.6	0.29	3.2	9.7	13.8	**24**	NA	**20**	NA	**11**	**11**	**31**	NA	**27**	NA	**32**	NA
Cobalt	0.294	--	30	2.3	7.4 U	0.59 J	0.93 J	4.7	NA	3.6	NA	1 J	1 J	6.8	NA	4.3	NA	7.9	NA
Copper	4.83	700	4,100	310	0.83 J	9.6	14.1	25	NA	15	NA	3.3	3.6	26	NA	17	NA	35	NA
Iron	3,245	150	72,000	5,500	1,690	4,770	7,150	6,900	NA	6,900	NA	3,400	3,400	6,900	NA	9,900	NA	11,000	NA
Lead	12.3	270	800	400	2.6	32.7	50.6	29	NA	22	NA	14	14	66	NA	45	NA	51	NA
Magnesium	238	--	--	--	736 U	967 U	1,220 U	1,700	NA	2,600	NA	410	420	830	NA	970	NA	970	NA
Manganese	13.7	65	2,300	180	5.6	16.3	20.5	110	NA	97	NA	14	16	44	NA	61	NA	65	NA
Mercury	0.081	1	31	2.3	0.15 U	0.17 U	0.23 U	0.052 J	NA	0.035 J	NA	0.098 U	0.013 J	0.078 J	NA	0.058 J	NA	0.11 J	NA
Nickel	1.21	130	2,000	160	5.9 U	6.9 U	9.7 U	15	NA	11	NA	2.6	3.1	16	NA	12	NA	19	NA
Potassium	116	--	--	--	70.5 J	224 J	292 J	620 J	NA	700 J	NA	390	440	610 J	NA	950 J	NA	870 J	NA
Selenium	0.563	2.1	510	39	5.2 U	6 U	8.5 U	0.98 J	NA	1 U	NA	0.6 U	0.57 U	28	NA	1.2 U	NA	1.2	NA
Silver	0.14	3.4	510	39	1.5 U	1.7 U	2.4 U	0.4 J	NA	0.24 J	NA	0.052 J	0.057 J	1.1	NA	0.31 J	NA	0.59	NA
Thallium	0.36	--	6.6	0.51	3.7 U	4.3 U	6.1 U	5.1 U	NA	5.2 U	NA	3 U	2.8 U	3.4 J	NA	5.8 U	NA	5 U	NA
Vanadium	8.9	--	520	39	5.7 J	17.5	24.3	26	NA	22	NA	15	16	30	NA	35	NA	37	NA
Zinc	10.8	1,200	31,000	2,300	9.9	87.7	129	160	NA	100	NA	12	16	160	NA	110	NA	190	NA
Wet Chemistry																			
% Solids (pct)	--	--	--	--	NA	NA	NA	46.8	35.6	45.2	28.1	81.2	85	61.5	34.6	43.3	50	49.3	53.3
Total organic carbon (TOC) (mg/kg)	--	--	--	--	NA	NA	NA	61,000	NA	90,000	NA	NA	NA	38,000	NA	NA	NA	43,000	NA

Notes:
Shading indicates exceedance of two times the mean base background concentration for surface soil
Bold box indicates exceedance of NCSSLs
Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
µg/kg - Micrograms per kilogram
J - Analyte present, value may or may not be accurate or precise
mg/kg - Milligrams per kilogram
NA - Not analyzed
NC SSLs - NC Department of Environment and Natural Resources' Federal Remediation Branch Soil Screening Levels
pct - Percent
R - Unreliable result
RSLs - USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: K. Ramsey/CLT
Checked By: T.Grim/CLT

TABLE 5-2
Sediment Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NC SSLs (January, 2010)	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs	IR86-SD112			IR86-SD113	
Sample ID					IR86-SD112-0-0_5-09D	IR86-SD112-10A	IR86-SD112D-10A	IR86-SD113-0-0_5-09D	IR86-SD113-10A
Sample Date					11/08/09	03/16/10	03/16/10	11/08/09	03/16/10
Chemical Name									
Volatile Organic Compounds (µg/kg)									
1,2-Dichlorobenzene	--	240	380,000	190,000	15 UJ	NA	NA	9.4 U	NA
1,3-Dichlorobenzene	--	7,600	--	--	15 UJ	NA	NA	9.4 U	NA
1,4-Dichlorobenzene	--	70	12,000	2,400	15 UJ	NA	NA	9.4 U	NA
Acetone	--	24,000	63,000,000	6,100,000	61 U	NA	NA	38 U	NA
Semivolatile Organic Compounds (µg/kg)									
Acenaphthylene	--	11,000	3,300,000	340,000	9.2 U	NA	NA	24 U	NA
Anthracene	--	660,000	17,000,000	1,700,000	66	NA	NA	20 J	NA
Benzo(a)anthracene	--	180	2,100	150	240	NA	NA	140	NA
Benzo(a)pyrene	--	59	210	15	360	NA	NA	160	NA
Benzo(b)fluoranthene	--	600	2,100	150	730	NA	NA	270	NA
Benzo(g,h,i)perylene	--	360,000	1,700,000	170,000	510	NA	NA	180	NA
Benzo(k)fluoranthene	--	5,900	21,000	1,500	290	NA	NA	93	NA
Butylbenzylphthalate	--	150,000	910,000	260,000	1,400 U	NA	NA	740 UJ	NA
Carbazole	--	--	--	--	1,400 U	NA	NA	740 UJ	NA
Chrysene	--	18,000	210,000	15,000	520	NA	NA	160	NA
Dibenz(a,h)anthracene	--	190	210	15	100	NA	NA	59	NA
Di-n-butylphthalate	--	19,000	6,200,000	610,000	1,400 U	NA	NA	740 UJ	NA
Fluoranthene	--	330,000	2,200,000	230,000	670	NA	NA	220	NA
Fluorene	--	56,000	2,200,000	230,000	10	NA	NA	24 U	NA
Indeno(1,2,3-cd)pyrene	--	2,000	2,100	150	460	NA	NA	160	NA
Naphthalene	--	210	18,000	3,600	6.8 J	NA	NA	24 U	NA
Phenanthrene	--	57,000	17,000,000	1,700,000	170	NA	NA	49	NA
Pyrene	--	220,000	1,700,000	170,000	730	NA	NA	180	NA
Pesticide/Polychlorinated Biphenyls (µg/kg)									
4,4'-DDD	--	240	7,200	2,000	NA	11 U	120 U	NA	7 U
4,4'-DDE	--	--	5,100	1,400	NA	11 U	120 U	NA	7 U
4,4'-DDT	--	340	7,000	1,700	NA	11 UJ	120 UJ	NA	7 UJ
Endosulfan I	--	5,600	370,000	37,000	NA	5.5 U	60 U	NA	3.6 U
Endrin aldehyde	--	810	18,000	1,800	NA	1.2 J	120 U	NA	7 U
Endrin ketone	--	810	18,000	1,800	NA	11 UJ	120 U	NA	7 UJ
gamma-Chlordane	--	68	6,500	1,600	NA	5.5 U	60 U	NA	3.6 U
Heptachlor epoxide	--	0.82	190	53	NA	5.5 U	60 U	NA	3.4 J
Total Metals (mg/kg)									
Aluminum	5,487	--	99,000	7,700	16,000	NA	NA	3,200	NA
Antimony	0.447	--	41	3.1	1.4	NA	NA	0.44 J	NA
Arsenic	0.626	5.8	1.6	0.39	**9.7**	NA	NA	**3.9**	NA
Barium	14.5	580	19,000	1,500	78	NA	NA	20	NA
Beryllium	0.103	--	200	16	1.2	NA	NA	0.2 J	NA
Cadmium	0.033	3	80	7	3.8	NA	NA	0.69	NA
Calcium	6,360	--	--	--	5,800	NA	NA	1,800	NA
Chromium	6.05	3.8	5.6	0.29	**36**	NA	NA	**5.7**	NA
Cobalt	0.294	--	30	2.3	5.4	NA	NA	2	NA
Copper	4.83	700	4,100	310	16	NA	NA	1.9	NA
Iron	3,245	150	72,000	5,500	30,000	NA	NA	14,000	NA
Lead	12.3	270	800	400	19	NA	NA	4.1	NA
Magnesium	238	--	--	--	1,100	NA	NA	300 J	NA
Manganese	13.7	65	2,300	180	66	NA	NA	55	NA
Mercury	0.081	1	31	2.3	0.081 J	NA	NA	0.013 J	NA
Nickel	1.21	130	2,000	160	14	NA	NA	2.2 J	NA
Potassium	116	--	--	--	990 J	NA	NA	220 J	NA
Selenium	0.563	2.1	510	39	2	NA	NA	0.76 U	NA
Silver	0.14	3.4	510	39	1.5	NA	NA	0.23 J	NA
Thallium	0.36	--	6.6	0.51	1.2 J	NA	NA	0.69 J	NA
Vanadium	8.9	--	520	39	52	NA	NA	8.2	NA
Zinc	10.8	1,200	31,000	2,300	130	NA	NA	19	NA
Wet Chemistry									
% Solids (pct)	--	--	--	--	34.7	31.1	28	64.8	47.1
Total organic carbon (TOC) (mg/kg)	--	--	--	--	40,000	NA	NA	NA	NA

Notes:
Shading indicates exceedance of two times the mean base background concentration for surface soil
Bold box indicates exceedance of NCSSLs
Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
µg/kg - Micrograms per kilogram
J - Analyte present, value may or may not be accurate or precise
mg/kg - Milligrams per kilogram
NA - Not analyzed
NC SSLs - NC Department of Environment and Natural Resources' Federal Remediation Branch Soil Screening Levels
pct - Percent
R - Unreliable result
RSLs - USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: K. Ramsey/CLT
Checked By: T.Grim/CLT

TABLE 5-3
Surface Soil Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NC SSLs (Jan. 2010)	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs	IR86-SS01	IR86-SS02	IR86-SS03	IR86-SS04	IR86-SS05		IR86-SS06	IR86-SS07	IR86-SS08	IR86-SS09	IR86-SS10	IR86-IS100	IR86-IS101	IR86-IS102	IR86-IS103		IR86-IS104
Sample ID					IR86-SS01-07D	IR86-SS02-07D	IR86-SS03-07D	IR86-SS04-07D	IR86-SS05-07D	IR86-SS05D-07D	IR86-SS06-07D	IR86-SS07-07D	IR86-SS08-07D	IR86-SS09-07D	IR86-SS10-07D	IR86-SS100-09D	IR86-SS101-0-0.5-09D	IR86-SS102-0-0.5-09D	IR86-SS103-0-0.5-09D	IR86-SS103D-0-0.5-09D	IR86-SS104-0-0.5-09D
Sample Date					12/07/07	12/07/07	12/07/07	12/07/07	12/07/07	12/07/07	12/07/07	12/07/07	12/07/07	12/07/07	12/07/07	10/07/09	10/09/09	10/09/09	10/09/09	10/09/09	10/09/09
Chemical Name																					
Volatile Organic Compounds (µg/kg)																					
2-Butanone	--	16,000	20,000,000	2,800,000	14 U	14 U	12 U	19 U	13 U	12 U	13 UJ	21 UJ	15 U	13 UJ	14 UJ	12 UJ	11 UJ	9.7 U	10 U	9.6 UJ	18 UJ
Acetone	--	24,000	63,000,000	6,100,000	14 U	14 U	12 U	19 U	13 U	12 U	13 UJ	24 UJ	20 U	13 UJ	14 UJ	4.9 J	22 UJ	19 U	21 U	19 UJ	37 UJ
Ethylbenzene	--	8,100	27,000	5,400	14 U	14 U	12 U	19 U	13 U	12 U	13 U	21 U	15 U	13 U	14 U	5.8 UJ	5.5 UJ	1.1 J	5.1 U	4.8 UJ	9.2 UJ
Isopropylbenzene	--	1,300	270,000	210,000	14 U	14 U	12 U	19 U	13 U	12 U	13 U	21 U	15 U	13 U	14 U	5.8 UJ	5.5 UJ	2.5 J	5.1 U	4.8 UJ	9.2 UJ
Methylcyclohexane	--	--	--	--	14 U	14 U	12 U	19 U	13 U	12 U	13 U	21 U	15 U	13 U	14 U	5.8 UJ	5.5 UJ	4.9 U	5.1 U	4.8 UJ	9.2 UJ
Methylene chloride	--	23	53,000	11,000	14 U	14 U	12 U	19 U	13 U	12 U	13 U	21 U	15 U	13 U	14 U	5.8 UJ	5.5 UJ	4.9 U	5.1 U	4.8 UJ	9.2 UJ
Toluene	--	5,500	820,000	500,000	14 U	14 U	12 U	19 U	13 U	12 U	13 U	21 U	15 U	13 U	14 U	5.8 UJ	5.5 UJ	4.9 U	5.1 U	4.8 UJ	9.2 UJ
Xylene, total	--	6,000	260,000	63,000	14 U	14 U	12 U	19 U	13 U	12 U	13 U	21 U	15 U	13 U	14 U	5.8 UJ	5.5 UJ	9	5.1 U	4.8 UJ	9.2 UJ
Semivolatile Organic Compounds (µg/kg)																					
Acenaphthene	--	8,400	3,300,000	340,000	360 U	380 U	370 U	370 U	360 U	360 U	360 U	400 U	370 U	390 U	360 U	3.7 U	4.4 U	3.7 U	3.5 U	3.6 U	79
Acenaphthylene	--	11,000	3,300,000	340,000	360 U	380 U	370 U	370 U	360 U	360 U	360 U	400 U	370 U	390 U	360 U	3.7 U	4.4 U	3.7 U	3.5 U	3.6 U	2.2 J
Acetophenone	--	--	2,500,000	780,000	360 U	87 J	370 U	370 U	360 U	360 U	360 U	400 U	370 U	390 U	360 U	280 R	330 U	280 R	270 UJ	270 UJ	290 R
Anthracene	--	660,000	17,000,000	1,700,000	360 U	380 U	370 U	370 U	360 U	360 U	360 U	400 U	370 U	390 U	360 U	3.7 U	2.5 J	3.8	3.5 U	3.6 U	140
Benzaldehyde	--	--	1,200,000	780,000	360 U	380 U	370 U	370 U	360 U	360 U	360 U	400 U	370 U	390 U	360 U	280 UJ	330 U	280 UJ	270 UJ	270 UJ	290 UJ
Benzo(a)anthracene	--	180	2,100	150	360 U	380 U	370 U	370 U	360 U	360 U	170 J	250 J	370 U	390 U	360 U	3.7 U	42	45 J	11	3.9	260
Benzo(a)pyrene	--	59	210	15	360 U	380 U	370 U	370 U	360 U	360 U	140 J	140 J	370 U	390 U	360 U	3.7 U	57	58 J	16 J	4.8 J	**220**
Benzo(b)fluoranthene	--	600	2,100	150	360 U	380 U	370 U	96 J	360 U	360 U	220 J	170 J	370 U	390 U	360 U	3.7 U	89	87 J	21 J	6.3 J	290
Benzo(g,h,i)perylene	--	360,000	1,700,000	170,000	360 U	380 U	370 U	370 U	360 U	360 U	360 U	400 U	370 U	390 U	360 U	3.7 U	50	60 J	20 J	5.1 J	190
Benzo(k)fluoranthene	--	5,900	21,000	1,500	360 U	380 U	370 U	370 U	360 U	360 U	190 J	190 J	370 U	390 U	360 U	3.7 U	32	34 J	8.2 J	2.5 J	140
bis(2-Ethylhexyl)phthalate	--	7,200	120,000	35,000	360 U	380 U	370 U	290 J	360 U	100 J	210 J	83 J	370 U	390 U	360 U	280 U	330 U	280 U	270 UJ	270 UJ	290 U
Butylbenzylphthalate	--	150,000	910,000	260,000	360 U	380 U	370 U	240 J	360 U	360 U	240 J	400 U	370 U	390 U	360 U	280 U	330 U	280 U	270 UJ	270 UJ	99 J
Carbazole	--	--	--	--	360 U	380 U	370 U	370 U	360 U	360 U	360 U	400 U	370 U	390 U	360 UJ	280 U	330 U	280 U	270 UJ	270 UJ	29 J
Chrysene	--	18,000	210,000	15,000	360 U	380 U	370 U	370 U	360 U	360 U	250 J	260 J	370 U	390 U	360 U	3.7 U	61	57 J	12	4.3	250
Dibenz(a,h)anthracene	--	190	210	15	360 U	380 U	370 U	370 U	360 U	360 U	360 U	400 U	370 U	390 U	360 U	3.7 U	4.4 U	3.7 U	3.5 U	3.6 U	3.9 U
Di-n-butylphthalate	--	19,000	6,200,000	610,000	360 U	380 U	370 U	80 J	360 U	360 U	240 J	400 U	370 U	390 U	360 U	280 U	330 U	280 U	270 UJ	270 UJ	290 U
Di-n-octylphthalate	--	38,000	120,000	35,000	360 U	380 U	370 U	370 U	360 U	360 U	360 U	400 U	370 U	390 U	360 U	280 U	330 U	47 J	270 UJ	270 UJ	290 U
Fluoranthene	--	330,000	2,200,000	230,000	360 U	380 U	370 U	370 U	360 U	360 U	350 J	460	370 U	87 J	360 U	3.7 U	91	69	15	5.3	540
Fluorene	--	56,000	2,200,000	230,000	360 U	380 U	370 U	370 U	360 U	360 U	360 U	400 U	370 U	390 U	360 U	3.7 U	4.4 U	3.7 U	3.5 U	3.6 U	60
Indeno(1,2,3-cd)pyrene	--	2,000	2,100	150	360 U	380 U	370 U	370 U	360 U	360 U	120 J	97 J	370 U	390 U	360 U	3.7 U	45	47 J	13 J	3.9 J	170
Naphthalene	--	210	18,000	3,600	360 U	380 U	370 U	370 U	360 U	360 U	360 U	400 U	370 U	390 U	360 U	3.7 U	4.4 U	3.7 U	3.5 U	3.6 U	12
Phenanthrene	--	57,000	17,000,000	1,700,000	360 U	380 U	370 U	370 U	360 U	360 U	81 J	310 J	370 U	390 U	360 U	3.7 U	13	11	3.5 U	3.6 U	360
Pyrene	--	220,000	1,700,000	170,000	360 U	380 U	370 U	370 U	360 U	360 U	290 J	340 J	370 U	390 U	360 U	1.7 J	68	71 J	13	5	430
Pesticide/Polychlorinated Biphenyls (µg/kg)																					
4,4'-DDD	--	240	7,200	2,000	0.94 J	3.8 U	3.7 U	3.7 U	3.6 U	3.6 U	3.6 U	4 U	3.7 U	0.95 J	3.6 UJ	3.6 U	4.4 U	1.7 J	0.73 J	0.55 J	1.3 J
4,4'-DDE	--	--	5,100	1,400	4.1	2 J	4.6	2.2 J	2.9 J	3.6	18 J	3.4 J	3.7 U	1.9 J	3.6 UJ	3.6 U	4.4 U	19	0.66 J	1.2 J	2.1 J
4,4'-DDT	--	340	7,000	1,700	2.7 J	3.8 U	1.2 J	3.7 U	3.6 U	3.6 U	9	2.5 J	3.7 U	1.6 J	3.6 UJ	3.6 U	4.4 U	3.5 J	3.5 U	3.5 U	6.9 J
alpha-Chlordane	--	68	6,500	1,600	1.6 J	1.9 U	2.6 J	1.9 U	1.8 U	1.8 U	1.9 U	1.7 J	1.9 U	1.3 J	1.9 UJ	1.9 U	2.2 U	1.9 U	1.8 U	1.8 U	4.6
beta-BHC	--	1.2	960	270	1.9 U	1.9 U	0.9 U	1.9 U	1.8 U	1.8 U	1.9 U	2 U	1.9 U	2 U	1.9 UJ	1.9 U	2.2 U	1.9 U	1.8 U	1.8 U	2 U
Dieldrin	--	0.81	110	30	0.99 J	0.96 J	3.7 U	3.7 U	3.6 U	3.6 U	3.6 U	4 U	3.7 U	0.8 J	3.6 UJ	3.6 U	4.4 U	0.88 J	1.3 J	1.7 J	5.7 J
Endosulfan I	--	5,600	370,000	37,000	1.9 U	1.9 U	1.9 U	1.9 U	1.8 U	1.8 U	1.9 U	2 U	1.9 U	2 U	1.9 UJ	1.9 U	2.2 U	1.9 U	1.8 U	1.8 U	2 U
Endosulfan II	--	5,600	370,000	37,000	5	0.84 J	3.7 U	3.7 U	3.6 U	3.6 U	3.6 U	4 U	3.7 U	3.9 U	3.6 UJ	3.6 U	4.4 U	2.7 J	3.5 U	3.5 U	2.4 J
Endosulfan sulfate	--	5,600	370,000	37,000	3.6 U	3.8 U	3.7 U	3.7 U	3.6 U	3.6 U	3.6 U	4 U	3.7 U	3.9 U	3.6 UJ	3.6 U	4.4 U	3.7 U	3.5 U	3.5 U	3.8 U
Endrin ketone	--	810	18,000	1,800	3.6 U	3.8 U	3.7 U	3.7 U	3.6 U	3.6 U	3.6 U	4 U	3.7 U	3.9 U	3.6 UJ	3.6 U	4.4 U	3.7 U	3.5 U	3.5 U	3.8 U
gamma-Chlordane	--	68	6,500	1,600	1.6 J	0.51 J	1.8 J	0.45 J	1.8 U	1.8 U	3.6 U	1.5 J	3.7 U	1.1 J	3.6 UJ	1.9 U	2.2 U	1.9 U	1 J	0.65 J	5.9
Heptachlor epoxide	--	0.82	190	53	1.9 U	1.9 U	1.9 U	1.9 U	1.8 U	1.8 U	1.9 U	2 U	1.9 U	2 U	1.9 UJ	1.9 U	2.2 U	1.9 U	1.8 U	1.8 U	2 U
Methoxychlor	--	22,000	310,000	31,000	19 U	19 U	19 U	19 U	1.8 U	1.8 U	19 U	20 U	1.9 U	2 U	19 UJ	19 U	22 U	19 U	18 U	18 U	20 U
Total Metals (mg/kg)																					
Aluminum	5,487	--	99,000	7,700	4,360	4,050	5,070	2,480	2,030	1,580	3,800	4,970	1,130	3,820	3,990	3,600	10,000	5,200	3,400	5,100	6,800
Antimony	0.447	--	41	3.1	6.6 U	6.8 U	6.7 U	6.7 U	6.5 U	6.5 U	6.6 U	7.3 U	6.8 U	7.2 U	6.6 U	0.56 UJ	0.67 UJ	0.57 UJ	0.54 UJ	0.54 UJ	0.26 J
Arsenic	0.626	5.8	1.6	0.39	1.6	0.98 J	1.5	0.67 J	1.1 U	1 U	**2.3**	0.88 J	1.1 U	1.1 J	0.63 J	**3.2**	1.4	**2.1**	1.5	**1.8**	**1.7**
Barium	14.5	580	19,000	1,500	9.4 J	12.1 J	10.8 J	18.6 J	12.3 J	10.3 J	17.9 J	27.1	14.1 J	16.1 J	11.3 J	22	23	38	28	23	17
Beryllium	0.103	--	200	16	0.55 U	0.56 U	0.56 U	0.55 U	0.54 U	0.52 U	0.54 U	0.6 U	0.56 U	0.6 U	0.53 U	0.19 J	0.14 J	0.16 J	0.19 J	0.17 J	0.081 J
Cadmium	0.033	3	80	7	0.55 U	0.048 J	0.081 J	1.6	0.064 J	0.52 U	0.47 J	0.087 J	0.56 U	0.59 J	0.063 J	0.6	0.46	0.6	0.51	0.41	0.93
Calcium	6,360	--	--	--	17,100	1,780	32,000	14,700	2,110	1,200	35,500	3,280	683	28,300	4,870	12,000	6,000	70,000	15,000	22,000	20,000
Chromium	6.05	3.8	5.6	0.29	**6.4**	**5.8**	**6.8**	**13.3**	3.5	2.7	**12.6**	**10.9**	1.4	**6.6**	4.2	**23**	**12**	**12**	**19**	**16**	**10**
Cobalt	0.294	--	30	2.3	5.5 U	5.6 U	5.6 U	5.5 U	5.4 U	5.2 U	5.4 U	6 U	5.6 U	6 U	5.3 U	2.5	0.78 J	1.8	0.95 J	1.3 J	1 J
Copper	4.83	700	4,100	310	2.4 J	2.4 J	2.2 J	5.8 J	1.6 J	1.1 J	7.2 J	7.3 J	1.3 J	8.3 J	2.1 J	1	3	6	1.2	1.9	4.8
Iron	3,245	150	72,000	5,500	4,120 J	2,900 J	4,020 J	2,310 J	1,520 J	1,490 J	3,840 J	1,760 J	499 J	2,660 J	2,550 J	2,700 J	4,000 J	3,300 J	2,100 J	2,700 J	3,700 J
Lead	12.3	270	800	400	11.5 J	11.1 J	12.2 J	42.1 J	5.9 J	3.8 J	61.3 J	99.9 J	3.7 J	18.8 J	9 J	0.19 J	12	3.7	0.74 J	2.7 J	27
Magnesium	238	--	--	--	370 J	145 J	617	471 J	97.6 J	72.1 J	1,280	352 J	67.4 J	450 J	177 J	410	590	1,900	520	700	620
Manganese	13.7	65	2,300	180	9.4 J	7.9 J	15.6 J	21.8 J	7.7 J	6.2 J	18.6 J	29.3 J	1.5 J	23.6 J	8.1 J	14	16	79	17	20	26
Mercury	0.081	1	31	2.3	0.047 J	0.11 UJ	0.11 UJ	0.048 J	0.1 UJ	0.1 UJ	0.06 J	0.076 J	0.11 UJ	0.12 UJ	0.1 UJ	0.092 U	0.11 U	0.094 U	0.09 U	0.09 U	0.098 U
Nickel	1.21	130	2,000	150	1.7 J	1.8 J	1.7 J	2.8 J	0.71 J	0.54 J	3 J	4.6 J	0.75 J	2.2 J	0.83 J	7.3 J	3.3	5.5	3.3	4.3	3.1
Potassium	116	--	--	--	171 J	96 J	227 J	98.8 J	68 J	46.9 J	328 J	150 J	35.4 J	94.4 J	126 J	480	370 J	1,500 J	410 J	460 J	240 J
Selenium	0.563	2.1	510	39	0.28 J	0.3 J	3.9 U	3.9 U	3.8 U	3.7 U	3.8 U	4.2 U	3.9 U	4.2 U	3.7 U	1.1	0.34 J	0.39 J	0.26 J	0.34 J	0.48 J
Silver	0.14	3.4	510	39	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1 U	1.1 U	1.2 U	1.1 U	1.2 U	1.1 U	0.28 U	0.34 U	0.28 U	0.27 U	0.27 U	0.29 U
Sodium	80.9	--	--	--	552 U	568 U	556 U	559 U	545 U	542 U	549 U	604 U	564 U	597 U	550 U	180 J	32 J	380	130 J	130 J	64 J
Thallium	0.36	--	6.6	0.51	2.8 U	2.8 U	0.35 J	0.41 J	2.7 U	2.6 U	0.4 J	0.4 J	2.8 U	3 U	2.7 U	0.53 J	3.4 U	2.8 U	2.7 U	2.7 U	2.9 U
Vanadium	8.9	--	520	39	13.6	11.1	12.1	8.5	4.7 J	3.7 J	16.6	22.5	4.9 J	8.5	7.4	15	18	10	11	12	13
Zinc	10.8	1,200	31,000	2,400	11.3	12	17.6	68.1	10.7	6 J	32.4	28.9	5.3 J	35.2	5.4 J	18	15	21	17	16	39
Wet Chemistry (mg/kg)																					
Cyanide	--	0.28	2,000	160	0.19 J	0.2 J	2.8 U	0.4 J	2.7 U	2.7 U	0.22 J	0.33 J	0.21 J	0.39 J	0.5 J	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs

Underline indicates exceedance of Adjusted Residential Soil RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

µg/kg - Micrograms per kilogram
J - Analyte present, value may or may not be accurate or precise
mg/kg - Milligrams per kilogram
NA - Not analyzed
NC SSLs - NC Department of Environment and Natural Resources' Federal Remediation Branch Soil Screening Levels
R - Unreliable result
RSLs - USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites

TABLE 5-3
Surface Soil Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NC SSLs (Jan. 2010)	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs	IR86-IS105	IR86-IS106	IR86-IS107	IR86-IS108	IR86-IS109	IR86-IS110	IR86-IS111	IR86-IS112	IR86-IS113	IR86-IS114	
Sample ID					IR86-SS105-0-0.5-09D	IR86-SS106-0-0.5-09D	IR86-SS107-0-0.5-09D	IR86-SS108-0-0.5-09D	IR86-SS109-09D	IR86-SS110-0-0.5-09D	IR86-SS111-0-0.5-09D	IR86-SS112-0-0.5-09D	IR86-SS113-0-0.5-09D	IR86-SS114-0-0.5-09D	IR86-SS114D-0-0.5-09D
Sample Date					10/10/09	10/10/09	10/10/09	10/11/09	10/08/09	10/11/09	10/11/09	10/12/09	10/12/09	10/13/09	10/13/09
Chemical Name															
Volatile Organic Compounds (µg/kg)															
2-Butanone	--	16,000	20,000,000	2,800,000	11 UJ	13 UJ	16 U	16 UJ	13 U	18 UJ	20 J	9.9 UJ	15 J	13 U	11 UJ
Acetone	--	24,000	63,000,000	6,100,000	22 UJ	26 UJ	31 U	32 UJ	25 U	130 J	140 J	6.7 J	230 J	9.5 J	23 UJ
Ethylbenzene	--	8,100	27,000	5,400	5.5 UJ	6.6 UJ	7.8 U	8.1 UJ	6.3 U	9.1 UJ	7.7 UJ	4.9 UJ	7.6 UJ	6.6 U	5.7 UJ
Isopropylbenzene	--	1,300	270,000	210,000	5.5 UJ	6.6 UJ	7.8 U	8.1 UJ	6.3 U	9.1 UJ	7.7 UJ	4.9 UJ	7.6 UJ	6.6 U	5.7 UJ
Methylcyclohexane	--	--	--	--	5.5 UJ	6.6 UJ	7.4 J	8.1 UJ	6.3 U	9.1 UJ	7.7 UJ	4.9 UJ	7.6 UJ	6.6 U	5.7 UJ
Methylene chloride	--	23	53,000	11,000	9.9 UJ	6.6 UJ	7.8 U	8.1 UJ	6.3 U	9.1 UJ	7.7 UJ	4.9 UJ	7.6 UJ	12	5.7 UJ
Toluene	--	5,500	820,000	500,000	4.2 J	6.6 UJ	53	8.1 UJ	6.3 U	9.1 UJ	7.7 UJ	4.9 UJ	7.6 UJ	6.6 U	5.7 UJ
Xylene, total	--	6,000	260,000	63,000	5.5 UJ	6.6 UJ	7.8 U	8.1 UJ	6.3 U	9.1 UJ	7.7 UJ	4.9 UJ	7.6 UJ	6.6 U	5.7 UJ
Semivolatile Organic Compounds (µg/kg)															
Acenaphthene	--	8,400	3,300,000	340,000	4.1 U	4.1 U	3.6 U	4.2 U	3.7 U	4.2 U	3.8 U	3.9 U	4.8 U	4.6 U	4.5 U
Acenaphthylene	--	11,000	3,300,000	340,000	4.1 U	4.1 U	3.6 U	4.2 U	3.7 U	4.2 U	3.8 U	3.9 U	4.8 U	4.6 U	4.5 U
Acetophenone	--	--	2,500,000	780,000	310 UJ	310 R	270 U	320 U	280 UJ	320 UJ	290 U	290 U	370 U	350 U	340 U
Anthracene	--	660,000	17,000,000	1,700,000	0.92 J	5.3	3.6 U	2.7 J	0.95 J	1 J	3.8 U	3.9 U	4.8 U	4.3 J	44 J
Benzaldehyde	--	--	1,200,000	780,000	310 UJ	310 U	270 U	320 U	280 UJ	320 UJ	290 U	290 U	30 J	350 U	340 U
Benzo(a)anthracene	--	180	2,100	150	8.7	38	5.7 J	30	10	7.6	1.8 J	3.6 J	9.4 J	47 J	240 J
Benzo(a)pyrene	--	59	210	15	12	49	5.7 J	41	10	11	3.5 J	3.6 J	9.1 J	47 J	**290 J**
Benzo(b)fluoranthene	--	600	2,100	150	17	73	8.1 J	67	17	19	5.7	4.6 J	14 J	84 J	360 J
Benzo(g,h,i)perylene	--	360,000	1,700,000	170,000	11		5.3 J	39	9.2	11	4	3.9 U	1.4 J	46 J	230 J
Benzo(k)fluoranthene	--	5,900	21,000	1,500	7.6	24	2.6 J	23	6.6	6.6	2.3 J	4	7.9	39 J	280 J
bis(2-Ethylhexyl)phthalate	--	7,200	120,000	35,000	310 UJ	310 U	270 U	320 U	280 UJ	320 UJ	290 U	290 U	370 U	41 J	140 J
Butylbenzylphthalate	--	150,000	910,000	260,000	310 UJ	310 U	270 U	320 U	280 UJ	320 UJ	290 U	290 U	370 U	350 U	60 J
Carbazole	--	--	--	--	310 UJ	310 U	270 U	320 U	280 UJ	320 UJ	290 U	290 U	370 U	350 U	46 J
Chrysene	--	18,000	210,000	15,000	11	48	6 J	45	16	13	3.3 J	3.9 UJ	3.6 J	62 J	290 J
Dibenz(a,h)anthracene	--	190	210	15	4.1 U	4.1 U	3.6 U	8.3	3.7 U	4.2 U	3.8 U	3.9 UJ	4.8 UJ	4.6 U	4.5 U
Di-n-butylphthalate	--	19,000	6,200,000	610,000	310 UJ	310 U	270 U	320 U	280 UJ	320 UJ	290 U	290 U	30 J	350 U	340 U
Di-n-octylphthalate	--	38,000	120,000	35,000	310 UJ	310 U	270 U	320 U	280 UJ	320 UJ	290 U	290 U	370 U	350 U	340 U
Fluoranthene	--	330,000	2,200,000	230,000	15	73	9.7 J	65	31	19	4.5	7.8 J	17 J	99 J	430 J
Fluorene	--	56,000	2,200,000	230,000	4.1 U	4.1 U	3.6 U	4.2 U	3.7 U	4.2 U	3.8 U	3.9 U	4.8 U	4.6 U	4.5 U
Indeno(1,2,3-cd)pyrene	--	2,000	2,100	150	8.7	37	4.4 J	33	7.7	9	3.3 J	3.9 UJ	2 J	46 J	220 J
Naphthalene	--	210	18,000	3,600	4.1 U	4.1 U	3.6 UJ	4.2 U	3.7 U	4.2 U	3.8 U	3.9 U	4.8 U	4.6 U	1.7 J
Phenanthrene	--	57,000	17,000,000	1,700,000	4.9	19	4.3 J	14	4.3	5.6	3.8 U	2.7 J	4.9	23 J	110 J
Pyrene	--	220,000	1,700,000	170,000	14	58	8.8 J	55	25	16	3.8	6	14	81 J	370 J
Pesticide/Polychlorinated Biphenyls (µg/kg)															
4,4'-DDD	--	240	7,200	2,000	14 J	4.2 J	3.6 U	0.71 J	6.4	4.2 U	3.8 UJ	3.9 U	3.9 J	4.6 U	1.3 J
4,4'-DDE	--	--	5,100	1,400	3.9 J	0.89 J	3.2 J	1.2 J	5.2	0.99 J	0.41 J	3.9 U	16	4.6 U	1.7 J
4,4'-DDT	--	340	7,000	1,700	5.1 J	2.1 J	3.6 UJ	4.3 U	1.5 J	5.8 J	3.8 UJ	3.9 U	15	4.6 U	4.5 U
alpha-Chlordane	--	68	6,500	1,600	30	0.74 J	1.9 U	2.2 U	1.9 U	9.3 J	2 UJ	2 U	2.5 U	2.3 U	2.3 U
beta-BHC	--	1.2	960	270	28	2.1 U	1.9 U	2.2 U	1.9 U	2.2 U	2 UJ	2 U	2.5 U	2.3 U	2.3 U
Dieldrin	--	0.81	110	30	4.1 U	4.1 U	3.6 U	4.3 U	0.57 J	4.2 U	3.8 UJ	3.9 U	4.8 U	4.6 U	4.5 U
Endosulfan I	--	5,600	370,000	37,000	34 J	2.1 U	1.9 U	2.2 U	1.9 U	2.2 U	2 UJ	2 U	2.5 U	2.3 U	2.3 U
Endosulfan II	--	5,600	370,000	37,000	4.8 J	3.4 J	3.6 U	4.3 U	3.7 U	8.8 J	3.8 UJ	3.9 U	4.8 U	4.6 U	2.7 J
Endosulfan sulfate	--	5,600	370,000	37,000	2.7 J	4.1 U	3.6 U	4.3 U	3.7 U	4.2 U	3.8 UJ	3.9 U	4.8 U	4.6 U	4.5 U
Endrin ketone	--	810	18,000	1,800	4.1 U	4.1 U	3.6 U	4.3 U	3.7 U	4.2 U	3.8 UJ	3.9 U	4.8 U	4.6 U	3.5 J
gamma-Chlordane	--	68	6,500	1,600	30 J	1.1 J	1.8 J	2.2 U	7 J	2.2 U	2 UJ	2 U	4.3 J	2.3 U	1.1 J
Heptachlor epoxide	--	0.82	190	53	2.4	2.1 U	1.9 U	2.2 U	1.9 U	2.2 U	2 UJ	2 U	8.4	2.3 U	2.3 U
Methoxychlor	--	22,000	310,000	31,000	21 U	9.5 J	19 UJ	22 U	19 U	51 J	20 UJ	20 U	25 U	23 U	2.9 J
Total Metals (mg/kg)															
Aluminum	5,487	--	99,000	7,700	8,300 J	10,000 J	3,500 J	8,700 J	3,100	7,800 J	14,000 J	15,000	3,100	8,000	7,400
Antimony	0.447	--	41	3.1	0.23 J	0.3 J	0.55 UJ	0.65 UJ	0.56 UJ	0.65 UJ	0.58 UJ	0.6 UJ	0.74 UJ	0.71 U	0.68 U
Arsenic	0.626	5.8	1.6	0.39	0.98	1.2	**2.2**	0.64 J	**2.3**	0.33 J	0.65	0.61	0.74 U	0.5 J	0.68 U
Barium	14.5	580	19,000	1,500	21	19	24	19	14	23	18	20	28	32	91
Beryllium	0.103	--	200	16	0.25 U	0.25 U	0.14 J	0.036 J	0.15 J	0.26 U	0.23 U	0.24 U	0.29 U	0.28 U	0.27 U
Cadmium	0.033	3	80	7	0.18	0.19	0.48	0.4	0.58	0.13	0.3	0.063 J	0.11 J	0.67	1.8
Calcium	6,360	--	--	--	3,400	26,000	26,000	3,400	37,000	650	940	160 J	260 J	2,100	2,600
Chromium	6.05	3.8	5.6	0.29	**11**	**11**	**20**	**9.6**	**15**	**7.9**	**13**	**13**	3.4	**8.4**	**9.5**
Cobalt	0.294	--	30	2.3	1.8	0.96 J	1.1 J	0.67 J	0.9 J	0.81 J	0.98 J	1.4 J	0.61 J	0.72 J	0.75 J
Copper	4.83	700	4,100	310	5.4	2.4	2.1	2.4	1.3	2.7	1.8	1.7	1.4	11	6.6
Iron	3,245	150	72,000	5,500	4,500 J	3,900 J	3,200 J	2,700 J	2,100 J	2,900 J	4,200 J	3,700 J	2,600 J	2,600	2,500
Lead	12.3	270	800	400	12	11	1.5	11	1.3	11	9.6	8.9	15	15	17
Magnesium	238	--	--	--	360	980	950	490	720	280 J	510	420	99 J	420	380
Manganese	13.7	65	2,300	180	26 J	29 J	43 J	14 J	14	18 J	11 J	12	9.5	21	36
Mercury	0.081	1	31	2.3	0.1 U	0.1 U	0.091 U	0.036 J	0.093 U	0.054 J	0.096 U	0.051 J	0.064 J	0.037 J	0.05 J
Nickel	1.21	130	2,000	150	3.7	3.6	4.7	2.5 J	4.8	2.4 J	2.4	3.2	1.5 J	2.6 J	3.6
Potassium	116	--	--	--	410	540	900	370	360 J	290 J	420	490 J	370 U	350	330 J
Selenium	0.563	2.1	510	39	0.3 J	0.25 J	0.49 J	0.65 U	0.9	0.65 U	0.37 J	0.6 U	0.74 U	0.71 U	0.68 U
Silver	0.14	3.4	510	39	0.31 U	0.31 U	0.28 U	0.32 U	0.27 J	0.32 U	0.29 U	0.3 U	0.37 U	0.35 U	0.34 U
Sodium	80.9	--	--	--	60 J	94 J	340	49 J	220 J	43 J	63 J	49 J	54 J	53 J	97 J
Thallium	0.36	--	6.6	0.51	3.1 U	3.1 U	2.8 U	3.2 U	2.8 U	3.2 U	2.9 U	3 U	3.7 U	3.5 U	3.4 U
Vanadium	8.9	--	520	39	16	17	13	14	11	14	19	20	11	13	13
Zinc	10.8	1,200	31,000	2,400	19	24	14	11	12	13	5.9	4.6	3.4 J	23 J	92 J
Wet Chemistry (mg/kg)															
Cyanide	--	0.28	2,000	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs

Underline indicates exceedance of Adjusted Residential Soil RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

µg/kg - Micrograms per kilogram
J - Analyte present, value may or may not be accurate or precise
mg/kg - Milligrams per kilogram
NA - Not analyzed
NC SSLs - NC Department of Environment and Natural Resources' Federal Remediation Branch Soil Screening Levels
R - Unreliable result
RSLs - USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites

TABLE 5-4
Subsurface Soil Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background SB 2X Mean	NC SSLs (Jan. 2010)	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs	IR86-IS100	IR86-IS101	IR86-IS102	IR86-IS103	IR86-IS104	IR86-IS105	IR86-IS106	IR86-IS107		
Sample ID					IR86-SB100-06-07-09D	IR86-SB101-06-07-09D	IR86-SB102-07-08-09D	IR86-SB103-08-09-09D	IR86-SB104-08-09-09D	IR86-SB105-05-06-09D	IR86-SB106-07-08-09D	IR86-SB107-16-17-09D	IR86-SB107-07-08-09D	IR86-SB107D-07-08-09D
Sample Date					10/08/09	10/08/09	10/09/09	10/09/09	10/09/09	10/09/09	10/10/09	10/10/09	10/11/09	10/11/09
Chemical Name														
Volatile Organic Compounds (µg/kg)														
Acetone	--	24,000	63,000,000	6,100,000	19 U	17 U	17	21 J	25 J	16 U	23 U	21 U	39 U	22 UJ
Semivolatile Organic Compounds (µg/kg)														
Acetophenone	--	--	2,500,000	780,000	300 U	300 R	290 U	280 R	320 UJ	300 U	310 U	300 U	300 U	300 U
Benzaldehyde	--	--	1,200,000	780,000	300 U	300 UJ	290 U	280 UJ	320 UJ	300 U	310 U	300 U	300 U	300 U
Benzo(a)anthracene	--	180	2,100	150	4 U	4 U	3.9 U	3.8 U	4.2 U	3.9 U	4.1 U	4 U	4 U	3.9 U
Benzo(a)pyrene	--	59	210	15	4 U	4 U	3.9 U	3.8 U	4.2 U	3.9 U	4.1 U	4 U	4 U	3.9 U
Benzo(b)fluoranthene	--	600	2,100	150	4 U	4 U	3.9 U	3.8 U	4.2 U	3.9 U	4.1 U	4 U	4 U	3.9 U
Benzo(g,h,i)perylene	--	360,000	1,700,000	170,000	4 U	4 U	3.9 U	3.8 U	4.2 U	3.9 U	4.1 U	4 U	4 U	3.9 U
Benzo(k)fluoranthene	--	5,900	21,000	1,500	4 U	4 U	3.9 U	3.8 U	4.2 U	3.9 U	4.1 U	4 U	4 U	3.9 U
Chrysene	--	18,000	210,000	15,000	4 U	4 U	3.9 U	3.8 U	4.2 U	3.9 U	4.1 U	4 U	4 U	3.9 U
Fluoranthene	--	330,000	2,200,000	230,000	2.1 J	4 U	3.9 U	3.8 U	4.2 U	3.9 U	4.1 U	4 U	4 U	3.9 U
Indeno(1,2,3-cd)pyrene	--	2,000	2,100	150	4 U	4 U	3.9 U	3.8 U	4.2 U	3.9 U	4.1 U	4 U	4 U	3.9 U
Naphthalene	--	210	18,000	3,600	4 U	4 U	2.9 J	3.8 U	4.2 U	3.9 U	4.1 U	4 U	4 U	3.9 U
Phenanthrene	--	57,000	17,000,000	1,700,000	4 U	4 U	3.9 U	3.8 U	4.2 U	3.9 U	4.1 U	4 U	4 U	3.9 U
Pyrene	--	220,000	1,700,000	170,000	1.8 J	4 U	3.9 U	3.8 U	4.2 U	3.9 U	4.1 U	4 U	4 U	3.9 U
Pesticide/Polychlorinated Biphenyls (µg/kg)														
4,4'-DDD	--	240	7,200	2,000	3.9 UJ	3.9 U	3.9 U	3.7 U	4.2 U	3.8 U	4.1 U	4 U	4 U	3.9 U
4,4'-DDE	--	--	5,100	1,400	3.9 UJ	3.9 U	1 J	3.7 U	4.2 U	3.8 U	4.1 U	4 U	4 U	3.9 U
4,4'-DDT	--	340	7,000	1,700	1.5 J	3.9 U	3.9 U	3.7 U	4.2 U	3.8 U	1.7 J	4 U	4 U	3.9 U
Aldrin	--	--	100	29	2 UJ	2 U	2 U	1.9 U	2.1 U	2 U	2.1 U	2 U	2.1 U	2 U
Dieldrin	--	0.81	110	30	3.9 UJ	3.9 U	3.9 U	3.7 U	4.2 U	3.8 U	4.1 U	4 U	4 U	3.9 U
Endosulfan II	--	5,600	370,000	37,000	0.83 J	3.9 U	3.9 U	3.7 U	4.2 U	0.41 J	4.5	4 U	4 U	0.55 J
Endosulfan sulfate	--	5,600	370,000	37,000	3.9 UJ	3.9 U	3.9 U	3.7 U	4.2 U	3.8 U	4.1 U	4 U	4 U	3.9 U
Endrin ketone	--	810	19,000	1,800	3.9 UJ	3.9 U	3.9 U	3.7 U	4.2 U	3.8 U	4.1 U	4 U	4 U	3.9 U
Heptachlor epoxide	--	0.82	190	53	2 UJ	2 U	2 U	1.9 U	2.1 U	2 U	2.1 U	2 U	2.1 U	2 U
Total Metals (mg/kg)														
Aluminum	10,369	--	99,000	7,700	9,600	14,000	19,000	15,000	5,800	16,000	38,000 J	6,900 J	18,000 J	20,000 J
Antimony	0.36	--	41	3.1	0.61 UJ	0.6 UJ	0.6 UJ	0.58 UJ	0.64 UJ	0.59 UJ	0.63 UJ	0.6 UJ	0.61 UJ	0.6 UJ
Arsenic	2.12	5.8	1.6	0.39	0.47 J	0.49 J	**2.6**	0.79	0.64 U	0.91	1.2 J	0.56 J	0.39 J	0.53 J
Barium	16.6	580	18,000	1,500	14	20	21	20	8.3	17	44	24	26	22
Beryllium	0.165	--	200	16	0.054 J	0.058 J	0.093 J	0.04 J	0.26 U	0.036 J	0.42	0.24 U	0.24 U	0.076 J
Cadmium	0.023	3	80	7	0.12 U	0.12 U	0.12 U	0.12 U	0.13 U	0.12 U	0.041 J	0.12	0.021 J	0.025 J
Calcium	441	--	--	--	740	100 J	99 J	180 J	50 J	240 J	120 J	130 J	89 J	49 J
Chromium	14.5	3.8	5.6	0.29	**8.7**	**13**	**18**	**14**	**6.9**	**14**	**41**	**9.9**	**15**	**17**
Cobalt	0.822	--	30	2.3	1 J	0.96 J	1.8	1.3 J	0.58 J	1.4 J	2.1	0.97 J	1.3 J	1.3 J
Copper	2.56	700	4,100	310	0.15 J	1.1	0.3 U	0.54	0.52	0.19 J	3.2	1.1	0.42 J	0.11 J
Iron	5,439	150	72,000	5,500	2,300 J	2,700 J	15,000 J	3,800 J	1,300 J	4,900 J	8,300 J	1,800 J	4,000 J	6,600 J
Lead	8.49	270	800	400	7	13	0.6 U	11	5.3	7.8	15	4.1	7.3	8
Magnesium	363	--	--	--	340	570	700	630	220 J	560	1,600	330	660	660
Manganese	9.25	65	2,300	180	8.2	12	19	19	11	15	24 J	16 J	19 J	15 J
Mercury	0.071	1	31	2.3	0.1 U	0.1 U	0.099 U	0.096 U	0.11 U	0.098 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	2.27	130	2,000	150	1.6 J	2 J	2.7	2.3	0.99 J	2.7	8.1	1.7 J	2.8	2.9
Potassium	361	--	--	--	220 J	360 J	490 J	480 J	330 J	430 J	2,200	470	580	510
Selenium	0.505	2.1	510	39	0.61 U	0.6 U	0.23 J	0.3 J	0.64 U	0.41 J	0.84 J	0.6 U	0.28 J	0.6 U
Sodium	68.3	--	--	--	300 U	300 U	33 J	31 J	320 U	20 J	110 J	40 J	55 J	50 J
Vanadium	17.2	--	520	39	13	16	33	18	7.7	21	37	8.6	21	24
Zinc	6.59	1,200	31,000	2,400	3.7	4.6	6	6.9	3.6	5.9	16	5.8	6.2	6.2

Notes:

Shading indicates exceedance of two times the mean base background concentration for subsurface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs

Underline indicates exceedance of Adjusted Residential Soil RSLs

µg/kg - Micrograms per kilogram
J - Analyte present, value may or may not be accurate or precise
mg/kg - Milligrams per kilogram
NA - Not analyzed
NC SSLs - NC Department of Environment and Natural Resources' Federal Remediation Branch Soil Screening Levels
R - Unreliable Result
RSLs - USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: K. Ramsey/CLT
Checked By: T.Grim/CLT

TABLE 5-4
Subsurface Soil Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID / Sample ID / Sample Date / Chemical Name	Camp Lejeune Background SB 2X Mean	NC SSLs (Jan. 2010)	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs	IR86-IS108	IR86-IS109	IR86-IS110	IR86-IS111	IR86-IS112	IR86-IS113	IR86-IS114
Sample ID					IR86-SB108-05-06-09D	IR86-SB109-07-08-09D	IR86-SB110-06-07-09D	IR86-SB111-01-02-09D	IR86-SB112-05-06-09D	IR86-SB113-02-03-09D	IR86-SB114-05-06-09D
Sample Date					10/11/09	10/06/09	10/12/09	10/12/09	10/12/09	10/12/09	10/13/09
Volatile Organic Compounds (µg/kg)											
Acetone	--	24,000	63,000,000	6,100,000	25	15 J	22 UJ	28 U	2.5 J	18 UJ	3.1 J
Semivolatile Organic Compounds (µg/kg)											
Acetophenone	--	--	2,500,000	780,000	300 U	320 R	350 U	290 U	340 U	290 U	24 J
Benzaldehyde	--	--	1,200,000	780,000	300 U	320 UJ	350 U	290 U	340 U	290 U	28 J
Benzo(a)anthracene	--	180	2,100	150	1.4 J	4.2 U	4.7 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.4 U
Benzo(a)pyrene	--	59	210	15	2.2 J	4.2 U	4.7 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.4 U
Benzo(b)fluoranthene	--	600	2,100	150	6.3	4.2 U	4.7 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.4 U
Benzo(g,h,i)perylene	--	360,000	1,700,000	170,000	4.5	4.2 U	4.7 U	3.9 U	4.4 U	3.9 U	4.4 U
Benzo(k)fluoranthene	--	5,900	21,000	1,500	1.8 J	4.2 U	4.7 U	3.9 U	4.4 U	3.9 U	4.4 U
Chrysene	--	18,000	210,000	15,000	3.8 J	4.2 U	4.7 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.4 U
Fluoranthene	--	330,000	2,200,000	230,000	2.8 J	4.2 U	4.7 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.4 U
Indeno(1,2,3-cd)pyrene	--	2,000	2,100	150	3.5 J	4.2 U	4.7 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.4 U
Naphthalene	--	210	18,000	3,600	4 U	4.2 U	4.7 U	3.9 U	4.4 U	3.9 U	4.4 U
Phenanthrene	--	57,000	17,000,000	1,700,000	4 U	4.2 U	4.7 U	3.9 U	4.4 U	3.9 U	4.2 J
Pyrene	--	220,000	1,700,000	170,000	2.6 J	4.2 U	4.7 U	3.9 U	4.4 U	3.9 U	4.4 U
Pesticide/Polychlorinated Biphenyls (µg/kg)											
4,4'-DDD	--	240	7,200	2,000	11	1.3 J	4.7 U	3.8 U	4.4 U	3.9 U	6.5 J
4,4'-DDE	--	--	5,100	1,400	1.2 J	2.7 J	4.7 U	3.8 U	4.4 U	3.9 U	9.1 J
4,4'-DDT	--	340	7,000	1,700	1.2 J	1.5 J	4.7 U	3.8 U	4.4 U	3.9 U	5.9 J
Aldrin	--	--	100	29	2.1 U	2.2 U	2.4 U	2 U	2.3 U	2 U	2 J
Dieldrin	--	0.81	110	30	4 U	4.2 U	4.7 U	3.8 U	4.4 U	3.9 U	0.69 J
Endosulfan II	--	5,600	370,000	37,000	4 U	4.2 U	4.7 U	3.8 U	3.5 J	3.9 U	4.3 U
Endosulfan sulfate	--	5,600	370,000	37,000	0.92 J	4.2 U	4.7 U	3.8 U	4.4 U	3.9 U	4.3 U
Endrin ketone	--	810	19,000	1,800	4 U	4.2 U	4.7 U	3.8 U	4.4 U	3.9 U	17 J
Heptachlor epoxide	--	0.82	190	53	2.1 U	2.2 U	2.4 U	2 U	2.3 U	2 U	6.7 J
Total Metals (mg/kg)											
Aluminum	10,369	--	99,000	7,700	18,000 J	9,000	52,000	13,000	43,000	14,000	9,200
Antimony	0.36	--	41	3.1	0.26 J	0.64 UJ	0.32 J	0.25 J	0.44 J	0.6 UJ	0.67 U
Arsenic	2.12	5.8	1.6	0.39	**1.9**	1.1	**16**	0.59 U	**20**	0.61	0.67 U
Barium	16.6	580	18,000	1,500	22	34	52	15	43	15	13
Beryllium	0.165	--	200	16	0.078 J	0.12 J	0.54	0.24 U	0.52	0.24 U	0.27 U
Cadmium	0.023	3	80	7	0.39	0.066 J	0.27	0.035 J	0.32	0.021 J	0.065 J
Calcium	441	--	--	--	1,100	2,800	91 J	26 J	79 J	29 J	530
Chromium	14.5	3.8	5.6	0.29	**20**	**8.7**	**63**	**13**	**58**	**13**	**9**
Cobalt	0.822	--	30	2.3	1.4 J	0.56 J	2.8	1 J	2.2	1.1 J	0.79 J
Copper	2.56	700	4,100	310	2.6	1.6	4.6	0.62	5	0.3 U	1.5
Iron	5,439	150	72,000	5,500	6,800 J	2,900 J	24,000 J	2,700 J	25,000 J	5,400 J	2,500
Lead	8.49	270	800	400	19	12	20	6.8	19	6.6	7.8
Magnesium	363	--	--	--	760	280 J	2,200	450	1,800	480	200 J
Manganese	9.25	65	2,300	180	15 J	11	23	13	18	11	7.3
Mercury	0.071	1	31	2.3	0.1 U	0.019 J	0.12 U	0.098 U	0.047 J	0.034 J	0.037 J
Nickel	2.27	130	2,000	150	3.5	1.5 J	8.2	2.1 J	6.1	1.9 J	1.4 J
Potassium	361	--	--	--	630	200 J	2,500 J	430 J	1,900 J	350 J	270 J
Selenium	0.505	2.1	510	39	0.61 U	0.69	0.67 J	0.59 U	0.92 J	0.6 U	0.67 U
Sodium	68.3	--	--	--	65 J	22 J	130 J	40 J	100 J	41 J	48 J
Vanadium	17.2	--	520	39	28	11	100	16	120	20	13
Zinc	6.59	1,200	31,000	2,400	12	4.8	19	4.3	16	3.9	2.3 J

Notes:

Shading indicates exceedance of two times the mean base background concentration for subsurface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs

Underline indicates exceedance of Adjusted Residential Soil RSLs

µg/kg - Micrograms per kilogram
J - Analyte present, value may or may not be accurate or precise
mg/kg - Milligrams per kilogram
NA - Not analyzed
NC SSLs - NC Department of Environment and Natural Resources' Federal Remediation Branch Soil Screening Levels
R - Unreliable Result
RSLs - USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: K. Ramsey/CLT
Checked By: T.Grim/CLT

TABLE 5-5
Surficial Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NCGWQS (January, 2010)*[1]	IR86-MW03	IR86-MW09	IR86-MW10IW	IR86-MW27IW	IR86-MW38IWA	IR86-MW39	IR86-MW40		IR86-MW41	IR86-MW47	IR86-MW48	IR86-MW52	IR86-MW53	IR86-MW56		IR86-MW58		
Sample ID			IR86-GW03-09D	IR86-GW09-09D	IR86-GW10IW-09D	IR86-GW27IW-09D	IR86-GW38IWA-09D	IR86-GW39-10A	IR86-GW40-09D	IR86-GW40D-09D	IR86-GW41-09D	IR86-GW47-09D	IR86-GW48-09D	IR86-GW52-09D	IR86-GW53-09D	IR86-GW56-09D	IR86-GW56-09D	IR86-GW58-09D	IR86-GW58-10A	IR86-GW58D-10A
Sample Date			12/14/09	12/11/09	12/14/09	12/10/09	12/10/09	01/13/10	12/15/09	12/15/09	12/07/09	12/09/09	12/13/09	12/09/09	12/08/09	12/16/09	03/16/10	12/16/09	03/16/10	03/16/10
Chemical Name																				
Volatile Organic Compounds (µg/L)																				
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	--	200,000	1 U	1 U	620	1.5	1 U	1 U	1 U	1 U	28	1 U	1 U	1 U	1 U	1 U	NA	1 U	NA	NA
1,1-Dichloroethane	--	6	1 U	1 U	3.4	0.19 J	1 U	1 U	0.3 J	0.35 J	0.52 J	0.36 J	0.67 J	1 U	0.2 J	1 U	NA	1 U	NA	NA
1,1-Dichloroethene	--	7	1 U	1 U	1 U	0.6 J	1 U	1 U	1 U	1 U	0.63 J	1 U	1 U	1 U	1 U	2.3	NA	0.48 J	NA	NA
2-Hexanone	--	280	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U	NA	NA
Benzene	--	1	1 U	1 U	1.9	0.75 J	0.22 J	0.11 J	1 U	1 U	0.34 J	9.6	0.86 J	11	1 U	4.3	NA	1.2 J	NA	NA
Carbon disulfide	--	700	1 U	1 U	1 U	1 U	1 U	0.6 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 UJ	NA	NA
Chloroform	--	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	2 J	NA	NA
Chloromethane	--	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.3 J	1 U	1 U	NA	1 U	NA	NA
cis-1,2-Dichloroethene	--	70	1 U	1 U	37	15	0.57 J	1 U	1.6	1.4	4.2	0.7 J	1.5	0.22 J	1 U	28	NA	150 J	NA	NA
Cyclohexane	--	1,300	1 U	1 U	1.5	32	1 U	0.61 J	1 U	1 U	1 U	8	4.7	1 U	1 U	1 U	NA	1 U	NA	NA
Dichlorodifluoromethane (Freon-12)	--	1,000	1 U	1 U	51	1.4	1 U	1 U	1 UJ	1 UJ	1.8	1 U	1 U	1 U	1 U	1 U	NA	2.8 J	NA	NA
Ethylbenzene	--	600	1 U	1 U	0.92 J	1 U	1 U	0.83 J	1 U	1 U	1 U	1 U	1 U	4.6	1 U	1 U	NA	1 U	NA	NA
Isopropylbenzene	--	70	1 U	1 U	1 U	1 U	1 U	0.12 J	1 U	1 U	1 U	1 U	1 U	0.46 J	1 U	1 U	NA	1 U	NA	NA
Methyl-tert-butyl ether (MTBE)	--	20	1 U	1 U	1 U	1 U	1 U	66	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	NA	NA
Methylcyclohexane	--	--	5 U	5 U	5 U	2.6 J	5 U	5 U	5 U	5 U	5 U	4.1 J	5 U	5 U	5 U	5 U	NA	5 U	NA	NA
Tetrachloroethene	--	0.7	1 U	1 U	190	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	NA	NA
Toluene	--	600	1 U	1 U	2.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5.1	1 U	1 U	NA	0.48 J	NA	NA
trans-1,2-Dichloroethene	--	100	1 U	1 U	1.1	0.22 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.6	NA	3.7 J	NA	NA
Trichloroethene	--	3	0.5 U	0.5 U	54	13	1.3	0.5 U	3.4	3.2	3.3	8	0.56	0.5 U	0.5 U	2.4	NA	52 J	NA	NA
Vinyl chloride	--	0.03	0.5 U	0.5 U	19	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	68 J	NA	NA
Xylene, total	--	500	0.5 U	0.5 U	6.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	6.8	0.5 U	0.5 U	NA	0.5 U	NA	NA
Semivolatile Organic Compounds (µg/L)																				
Acenaphthylene	--	200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3	NA	0.29	NA	NA
Benzo(a)pyrene	--	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	0.2 U	NA	NA
Benzo(b)fluoranthene	--	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	0.2 U	NA	NA
Benzo(g,h,i)perylene	--	200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	0.2 U	NA	NA
Benzo(k)fluoranthene	--	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	0.2 U	NA	NA
bis(2-Ethylhexyl)phthalate	--	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	5.1 U	NA	NA
Dibenz(a,h)anthracene	--	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	0.2 U	NA	NA
Fluorene	--	300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	0.2 U	NA	NA
Indeno(1,2,3-cd)pyrene	--	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	0.2 U	NA	NA
Naphthalene	--	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	0.19 J	NA	NA
Pesticide/Polychlorinated Biphenyls (µg/L)																				
4,4'-DDD	--	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.023 J	NA	0.026 UJ	NA	NA
Total Metals (µg/L)																				
Aluminum	1,886	3,700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	390 U	NA	1,200	NA	NA
Antimony	3.28	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 U	NA	3.4 J	NA	NA
Arsenic	5.77	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 U	NA	10 U	NA	NA
Barium	86.2	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	16 J	NA	39	NA	NA
Calcium	69,078	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	160,000	NA	110,000	NA	NA
Chromium	3.13	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	2.7 J	NA	NA
Copper	2.76	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.4 J	NA	5 U	NA	NA
Iron	5,999	300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,900	NA	11,000	NA	NA
Lead	2.8	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.1 J	NA	6.8 J	NA	NA
Magnesium	6,363	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4,200 J	NA	6,500	NA	NA
Manganese	214	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	51	NA	170	NA	NA
Potassium	3,277	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,000 J	NA	3,000 J	NA	NA
Silver	0.77	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.3 J	NA	1.7 J	NA	NA
Sodium	22,508	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	23,000 J	NA	28,000 J	NA	NA
Zinc	42.1	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.4 J	NA	9 J	NA	NA
Natural Attenuation Indicator Parameters																				
Alkalinity (mg/L)	--	--	6 J	39	7.2 J	180	10 U	28	17	NA	290	59	40	280	140	430	NA	290	NA	NA
Chloride (mg/L)	--	--	6.9 B	6 B	38 B	17 B	16 B	18 B	14 B	NA	12 B	6 B	18 B	13 B	7.4 B	15 B	NA	17 B	NA	NA
Ethane (µg/L)	--	--	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	10 U	NA	10 U	NA	NA
Ethene (µg/L)	--	--	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	10 U	NA	10 U	NA	NA
Methane (µg/L)	--	--	10	13	1,000 B	440 B	11 B	11	22 B	NA	110 B	150 B	1,000	820 B	94 B	610	NA	1,700	NA	NA
Sulfate (mg/L)	--	--	19 B	16 B	94 B	56 B	5,700 B	43 B	44 B	NA	130 B	62 B	0.25 BJ	16	220 B	10 B	NA	32 B	NA	NA
Sulfide (mg/L)	--	--	1 U	1 U	1.7	0.64 J	18	0.82 J	1 U	NA	1 U	0.64 J	0.99 J	1 U	1 U	1 U	NA	1 U	NA	NA
Total organic carbon (TOC) (mg/L)	--	--	5.8	3.3	6.4	5.1	11	2.4	2.7	NA	2.2	2.4	6.1	5.3	5	1.9	NA	7.5	NA	NA
Iron (mg/L)	5.999	0.3	0.1 B	0.3 B	9.3 B	4 B	800 B	4.9	7.2 B	NA	15	7.5	6 B	14	5.4	3.9 B	NA	11 B	NA	NA
Manganese (mg/L)	0.214	0.05	0.088	0.007 J	0.069	0.082	4.8	0.027	0.11	NA	0.15	0.029	0.037	0.17	0.13	0.051	NA	0.17	NA	NA

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available

µg/L - Micrograms per liter

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or

NA - Not analyzed

NCGWQS - North Carolina Groundwater Quality Standards

R - Unreliable result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: D.Brown/CLT
Checked By: T.Grim/CLT

TABLE 5-5
Surficial Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2× Mean	NCGWQS (January, 2010)*[1]	IR86-MW59		IR86-MW60	IR86-MW61	IR86-MW62		IR86-MW63	IR86-MW64	IR86-MW65	USTAS410S-MW02	SWMU318-MW01		SWMU318-MW05	SWMU318-MW08
Sample ID			IR86-GW59-09D	IR86-GW59D-09D	IR86-GW60-09D	IR86-GW61-09D	IR86-GW62-09D	IR86-GW62D-09D	IR86-GW63-10A	IR86-GW64-09D	IR86-GW65-10A	USTAS410S-GW02-09D	SWMU318-GW01-09D	SWMU318-GW01D-09D	SWMU318-GW05-09D	SWMU318-GW08-09D
Sample Date			12/12/09	12/12/09	12/18/09	12/12/09	12/14/09	12/14/09	01/13/10	12/16/09	03/24/10	12/09/09	12/10/09	12/10/09	12/15/09	12/08/09
Chemical Name																
Volatile Organic Compounds (µg/L)																
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	--	200,000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	--	6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.4 J	0.37 J	1 U	0.42 J
1,1-Dichloroethene	--	7	1 U	1 U	1 U	4	1 U	1 U	0.42 J	1 U	1 U	1 U	1 U	1 U	1 U	0.27 J
2-Hexanone	--	280	5 U	5 U	5 U	5 U	5 U	5 U	14	5 U	5 U	5 U	5 UJ	5 UJ	5 U	5 U
Benzene	--	1	1 U	1 U	2.2	1	1 U	1 U	0.27 J	1 U	1 U	1 U	1 U	1 U	1 U	1.9
Carbon disulfide	--	700	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	--	70	1 U	1 U	1 U	0.77 J	0.44 J	0.42 J	0.45 J	1 U	0.5 J	1 U	1 U	1 U	1 U	1 U
Chloromethane	--	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	--	70	1 U	1 U	9.9	79	1 U	1 U	12	1 U	1 U	1 U	0.24 J	0.21 J	0.83 J	1.5
Cyclohexane	--	1,300	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon-12)	--	1,000	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 UJ	2 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	--	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.38 J	1 U	1 U	1 U	1 U
Isopropylbenzene	--	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl-tert-butyl ether (MTBE)	--	20	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	--	0.7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	--	600	1 U	1 U	0.2 J	1 U	1 U	1 U	1 U	1 U	1 U	0.19 J	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	--	100	1 U	1 U	0.54 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	--	3	0.5 U	0.5 U	1.8	260	0.5 U	0.5 U	17	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.53	0.79
Vinyl chloride	--	0.03	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Xylene, total	--	500	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	3 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Semivolatile Organic Compounds (µg/L)																
Acenaphthylene	--	200	0.21 U	0.21 U	0.27 U	0.26	0.2 U	0.21 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	--	0.005	0.21 R	0.21 U	0.22 U	0.21 U	0.2 U	0.21 U	0.2 U	0.2 R	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	--	0.05	0.21 R	0.21 U	0.13 J	0.21 U	0.2 U	0.21 U	0.2 U	0.2 R	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	--	200	0.21 R	0.21 U	0.22 U	0.21 U	0.2 U	0.21 U	0.2 U	0.2 R	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	--	0.5	0.21 R	0.21 U	0.22 U	0.21 U	0.2 U	0.21 U	0.2 U	0.2 R	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	--	3	5.2 UJ	5.3 U	0.32 J	5.3 U	5.1 U	5.3 U	5 U	5 U	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	--	0.005	0.21 R	0.21 U	0.22 U	0.21 U	0.2 U	0.21 U	0.2 U	0.2 R	NA	NA	NA	NA	NA	NA
Fluorene	--	300	0.21 U	0.21 U	0.12 J	0.12 J	0.2 U	0.21 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	--	0.05	0.21 R	0.21 U	0.22 U	0.21 U	0.2 U	0.21 U	0.2 U	0.2 R	NA	NA	NA	NA	NA	NA
Naphthalene	--	6	0.21 U	0.21 U	0.22 U	0.21 U	0.2 U	0.21 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (µg/L)																
4,4'-DDD	--	0.1	0.027 U	0.026 U	0.027 U	0.026 UJ	0.026 U	0.026 U	0.025 U	0.025 U	NA	NA	NA	NA	NA	NA
Total Metals (µg/L)																
Aluminum	1,886	3,700	200 U	200 U	200 U	NA	70 J	150 J	420	1,300	NA	NA	NA	NA	NA	NA
Antimony	3.28	6	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	NA	NA	NA	NA	NA	NA
Arsenic	5.77	10	10 U	10 U	10 U	NA	3.4 J	10 U	10 U	10 U	NA	NA	NA	NA	NA	NA
Barium	86.2	700	14 J	15 J	45	NA	71	67	39	12 J	NA	NA	NA	NA	NA	NA
Calcium	69,078	--	140,000	130,000	290,000	NA	110,000	110,000	130,000	58,000	NA	NA	NA	NA	NA	NA
Chromium	3.13	10	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	NA	NA
Copper	2.76	1,000	5 U	5 U	3 J	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	NA	NA
Iron	5,999	300	4,400	4,600	8,200	NA	8,400	8,300	1,000	360	836	NA	NA	NA	NA	NA
Lead	2.8	15	4.1 J	4.3 J	10 U	NA	10 U	3.4 J	10 U	10 U	NA	NA	NA	NA	NA	NA
Magnesium	6,363	--	3,600 J	3,800 J	6,900	NA	4,600 J	4,500 J	3,500 J	5,000 U	NA	NA	NA	NA	NA	NA
Manganese	214	50	72	69	140	NA	160	160	45	13 J	88.5	NA	NA	NA	NA	NA
Potassium	3,277	--	1,600 J	2,400 J	2,400 J	NA	2,200 J	2,500 J	2,100 J	5,000 U	NA	NA	NA	NA	NA	NA
Silver	0.77	20	1.7 J	2.3 J	2.1 J	NA	5 U	5 U	1.9 J	2 J	NA	NA	NA	NA	NA	NA
Sodium	22,508	--	14,000	14,000 J	14,000 J	NA	17,000	16,000	13,000	5,700 J	NA	NA	NA	NA	NA	NA
Zinc	42.1	1,000	20 U	20 U	20 U	NA	20 U	20 U	20 U	20 U	NA	NA	NA	NA	NA	NA
Natural Attenuation Indicator Parameters																
Alkalinity (mg/L)	--	--	340	330	350	520	300	NA	280	120	24	69	110	100	8.1 J	320
Chloride (mg/L)	--	--	12 B	12 B	12 B	16 B	14 B	NA	10 B	4.5 B	6	6.7 B	6.7 B	6.7 B	23 B	9.9 B
Ethane (µg/L)	--	--	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	0.72 J	10 U	10 U	10 U	10 U	10 U
Ethene (µg/L)	--	--	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	0.78 J	10 U	10 U	10 U	10 U	10 U
Methane (µg/L)	--	--	36 B	34	14	230 B	25	NA	34	4.3 J	3.3 J	430 B	56 B	55 B	860	85 B
Sulfate (mg/L)	--	--	9.5	9.6 B	410	21 B	0.24 BJ	NA	11 B	16 B	7.8	13	120 B	120 B	47 B	95 B
Sulfide (mg/L)	--	--	1 U	1 U	1 U	1 U	1 U	NA	0.82 J	1 U	3	1 U	1 U	1 U	1.9	7.5
Total organic carbon (TOC) (mg/L)	--	--	2.1	2	0.74 J	3.2	1.6	NA	1.8	0.79 J	0.95 J	9.4	3.9	4	4.9	1.6
Iron (mg/L)	5.999	0.3	4.4 B	4.6 B	8.2	3.4	8.4 B	8.3 B	1	0.36 B	0.836	29	10	10	5.6 B	6.4
Manganese (mg/L)	0.214	0.05	0.072	0.069	0.14	0.087	0.16	0.16	0.045	0.013 J	0.0885	0.0073 J	0.14	0.14	0.033	0.092

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available

µg/L - Micrograms per liter

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or

NA - Not analyzed

NCGWQS - North Carolina Groundwater Quality Standards

R - Unreliable result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: D.Brown/CLT
Checked By: T.Grim/CLT

TABLE 5-6
Upper Castle Hayne Aquifer Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2X Mean	CLEAN NCGWQS (January, 2010)*[1,2]	IR86-MW15IW	IR86-MW16IW	IR86-MW17IW	IR86-MW22IW	IR86-MW29IW	IR86-MW30IW	IR86-MW31IW	IR86-MW34IW	IR86-MW38IWB	IR86-MW38IWC	IR86-MW42IW	IR86-MW43IW
Sample ID			IR86-GW15IW-09D	IR86-GW16IW-09D	IR86-GW17IW-09D	IR86-GW22IW-09D	IR86-GW29IW-09D	IR86-GW30IW-09D	IR86-GW31IW-09D	IR86-GW34IW-09D	IR86-GW38IWB-09D	IR86-GW38IWC-09D	IR86-GW42IW-09D	IR86-GW43IW-09D
Sample Date			12/14/09	12/15/09	12/11/09	12/13/09	12/15/09	12/11/09	12/16/09	12/17/09	12/10/09	12/10/09	12/12/09	12/13/09
Chemical Name														
Volatile Organic Compounds (µg/L)														
1,1-Dichloroethane	--	6	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1.5	1.5	1 U	1 U
1,1-Dichloroethene	--	7	1 U	1 U	1 U	1 U	1 U	0.85 J	1 UJ	0.58 J	0.66 J	0.45 J	1.1	1 U
2-Butanone		4,000	10 R	10 R	10 UJ	10 R	10 R	10 UJ	10 R	10 R	10 UJ	10 UJ	10 U	10 R
Acetone	--	6,000	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ	10 UJ	10 U	10 U
Benzene	--	1	4	0.25 J	1 U	0.32 J	0.45 J	1.1	1 UJ	1 U	1 U	1 U	0.7 J	1 U
Carbon disulfide	--	700	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Chloroform	--	70	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Chloromethane	--	3	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	0.35 J	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	--	70	350 J	3.3	1 U	4	41	150	4.2 J	4.2	66	64	63	1 U
Ethylbenzene	--	600	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	--	0.7	1 U	1 U	1 U	1 U	1 U	1 U	0.28 J	1 U	1 U	1 U	1 U	1 U
Toluene	--	600	0.31 J	0.17 J	0.23 J	1 U	0.19 J	1 U	0.19 J	0.26 J	1 U	0.24 J	1.1	0.22 J
trans-1,2-Dichloroethene	--	100	10	1 U	1 U	1 U	1 U	4.2	0.14 J	1 U	0.75 J	10	0.46 J	1 U
Trichloroethene	--	3	0.5 U	3.8	0.5 U	0.5 U	140	1.1	7.7 J	3.5	2.7	3.1	330	0.5 U
Vinyl chloride	--	0.03	0.5 U	0.5 U	0.5 U	22	0.5 U	1.6	0.5 UJ	0.6	0.52	0.4 J	3.5	0.5 U
Semivolatile Organic Compounds (µg/L)														
Acenaphthylene	--	200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	--	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	--	300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (µg/L)														
Aluminum	8,031.8	3,700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	3.2	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	89.2	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	103,991	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	9.4	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	16,021.6	300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	10.2	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	7,275	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	274.2	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	4,348.6	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	0.7	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	32,452.6	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	65.2	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Natural Attenuation Indicator Parameters														
Alkalinity (mg/L)	--	--	260	230	340	210	270	220	310	250	400	320	250	210
Chloride (mg/L)	--	--	13 B	13 B	14 B	13 B	17 B	10 B	32 B	14 B	23 B	25 B	28 B	14 B
Ethane (µg/L)	--	--	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Ethene (µg/L)	--	--	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methane (µg/L)	--	--	40	35	170 B	410	200	370 B	70	53	250 B	15 B	110 B	32
Sulfate (mg/L)	--	--	3.1 B	11 B	0.13 BJ	0.46 BJ	20 B	5.2 B	100 B	630 B	370 B	1,400 B	1.5 B	5 B
Sulfide (mg/L)	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total organic carbon (TOC) (mg/L)	--	--	1.4	1.4	2.3	1.3	2	0.87 J	1.9	3.4	5.1	6.9	1.7	1.7
Iron (mg/L)	16.021	0.3	4 B	7.7 B	16 B	3.5 B	4.5 B	3.4 B	4.9 B	4.3 B	3.8	9.6 B	9.6 B	1.6 B
Manganese (mg/L)	0.274	0.05	0.053	0.088	0.21	0.044	0.055	0.057	0.11	0.1	0.16	0.49	0.097	0.034

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available
2 - Project Action Limits reported where no NCGWQS, MCL, or Adjusted Tap Water RSL was available

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
NCGWQS - North Carolina Groundwater Quality Standards
R - Unreliable result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: D. Brown/CLT
Checked By: T.Grim/CLT

TABLE 5-6
Upper Castle Hayne Aquifer Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2X Mean	CLEAN NCGWQS (January, 2010)*[1,2]	IR86-MW44IW	IR86-MW46IW	IR86-MW47IW	IR86-MW48IW	IR86-MW52IW		IR86-MW53IW	IR86-MW54IW	IR86-MW55IW	
Sample ID			IR86-GW44IW-09D	IR86-GW46IW-09D	IR86-GW47IW-09D	IR86-GW48IW-09D	IR86-GW52IW-10A	IR86-GW52IWD-10A	IR86-GW53IW-10A	IR86-GW54IW-09D	IR86-GW55IW-09D	IR86-GW55IWD-09D
Sample Date			12/12/09	12/07/09	12/09/09	12/16/09	03/17/10	03/17/10	03/16/10	12/14/09	12/13/09	12/13/09
Chemical Name												
Volatile Organic Compounds (µg/L)												
1,1-Dichloroethane	--	6	1 U	1 U	1 U	0.25 J	1 U	1 U	1 U	1 U	0.27 J	0.31 J
1,1-Dichloroethene	--	7	2.7 J	1 U	1 U	3.7	1 U	1 U	1 U	7.6	13	13
2-Butanone		4,000	10 U	10 U	10 UJ	10 R	4 J	4 J	5 U	10 R	10 R	10 R
Acetone	--	6,000	10 U	10 U	10 UJ	10 U	47 J	42	5 U	10 U	10 U	10 U
Benzene	--	1	1.6 J	1 U	1 U	2.4	1 U	1 U	1 U	2.4	2.3	2.3
Carbon disulfide	--	700	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	--	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	--	3	1 U	1 U	1 U	1 U	2 U	2 U	2 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	--	70	210 J	1 U	1 U	110	1 U	1 U	1 U	270	190	190
Ethylbenzene	--	600	1 U	1 U	1 U	1 U	0.3 J	0.3 J	1 U	1 U	1 U	1 U
Tetrachloroethene	--	0.7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	--	600	0.72 J	0.41 J	1 U	1 U	0.4 J	0.4 J	1 U	0.34 J	0.39 J	0.28 J
trans-1,2-Dichloroethene	--	100	1.5 J	1 U	1 U	6.4	1 U	1 U	1 U	1.4	16	15
Trichloroethene	--	3	110 J	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	260	0.28 J	0.25 J
Vinyl chloride	--	0.03	24 J	0.5 U	0.5 U	0.5 U	2 U	2 U	2 U	1.8	130	140
Semivolatile Organic Compounds (µg/L)												
Acenaphthylene	--	200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	--	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	--	300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (µg/L)												
Aluminum	8,031.8	3,700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	3.2	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	89.2	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	103,991	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	9.4	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	16,021.6	300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	10.2	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	7,275	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	274.2	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	4,348.6	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	0.7	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	32,452.6	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	65.2	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Natural Attenuation Indicator Parameters												
Alkalinity (mg/L)	--	--	220	220	200	310	NA	NA	NA	230	300	NA
Chloride (mg/L)	--	--	14 B	9.4 B	7 B	20 B	NA	NA	NA	12 B	21 B	NA
Ethane (µg/L)	--	--	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	10 U	NA
Ethene (µg/L)	--	--	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	9.7 J	NA
Methane (µg/L)	--	--	690 B	21 B	7.8 JB	790	NA	NA	NA	280 B	1,200	NA
Sulfate (mg/L)	--	--	1.1	6	2.4 B	4.9 B	NA	NA	NA	0.29 J	0.34 BJ	NA
Sulfide (mg/L)	--	--	1 U	0.99 J	1 U	1 U	NA	NA	NA	1 U	1 U	NA
Total organic carbon (TOC) (mg/L)	--	--	1.7	2.7	1	2.1	NA	NA	NA	1.3	3.2	NA
Iron (mg/L)	16.021	0.3	5.7 B	5.9	3	5.5 B	NA	NA	NA	6.3 B	7.7 B	NA
Manganese (mg/L)	0.274	0.05	0.07	0.064	0.042	0.065	NA	NA	NA	0.077	0.083	NA

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available
2 - Project Action Limits reported where no NCGWQS, MCL, or Adjusted Tap Water RSL was available

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
NCGWQS - North Carolina Groundwater Quality Standards
R - Unreliable result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: D. Brown/CLT
Checked By: T.Grim/CLT

TABLE 5-6
Upper Castle Hayne Aquifer Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2X Mean	CLEAN NCGWQS (January, 2010)*[1,2]	IR86-MW58IW	IR86-MW59IW	IR86-MW60IW	IR86-MW61IW	IR86-MW63IW	IR86-MW66IW
Sample ID			IR86-GW58IW-09D	IR86-GW59IW-09D	IR86-GW60IW-09D	IR86-GW61IW-09D	IR86-GW63IW-09D	IR86-GW63IW-10B
Sample Date			12/16/09	12/12/09	12/17/09	12/12/09	12/17/09	06/28/10
Chemical Name								
Volatile Organic Compounds (µg/L)								
1,1-Dichloroethane	--	6	1 U	1 U	1 U	1 U	1 U	0.5 U
1,1-Dichloroethene	--	7	6.6 J	1 U	1 U	1 U	1 U	0.5 U
2-Butanone		4,000	10 U	10 R	10 R	10 U	10 R	2.5 U
Acetone	--	6,000	10 U	4.3 J	10 U	10 U	10 U	2.5 U
Benzene	--	1	1.4 J	1 U	0.12 J	0.27 J	0.2 J	0.5 U
Carbon disulfide	--	700	1 UJ	0.21 J	1 U	1 U	1 U	0.5 U
Chloroform	--	70	1 U	1 U	1 U	0.98 J	1 U	0.5 U
Chloromethane	--	3	1 U	1 U	1 U	1 U	1 U	0.5 U
cis-1,2-Dichloroethene	--	70	100 J	1 U	0.51 J	4.4	1.7	0.5 U
Ethylbenzene	--	600	1 U	1 U	1 U	1 U	1 U	0.5 U
Tetrachloroethene	--	0.7	1 U	1 U	1 U	1 U	1 U	0.5 U
Toluene	--	600	0.26 J	1 U	0.22 J	1 U	1 U	0.5 U
trans-1,2-Dichloroethene	--	100	6.2 J	1 U	1 U	1 U	1 U	0.5 U
Trichloroethene	--	3	710	0.5 U	0.5 U	1.2	0.5 U	0.5 U
Vinyl chloride	--	0.03	9.1 J	0.5 U	0.5 U	0.5 U	0.5 U	1 U
Semivolatile Organic Compounds (µg/L)								
Acenaphthylene	--	200	0.2 U	0.2 UJ	0.23	0.21 U	0.23	NA
Benzo(b)fluoranthene	--	0.05	0.2 U	0.2 U	0.11 J	0.21 U	0.22 U	NA
Fluorene	--	300	0.2 U	0.2 UJ	0.1 J	0.21 U	0.22 U	NA
Total Metals (µg/L)								
Aluminum	8,031.8	3,700	200 U	340	270 U	NA	200 U	NA
Antimony	3.2	6	10 U	3.2 J	10 U	NA	10 U	NA
Barium	89.2	700	17 J	21	32	NA	24	NA
Calcium	103,991	--	140,000	69,000	130,000	NA	150,000	NA
Copper	9.4	1,000	1.6 J	5 U	1.6 J	NA	5 U	NA
Iron	16,021.6	300	3,600	1,300	3,200	NA	3,000	NA
Lead	10.2	15	5.4 J	4.5 J	7 J	NA	4.1 J	NA
Magnesium	7,275	--	3,400 J	5,000 U	3,100 J	NA	3,800 J	NA
Manganese	274.2	50	48	28	58	NA	58	NA
Potassium	4,348.6	--	6,400	6,800	5,000 U	NA	2,000 J	NA
Silver	0.7	20	2.5 J	5 U	2.1 J	NA	2.2 J	NA
Sodium	32,452.6	--	19,000 J	17,000	15,000 J	NA	12,000 J	NA
Zinc	65.2	1,000	20 U	18 J	20 U	NA	20 U	NA
Natural Attenuation Indicator Parameters								
Alkalinity (mg/L)	--	--	360	330	310	430	360	NA
Chloride (mg/L)	--	--	16 B	130 B	9.7 B	16 B	12 B	NA
Ethane (µg/L)	--	--	10 U	10 U	10 U	10 U	10 U	NA
Ethene (µg/L)	--	--	10 U	10 U	10 U	10 U	10 U	NA
Methane (µg/L)	--	--	830	13 B	16	71	40	NA
Sulfate (mg/L)	--	--	29 B	38	39 B	14 B	5.8 B	NA
Sulfide (mg/L)	--	--	6.8	1 U	1 U	1 U	1 U	NA
Total organic carbon (TOC) (mg/L)	--	--	0.7 J	2.8	0.48 J	2.5	2.1	NA
Iron (mg/L)	16.021	0.3	3.6 B	1.3 B	3.2 B	4	3 B	NA
Manganese (mg/L)	0.274	0.05	0.048	0.028	0.058	0.079	0.058	NA

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.

1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available
2 - Project Action Limits reported where no NCGWQS, MCL, or Adjusted Tap Water RSL was available

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
NCGWQS - North Carolina Groundwater Quality Standards
R - Unreliable result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

Generated By: D. Brown/CLT
Checked By: T.Grim/CLT

TABLE 5-7
Middle Castle Hayne Aquifer Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2X Mean	CLEAN NCGWQS (January, 2010)*[1,2]	IR86-MW15DW	IR86-MW16DW	IR86-MW17DW	IR86-MW18DW		IR86-MW19DW	IR86-MW31DW	IR86-MW42DW	IR86-MW44DW	IR86-MW45DW	IR86-MW49DW
Sample ID			IR86-GW15DW-10A	IR86-GW16DW-09D	IR86-GW17DW-09D	IR86-GW18DW-09D	IR86-GW18DWD-09D	IR86-GW19DW-09D	IR86-GW31DW-09D	IR86-GW42DW-09D	IR86-GW44DW-09D	IR86-GW45DW-10A	IR86-GW49DW-09D
Sample Date			01/14/10	12/15/09	12/11/09	12/15/09	12/15/09	12/14/09	12/18/09	12/13/09	12/13/09	01/15/10	12/17/09
Chemical Name													
Volatile Organic Compounds (µg/L)													
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	--	200,000	1 U	1 U	1 U	1 U	1 U	0.52 J	1 U	1 U	1 U	1 UJ	1 U
Carbon disulfide	--	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U
Chloroform	--	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U
Chloromethane	--	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U
cis-1,2-Dichloroethene	--	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U
Tetrachloroethene	--	0.7	1 U	1 U	1 U	1 U	1 U	2.4	1 U	1 U	1 U	1 UJ	1 U
Toluene	--	600	1 U	0.37 J	0.28 J	0.21 J	0.31 J	1	1 U	0.25 J	0.44 J	1 UJ	1 U
Trichloroethene	--	3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U
Xylene, total	--	500	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U
Semivolatile Organic Compounds (µg/L)													
Benzo(a)pyrene	--	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	--	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	--	200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	--	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	--	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	--	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	--	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	--	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (µg/L)													
Aluminum	8,031.8	3,700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	3.2	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	5.2	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	89.2	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	103,991	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	13.8	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	9.4	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	16,021.6	300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	10.2	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	7,275	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	274.2	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	4,348.6	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	0.7	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	32,452.6	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	65.2	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Natural Attenuation Indicator Parameters													
Alkalinity (mg/L)	--	--	170	220	270	250	NA	200	210	63	210	190	190
Chloride (mg/L)	--	--	16 B	38 B	88 B	72 B	NA	32 B	50 B	25 B	40 B	30 B	19 B
Ethane (µg/L)	--	--	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	10 U
Ethene (µg/L)	--	--	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	10 U
Methane (µg/L)	--	--	4.5 J	16 B	7.1 J	35	NA	30 B	10 U	10 U	15	20	4.5 J
Sulfate (mg/L)	--	--	5.1 B	9 B	23 B	19 B	NA	6.3 B	15	9.1 B	8 B	11 B	7.7 B
Sulfide (mg/L)	--	--	1 U	1 U	1 U	1 U	NA	1 U	13	1 U	1 U	1 U	1 U
Total organic carbon (TOC) (mg/L)	--	--	0.77 J	1.6	3.3	1.8	NA	1.1	1.4	9.5	2.7	1.8	1 U
Iron (mg/L)	16.021	0.3	0.61	0.46 B	0.17 B	1.1 B	NA	0.48 B	0.24	0.55 B	0.3 B	0.48	0.097 BJ
Manganese (mg/L)	0.274	0.05	0.058	0.058	0.0084 J	0.022	NA	0.033	0.033	0.0094 J	0.024	0.025	0.061

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* - The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.
1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available
2 - Project Action Limits reported where no NCGWQS, MCL, or Adjusted Tap Water RSL was available

µg/L - Micrograms per liter
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
NCGWQS- North Carolina Groundwater Quality Standards
R - Unreliable result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate

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TABLE 5-7
Middle Castle Hayne Aquifer Groundwater Analytical Data
Expanded Supplemental Remedial Investigation Site 86—Operable Unit No. 20
MCB CamLej, Jacksonville, North Carolina

Station ID	Camp Lejeune Background GW 2X Mean	CLEAN NCGWQS (January, 2010)*[1,2]	IR86-MW51DW		IR86-MW56DW	IR86-MW58DW	IR86-MW59DW	IR86-MW61DW
Sample ID			IR86-GW51DW-10A	IR86-GW51DWD-10A	IR86-GW56DW-10A	IR86-GW58DW-10A	IR86-GW59DW-09D	IR86-GW61DW-09D
Sample Date			01/15/10	01/15/10	01/14/10	01/13/10	12/18/09	12/18/09
Chemical Name								
Volatile Organic Compounds (µg/L)								
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	--	200,000	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	--	700	1 U	1 U	1 U	3.4	1 U	1 U
Chloroform	--	70	1 U	1 U	0.19 J	1 U	0.38 J	1 U
Chloromethane	--	3	1 U	1 U	1 U	0.18 J	1 U	0.18 J
cis-1,2-Dichloroethene	--	70	1 U	1 U	1 U	1 U	1 U	0.13 J
Tetrachloroethene	--	0.7	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	--	600	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	--	3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.29 J
Xylene, total	--	500	0.5 U	0.5 U	0.5 U	0.5 U	0.28 J	0.5 U
Semivolatile Organic Compounds (µg/L)								
Benzo(a)pyrene	--	0.005	NA	NA	0.2 U	0.22 U	0.2 J	0.22 U
Benzo(b)fluoranthene	--	0.05	NA	NA	0.2 U	0.22 U	0.38 J	0.22 U
Benzo(g,h,i)perylene	--	200	NA	NA	0.2 U	0.22 U	0.46 J	0.22 U
Benzo(k)fluoranthene	--	0.5	NA	NA	0.2 U	0.22 U	0.31 J	0.22 U
bis(2-Ethylhexyl)phthalate	--	3	NA	NA	0.2 U	5.6 U	5.3 U	0.33 J
Dibenz(a,h)anthracene	--	0.005	NA	NA	0.2 U	0.22 U	0.55 J	0.22 U
Di-n-butylphthalate	--	700	NA	NA	0.2 U	5.6 U	5.3 U	0.2 J
Indeno(1,2,3-cd)pyrene	--	0.05	NA	NA	0.2 U	0.22 U	0.45 J	0.22 U
Total Metals (µg/L)								
Aluminum	8,031.8	3,700	NA	NA	520	420	200 U	130 J
Antimony	3.2	6	NA	NA	10 U	10 U	10 U	10 U
Arsenic	5.2	10	NA	NA	10 U	10 U	10 U	10 U
Barium	89.2	700	NA	NA	10 J	11 J	19 J	20 U
Calcium	103,991	--	NA	NA	65,000	55,000	39,000	39,000
Chromium	13.8	10	NA	NA	5.2	6.2	76	5 U
Copper	9.4	1,000	NA	NA	5 U	5 U	1.8 J	5 U
Iron	16,021.6	300	NA	NA	2,600	1,300	320	1,100
Lead	10.2	15	NA	NA	10 U	10 U	10 U	10 U
Magnesium	7,275	--	NA	NA	4,600 J	5,100	6,200	10,000
Manganese	274.2	50	NA	NA	66	47	16	22
Potassium	4,348.6	--	NA	NA	9,200	29,000	34,000 J	21,000 J
Silver	0.7	20	NA	NA	5 U	5 U	5 U	5 U
Sodium	32,452.6	--	NA	NA	48,000	99,000	210,000 J	300,000 J
Zinc	65.2	1,000	NA	NA	20 U	9.2 J	20 U	20 U
Natural Attenuation Indicator Parameters								
Alkalinity (mg/L)	--	--	250	250	200	240	330	360
Chloride (mg/L)	--	--	95 B	96 B	32 B	69 B	130 B	210 B
Ethane (µg/L)	--	--	10 U	10 U	10 U	10 U	10 U	10 U
Ethene (µg/L)	--	--	10 U	10 U	10 U	10 U	10 U	10 U
Methane (µg/L)	--	--	19	19	30	3 J	10 U	10 U
Sulfate (mg/L)	--	--	23 B	23 B	6.1 B	23 B	38	63
Sulfide (mg/L)	--	--	5.9	1 U	8.7	1.3	1 U	1 U
Total organic carbon (TOC) (mg/L)	--	--	1.5	3.9	3	2.3	2.8	1.1
Iron (mg/L)	16.021	0.3	0.5	0.54	2.6	1.3	0.32	1.1
Manganese (mg/L)	0.274	0.05	0.031	0.031	0.066	0.047	0.016	0.022

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

* - The MCL-Groundwater value is reported in place of the NCGWQS where the MCL value is more conservative.
1 - Adjused Tap Water RSL value reported where no NCGWQS or MCL value was available
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Appendix C
Site 86 Supplemental Risk Assessment Technical Memorandum

Site 86 Subsurface Soil Chromium Evaluation

PREPARED FOR: Marine Corps Installations East-
Marine Corps Base Camp Lejeune

PREPARED BY: CH2M HILL

DATE: June 8, 2012

A Human Health Risk Assessment (HHRA) was completed as part of the Expanded Supplemental Remedial Investigation (ESRI) conducted at Site 86-Operable Unit No. 20 (CH2M HILL, 2011a). The HHRA concluded that contact with soils containing chromium within the flight line area of Site 86 by hypothetical future residents may result in a potential risk exceeding the USEPA's acceptable cancer risk range of 10^{-6} to 10^{-4}.

An assumption that all of the chromium in soils was present in its more toxic hexavalent valence state was made during the HHRA to provide a conservative evaluation of potential risk. Chromium speciation data was not collected during the ESRI. A separate initiative at Marine Corps Installations East-Marine Corps Base Camp Lejeune (MCIEAST-MCBCAMLEJ) included updating the base background data to provide a better understanding of background metals concentrations at the Base. As part of this investigation, chromium speciation data, was collected for various soil types and conditions.

Using the available chromium speciation data and updated base background concentrations presented in the Expanded Soil Background Study Report, chromium in the soil at Site 86 was re-evaluated to provide a more realistic assessment of potential risk. The following describes the process used to evaluate chromium in soil.

Expanded Soil Background Study

The Expanded Soil Background Study was conducted to evaluate the anthropogenic and naturally occurring chemical compositions of soils within MCIEAST-MCB CAMLEJ, including MCAS New River. During the study, 60 surface soil and 51 subsurface soil samples were collected from developed and undeveloped areas and analyzed for metals (including speciated chromium), polycyclic aromatic hydrocarbons (PAHs), and pesticides. The results of the study were utilized to establish a background threshold levels (BTVs) for use in site-specific environmental investigations and human health and ecological risk assessments.

Surface Soil Chromium Results

Eighteen surface soil samples were collected during the ESRI from the flight line area and analyzed for total chromium. Total chromium was detected in 15 of the 18 samples, with concentrations ranging from 7.9 milligrams per kilogram (mg/kg) to 23 mg/kg.

The total chromium concentrations reported in the ESRI were compared to the BTV for combined soil in an industrial area (23.1 mg/kg) established in the Expanded Soil Background Study. Surface soil concentrations of chromium were below the updated BTV.

Subsurface Soil Chromium Results

Seventeen subsurface soil samples were collected at Site 86 from the flight line area and analyzed for total chromium. Total chromium was detected in all 17 samples, with concentrations ranging from 6.9 mg/kg to 63 mg/kg.

The total chromium concentrations reported in the ESRI were compared to the BTV for combined subsurface soil in an industrial area (32.1 mg/kg) established in the Expanded Soil Background Study. Three subsurface soil samples contained concentrations of chromium exceeding the BTV.

To further evaluate chromium at Site 86, the speciated chromium data collected during the background study was used to estimate the ratio of hexavalent chromium to total chromium (the concentration of hexavalent chromium

divided by the concentration of total chromium in a sample). A similar ratio of hexavalent to total chromium is expected for the Site 86 data since hexavalent chromium is not a site-related chemical. The ratio was then applied to the Site 86 data to estimate the expected hexavalent chromium concentrations in site data.

Table 1 lists the total chromium and hexavalent chromium concentrations for the subsurface soil samples collected from developed areas during the Expanded Soil Background Study. The ratio of hexavalent chromium to total chromium (concentration of hexavalent chromium divided by concentration of total chromium) was calculated for each sample. The average of the ratio of hexavalent chromium to total chromium from all of the samples, 0.19, was used to estimate the hexavalent chromium concentrations in the subsurface samples at Site 86.

TABLE 1
Subsurface Soil Samples for Developed Areas Collected During the Expanded Soil Background Study

Background Subsurface Sample Location	Reported Total Chromium (mg/kg)	Reported Hexavalent Chromium (mg/kg)	Ratio (hexavalent/ trivalent)
BG71	13	1.22	0.09
BG72	13	2.22	0.17
BG73	12.6	2.74	0.22
BG74	9.5	1.09	0.11
BG75	15.4	3.84	0.25
BG76	32.3	1.88	0.06
BG78	21.6	0.989	0.05
BG79	11.2	1.71	0.15
BG82	14.8	2.27	0.15
BG83	8.3	1.52	0.18
BG85	6.1	4.4	0.72
BG86	12.9	2.45	0.19
BG88	23.6	1.98	0.08
		Average:	**0.19**

Table 2 lists the total chromium concentrations for the Site 86 subsurface soil samples collected during the ESRI. The estimated hexavalent chromium concentrations were calculated by multiplying the reported total chromium concentration by 0.19 (the average ratio in **Table 1**). The estimated hexavalent chromium concentrations were then compared to the hexavalent chromium RSL, based on a cancer risk of 10^{-6}, 10^{-5}, and 10^{-4}.

TABLE 2
Subsurface Soil Samples Collected at Site 86

Sample Location	Sample ID	Sample Date	Reported Total Chromium (mg/kg)	Estimated Hexavalent Chromium (mg/kg)*	Hexavalent Chromium RSL based on cancer risk of 10^{-6}	Hexavalent Chromium RSL based on cancer risk of 10^{-5}	Hexavalent Chromium RSL based on cancer risk of 10^{-4}
IR86-IS100	IR86-SB100-06-07-09D	10/08/09	8.7	1.7	0.29	2.9	29
IR86-IS101	IR86-SB101-06-07-09D	10/08/09	13	2.5	0.29	2.9	29
IR86-IS102	IR86-SB102-07-08-09D	10/09/09	18	3.4	0.29	2.9	29
IR86-IS103	IR86-SB103-08-09-09D	10/09/09	14	2.7	0.29	2.9	29
IR86-IS104	IR86-SB104-08-09-09D	10/09/09	6.9	1.3	0.29	2.9	29
IR86-IS105	IR86-SB105-05-06-09D	10/09/09	14	2.7	0.29	2.9	29
IR86-IS106	IR86-SB106-07-08-09D	10/10/09	41	7.8	0.29	2.9	29
IR86-IS107	IR86-SB107-16-17-09D	10/10/09	9.9	1.9	0.29	2.9	29
IR86-IS107	IR86-SB107-07-08-09D	10/11/09	15	2.9	0.29	2.9	29
IR86-IS107	IR86-SB107D-07-08-09D	10/11/09	17	3.2	0.29	2.9	29
IR86-IS108	IR86-SB108-05-06-09D	10/11/09	20	3.8	0.29	2.9	29
IR86-IS109	IR86-SB109-07-08-09D	10/06/09	8.7	1.7	0.29	2.9	29
IR86-IS110	IR86-SB110-06-07-09D	10/12/09	63	12.0	0.29	2.9	29
IR86-IS111	IR86-SB111-01-02-09D	10/12/09	13	2.5	0.29	2.9	29
IR86-IS112	IR86-SB112-05-06-09D	10/12/09	58	11.0	0.29	2.9	29
IR86-IS113	IR86-SB113-02-03-09D	10/12/09	13	2.5	0.29	2.9	29
IR86-IS114	IR86-SB114-05-06-09D	10/13/09	9	1.7	0.29	2.9	29
		Minimum	6.9	1.3			
		Maximum	63	12.0			

Note:
*= The hexavalent chromium concentration shown is based on the average percentage of hexavalent chromium to total chromium detected during the base background study (CH2M HILL, 2011). The average percent of hexavalent chromium detected was 19% of the total chromium detected.

The maximum estimated hexavalent chromium concentration of 12 mg/kg is below the hexavalent chromium RSL of 29 based on cancer risk of 10^{-4}. The 95% upper confidence limit of the mean (95% UCL), the concentration used as the exposure point concentration in human health risk assessments, would either be equal to the maximum concentraion, or would be lower than the maximum estimated concentration. Therefore, since the maximum estimated hexavalent chromium concentraiton does not exceed an RSL based on a 10^{-4} risk level, the exposure to chromium in soil would not result in a risk above USEPA's acceptable risk range of 10^{-6} to 10^{-4}.

References

CH2M HILL. 2011a. *Final Expanded Supplemental Remedial Investigation Site 86-Operable Unit No, 20, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina*. September.

CH2M HILL. 2011b. *Final Expanded Soil Background Study Report, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina*. August.

Appendix D
Site 86 Groundwater Modeling Technical Memorandum

Numerical Modeling of Vinyl Chloride Transport in Groundwater, Operable Unit 20 (Site 86), Camp Lejeune, North Carolina

PREPARED FOR: Kevin Howell/CLT

PREPARED BY: Darren Meadows/RDD
Nate Brown/RDD

DATE: September 27, 2013

Introduction

CH2M HILL is investigating the potential benefits of in situ treatment of four volatile organic compound (VOC) groundwater plumes beneath Site 86-Operable Unit No. 20 at Camp Lejeune, North Carolina (Figure D-1). Four target treatment zone (TTZ) areas have been proposed for treatment of these groundwater plumes (Figure D-2), two targeting plumes in the Surficial Aquifer and two targeting plumes in the Upper Castle Hayne Aquifer. This technical memorandum documents the application of a numerical groundwater flow and solute transport model to forecast the effect of in situ treatment on the remediation timeframe (RTF) of vinyl chloride (VC). The RTF is defined as the time required, following treatment, for VC concentrations in groundwater to decrease below the North Carolina Groundwater Quality Standard (NCGWQS) standard of 0.03 microgram per liter (µg/L).

The Site 86 Groundwater Model (GFM) and Solute Transport Model (STM) were developed for the Expanded Supplemental Remedial Investigation (CH2M HILL, 2011) as a screening-level tool for testing hypotheses related to the physical properties of the aquifer, subsurface solute conditions, and the potential effectiveness of different hypothetical remediation scenarios. The Site 86 GFM and a slightly modified version of the STM were used for this analysis as well.

Modeling Objectives

The Site 86 GFM and modified STM were used to meet the following objectives:

- Forecast the effect of in situ source area treatment on the VC RTF.
- Compare the two-dimensional extents of forecast VC plume footprints through time between a non-treatment scenario and two treatment scenarios.
- Forecast VC concentrations in groundwater discharging to the New River under the non-treatment scenario.

Computer Code Description

The Site 86 GFM is described in detail in CH2M HILL (2011). This model was developed with the MODFLOW-2000 (MF2K) code (Harbaugh et al., 2000) to solve the groundwater flow equations and establish a set of steady state groundwater elevations and associated fluxes consistent with average 2010 conditions. The MF2K code simulates single-density, three-dimensional (3D) groundwater flow through porous media using the finite-difference method (McDonald and Harbaugh, 1988).

The Site 86 STM was developed with the MT3DMS code (Zheng and Wang, 1999) and was used in conjunction with MF2K to simulate the transport of VC throughout the mobile porosity of the model domain. The modeling process includes running MF2K to establish a 3D, steady state representation of the groundwater flow system, followed by running MT3DMS to retrieve the necessary hydraulic results from MF2K and solving the governing solute transport equations necessary to simulate VC transport. Thus, both MF2K and MT3DMS are required to simulate VC transport. The original Site 86 STM is described in detail in CH2M HILL (2011); modifications to the original STM are described below.

Model Application

As with the original STM, this modified STM also uses a dual-domain (i.e., dual-porosity) transport formulation. With single domain transport models, the porous medium is conceptualized as one transport domain with a single defined effective (i.e., mobile) porosity (θ_m). The θ_m represents the interconnected pore space in the subsurface where the dominant transport process is advection, as opposed to diffusion. For the purposes of this memorandum, dead-end pore space and low-permeability zones, where only very slow advection and diffusion are the dominant transport processes, are contained within the immobile porosity (θ_{im}). With single-domain transport models, it is assumed that all of the void space represented by the θ_m value is available for fluid flow and transport; however, the θ_{im} of the porous medium is ignored. Ignoring effects of the θ_{im} can be problematic for multi-decade-old solute plumes, because the processes of very slow advection and diffusion have ample time to transmit a portion of the available solute mass into the less-mobile portions of the subsurface.

After the Site 86 GFM was run to establish the groundwater elevation field, a modified version of the Site 86 STM was run. The original Site 86 STM (CH2M HILL, 2011) was modified slightly for this analysis in the following ways. Although the original Site 86 STM simulated transport of trichloroethene and VC, VC was the only solute that was simulated in this analysis because the modeled TTZs were primarily conceptualized to treat VC. The modified Site 86 STM also differed from the original model in that the modified STM includes the process of biodegradation of VC, whereas the original STM did not. A biodegradation half-life (BHL) of VC was included in this version of the STM because national attenuation indicator parameter data collected during the remedial investigation phase indicate conditions favorable for natural attenuation of VC.

The sparse historical VC concentration data available for site monitoring wells prohibit the calculation of a reliable site-specific BHL for VC. However, wells IR86-MW10IW (Model Layer 2) and IR86-MW29IW (Model Layer 3) (Figure D-2) have recently exhibited decreasing VC trends. To gain insight into site-specific VC biodegradation rates, a first-order attenuation rate constant was estimated for these two wells. The first-order attenuation rate constants calculated for wells IR86-MW10IW and IR86-MW29IW are 0.188 and 0.132 per year, respectively (equivalent to VC attenuation half-lives of approximately 3.7 and 5.2 years) (Figure D-3). The first-order trendlines provide estimates of attenuation rates, which account for all attenuation processes, not just biodegradation processes. Thus, the presumed first-order biodegradation rate is less than the first-order attenuation rate, meaning the BHL is slower than the attenuation half-life. Howard et al. (1991) report VC BHLs ranging from 2 months to 7.9 years. As a conservative estimate, the maximum BHL in this range was rounded up to 8 years and used in the following simulations. Table D-1 summarizes the transport parameters used in the STM. With the exception of the VC BHL, these are the same values used in the original Site 86 STM, and the basis for these values is presented in CH2M HILL (2011). Likewise, no VC source-term boundary condition was simulated.

TABLE D-1
Summary of Vinyl Chloride Transport and Soil Parameter Values
Numerical Modeling of Vinyl Chloride Transport in Groundwater, Operable Unit 20 (Site 86), Camp Lejeune, North Carolina

Parameter	Modeled Value
Bulk Density, ρ_b (g/cm^3)	1.72
Mobile Porosity, θ_m	0.15
Immobile Porosity, θ_{im}	0.20
Total Porosity, θ_t	0.35
Dispersivity (feet) (longitudinal/transverse/vertical)	13/1.3/0.13
Fraction of Organic Carbon, f_{oc} (percent)	0.07
Soil Organic Carbon-Water Partitioning Coefficient, K_{oc} (mL/g)	57
Solute Distribution Coefficient, K_d (mL/g)	0.04

TABLE D-1
Summary of Vinyl Chloride Transport and Soil Parameter Values
Numerical Modeling of Vinyl Chloride Transport in Groundwater, Operable Unit 20 (Site 86), Camp Lejeune, North Carolina

Parameter	Modeled Value
Dual-domain Mass Transfer Coefficient, α (day^{-1})	1×10^{-5}
Biodegradation Half-life (years)	8

g/cm^3 = grams per cubic centimeter
mL/g = milliliters per gram

Three separate solute transport scenarios were run. These scenarios are defined as follows:

- Scenario 1–No further treatment
- Scenario 2–Additional in situ treatment in TTZs
- Scenario 3–More effective additional in situ treatment in TTZs

The modeled scenarios differ only in their initial subsurface VC concentration distributions. Scenario 1 includes the initial VC concentration distribution from the original STM (CH2M HILL, 2011) in both the mobile and immobile porosities (Figure D-4). This concentration distribution represents the 3D 2009-2010 dissolved-phase VC distribution. Scenario 2 includes the initial VC concentration distribution from the original STM in the immobile porosity (Figure D-4), but includes an initial VC concentration distribution representing the VC plumes following in situ treatment in the mobile porosity (Figure D-5). Assuming a relatively brief period of active in situ treatment under Scenario 2 as compared with the overall emplacement time of the VC plume in the subsurface, the initial VC concentrations in the immobile porosity of Scenario 2 were left unchanged from those of Scenario 1. However, the initial mobile-phase VC concentration values in the TTZs under Scenario 2 were reduced mathematically prior to running the model forward in time. It was assumed that mobile-phase VC concentrations in the TTZs would be reduced following a brief period of in situ treatment such that no mobile-phase VC concentrations would exceed one hundred times the NCGWQS (0.03 µg/L). Thus, the initial mobile-phase VC concentration values assigned to all model cells within each TTZ were reduced by a factor specific to each TTZ, so that the maximum VC concentration value within each TTZ equaled 3 µg/L in the mobile porosity (Table D-2).

TABLE D-2
Concentration Reduction Factors for Vinyl Chloride Treatment Areas for Treatment Scenarios
Numerical Modeling of Vinyl Chloride Transport in Groundwater, Operable Unit 20 (Site 86), Camp Lejeune, North Carolina

Target Treatment Zone (Model Layer in which Treatment is Effective)	Maximum Observed Vinyl Chloride Concentration (µg/L)	Vinyl Chloride Concentration Reduction Factor
Surficial Treatment Area 1 (Model Layer 2)	19	0.158
Surficial Treatment Area 2 (Model Layer 2)	68	0.044
Upper Castle Hayne Treatment Area 1 (Model Layer 3)	24	0.125
Upper Castle Hayne Treatment Area 2 (Model Layers 3 and 4)	130	0.023

Reduced initial VC concentration in treatment area = original initial VC concentration × concentration reduction factor in the mobile porosity.

Scenario 3 includes the assumption that the initial VC concentrations in both the mobile *and* immobile porosities of all model cells within each TTZ would be reduced by the VC concentration reduction factors listed in Table D-2. Thus, in this scenario, VC concentrations in the mobile and immobile porosities of model cells within the TTZs were equal and are shown in Figure D-5. It is possible that the initial in situ treatment effectiveness in the TTZs implied by Scenario 3 within the immobile porosity would be extremely difficult to achieve without a very aggressive remediation approach in the TTZs. Thus, Scenario 3 was simulated for illustrative purposes only.

Results

Figure D-6 depicts the forecast VC plume footprints at the NCGWQS of 0.03 µg/L for all model scenarios. The VC plumes shown in the figure are depth-integrated footprints, meaning that the maximum VC concentration from all model layers is projected onto the surface to produce a generalized plume boundary. Modeled plume footprints are depicted at 20, 30, and 45 years from the beginning of the forecast simulation. The model suggests that the easternmost extent of the VC plume would occur around 20 years following the beginning of the forecast simulation (Figure D-6). By 30 years, the forecast VC plume extents are reduced considerably. In both the 20- and 30-year forecasts, the model suggests that the VC plume extent for Scenario 1 would be considerably larger than those of Scenarios 2 and 3. However, by 40 years the VC plume extents from Scenarios 1 and 2 would have nearly identical footprints, according to the model. This is a result of the identical VC concentration distributions assigned to the immobile porosities for both scenarios. The back-diffusion of VC from the immobile porosity continues to sustain the mobile-phase VC plume in these forecast simulations. In contrast to Scenarios 1 and 2, the VC plume no longer exists at 40 years in the STM under Scenario 3.

Figure D-7 shows the modeled two-dimensional VC plume areas in the mobile porosity as a function of time for all scenarios. The figure shows a difference of tens of acres in the VC plume areas during most of the first 25 years of the forecast simulations between Scenario 1 and Scenarios 2 and 3. After approximately 25 years, the difference between the VC plume extents associated with Scenarios 1 and 2 begins to decrease; by approximately Simulation Year 35, there is little to no difference in these two VC plume extents. The RTF for Scenarios 1 and 2 equals 53 years, whereas the RTF for Scenario 3 is 40 years. These model results suggest that in situ treatment at these four treatment areas may result in no reduction in RTF unless the remedial action is effective at treating VC in the immobile porosity as well as the mobile porosity. However, the model also suggests that treatment of VC in only the mobile porosity may result in a significant reduction in the overall size and extent of the VC plume during most of the remaining life of the VC plume.

Figure D-6 shows the potential for VC to reach the New River at concentrations exceeding the NCGWQS. Therefore, the model was used to forecast the magnitude of mobile-phase VC concentrations that could potentially discharge to the New River. “Virtual” monitoring wells were programmed into the STM at three locations along the river to allow modeled mobile-phase VC concentrations to be compiled over the course of the simulation period under Scenario 1. Figure D-8 shows the maximum modeled VC concentration from all model layers versus simulation time at these three virtual monitoring wells. Although Figure D-6 shows that VC could reach the New River at concentrations exceeding the 0.03 µg/L NCGWQS, concentrations of VC in groundwater discharging to the river are forecast to remain very low (< 0.1 µg/L) throughout the simulation period (Figure D-8), even under Scenario 1 (no further treatment). Additionally, Figure D-8 shows that forecast concentrations of VC in groundwater discharging to the New River remain well below the North Carolina Surface Water Quality Standard of 2.4 µg/L.

According to the model, the maximum simulated VC concentrations in groundwater at the virtual monitoring wells occurred in Model Layer 7 (Middle Castle Hayne Aquifer). This implies that VC observed in the Surficial and Upper Castle Hayne aquifers may migrate downward into deeper aquifer units as it migrates toward the New River. This simulated transport of VC into deeper layers is most likely a result of calibrating the model’s hydraulics to the downward gradients observed at well pairs located in the interior of the site (IR86-MW42IW/IR86-MW42DW, IR86-MW44IW/IR86-MW44DW, and IR86-MW58IW/IR86-MW58DW) (Figure D-9). Figure D-9 shows that no wells screened deeper than the Upper Castle Hayne aquifer exist in the undeveloped, eastern portion of the site. Two significant limitations result from the lack of wells in this area. First, vertical gradients in this portion of the model remain uncalibrated, and thus it is not clear where vertical gradients reverse and groundwater flow transitions upward from the deeper units toward the New River. Second, it would not be possible to confirm or refute the mobile-phase VC plume forecasts in the Middle Castle Hayne aquifer in the eastern portion of the site given the current monitoring network.

Model Limitations

The Site 86 GFM and a modified version of the Site 86 STM were used to simulate processes of the physical subsurface system at the four proposed in situ treatment areas at Site 86. The model is imperfect because, like all models, it cannot accurately describe all aspects of interrelated physical and chemical processes beneath the Site. However, CH2M HILL incorporated as many details of the physical system into the original Site 86 GFM and modified STM as possible, given the limited available data. The sparse available data limits the degree to which the model assumptions and results can be constrained. Thus, the modeling solutions discussed herein should be considered nonunique, representing one potential outcome among others that could be plausible.

The following limitations introduce significant uncertainty into the model forecasts. First, a site-specific BHL is not known, and RTF is very sensitive to this parameter. The record of historical VC concentration data is very limited. A longer-term time history of VC concentrations at monitoring wells would be necessary to estimate a more reliable site-specific BHL. Second, vertical hydraulic gradients in the eastern portion of the site are poorly constrained. A lack of wells screened in the Middle Castle Hayne aquifer in this area prohibits the determination of vertical hydraulic gradients near the New River. Thus, the eastern extent of the downward hydraulic gradients observed in the interior of the site is not known. Finally, the lack of wells in this eastern area compounds the predictive uncertainty of the model because not only are vertical hydraulic gradients unknown in the eastern portion of the Site, but it would be impossible to verify the model forecasts of VC migrating into the Middle Castle Hayne aquifer in the future in this area with the current monitoring network.

Additional information related to the aquifer's physical and chemical parameters and their spatial distributions would also help constrain the model. Specifically, annual to biennial groundwater sampling of monitoring wells at Site 86 would facilitate quantification of site-specific biodegradation rates and help to better define the stage of the VOC plume evolution (growth versus stable versus retraction). Installation of new monitoring wells screened in the Middle Castle Hayne Aquifer in the eastern portion of the site would help constrain the modeled groundwater flow field and provide sentinel monitoring at depth to alert Site managers, should VC begin migrating into deeper aquifer units. As more data become available through time, hydraulic and chemical properties should be periodically evaluated and compared with the assumptions in the Site 86 models to improve the predictive capabilities of the model.

References

CH2M HILL. 2011. *Expanded Supplemental Remedial Investigation Site 86-Operable Unit No, 20, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.*

Harbaugh, A.W., E.R. Banta, M.C. Hill, and M.G. McDonald. 2000. *MODFLOW-2000, The U.S. Geological Survey Modular Ground-Water Model – User Guide to Modularization Concepts and the Ground-Water Flow Process*. USGS Open-File Report 00-92.

Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, and E.M. Michalenko. 1991. *Handbook of Environmental Degradation Rates.* Lewis Publishers, Inc., Chelsea, Michigan. 725 pp.

McDonald, M.G., and A.W. Harbaugh. 1988. *A Modular Three-Dimensional Finite-Difference Groundwater Flow Models*. USGS Techniques for Water-Resources Investigation. Book 6, Chapter A1.

Zheng, C., and P.P. Wang. 1999. *MT3DMS: A Modular Three-Dimensional Multispecies Transport Model for Simulation of Advection, Dispersion, and Chemical Reactions of Contaminants in Groundwater Systems; Documentation and User's Guide*. Contract Report SERDP-99-1.

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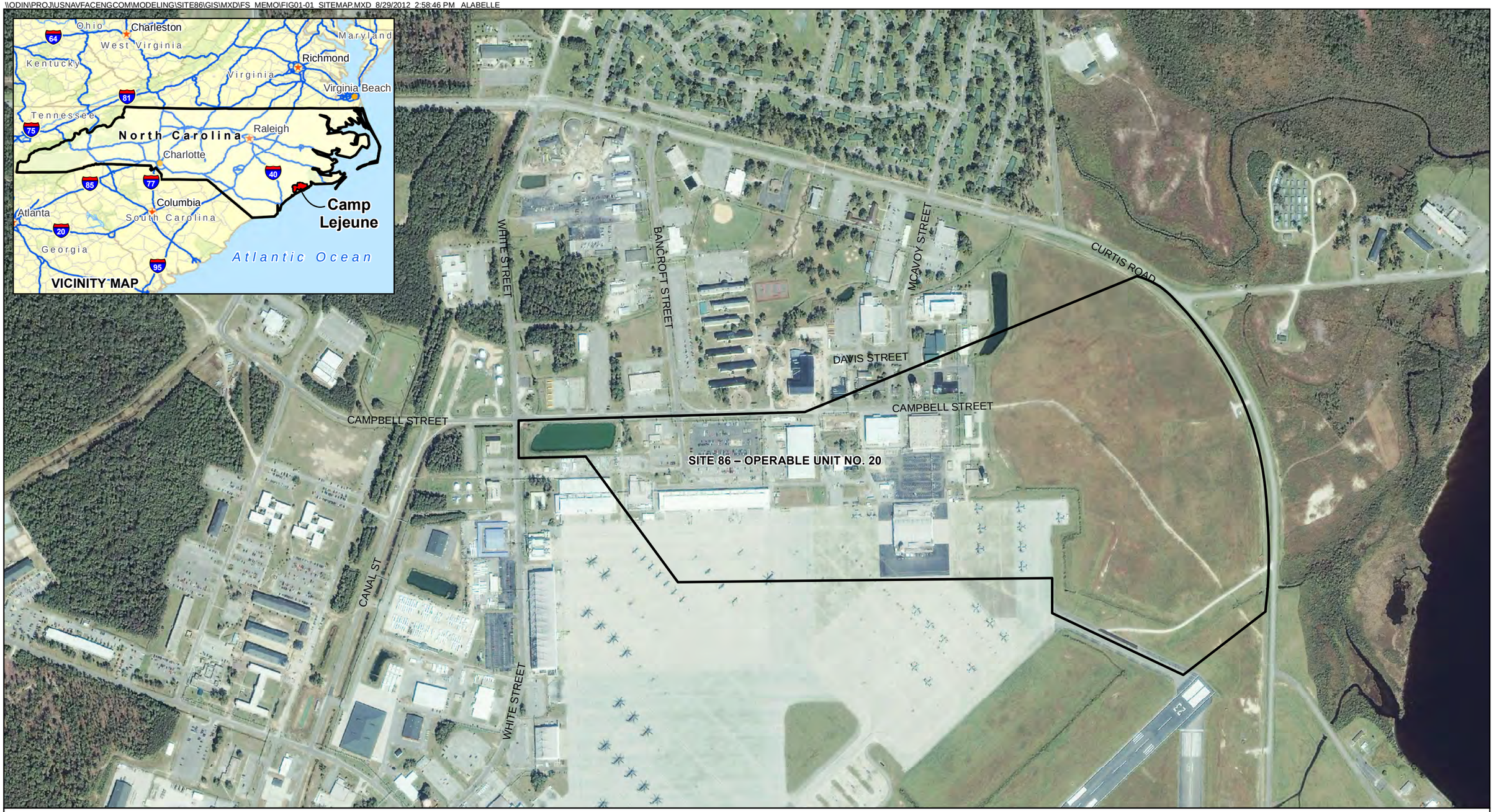

NOTE: DATE OF AERIAL PHOTOGRAPHY, OCTOBER 2006 (GeoEye 2006©).

LEGEND

MARCH 2010 SITE 86 BOUNDARY

N

0 300 600 1,200 Feet

1 inch = 600 feet

Figure D-1
Site Map
Numerical Modeling of Vinyl ChlorideTransport
in Groundwater, Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

CH2MHILL

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LEGEND

- MARCH 2010 SITE 86 BOUNDARY
- SURFICIAL AQUIFER
- UPPER CASTLE HAYNE AQUIFER

MODELED TARGET TREATMENT ZONES

- SURFICIAL AQUIFER
- UPPER CASTLE HAYNE AQUIFER

N

0 300 600 1,200 Feet

1 inch = 600 feet

Figure D-2
Modeled Treatment Areas
Numerical Modeling of Vinyl ChlorideTransport
in Groundwater, Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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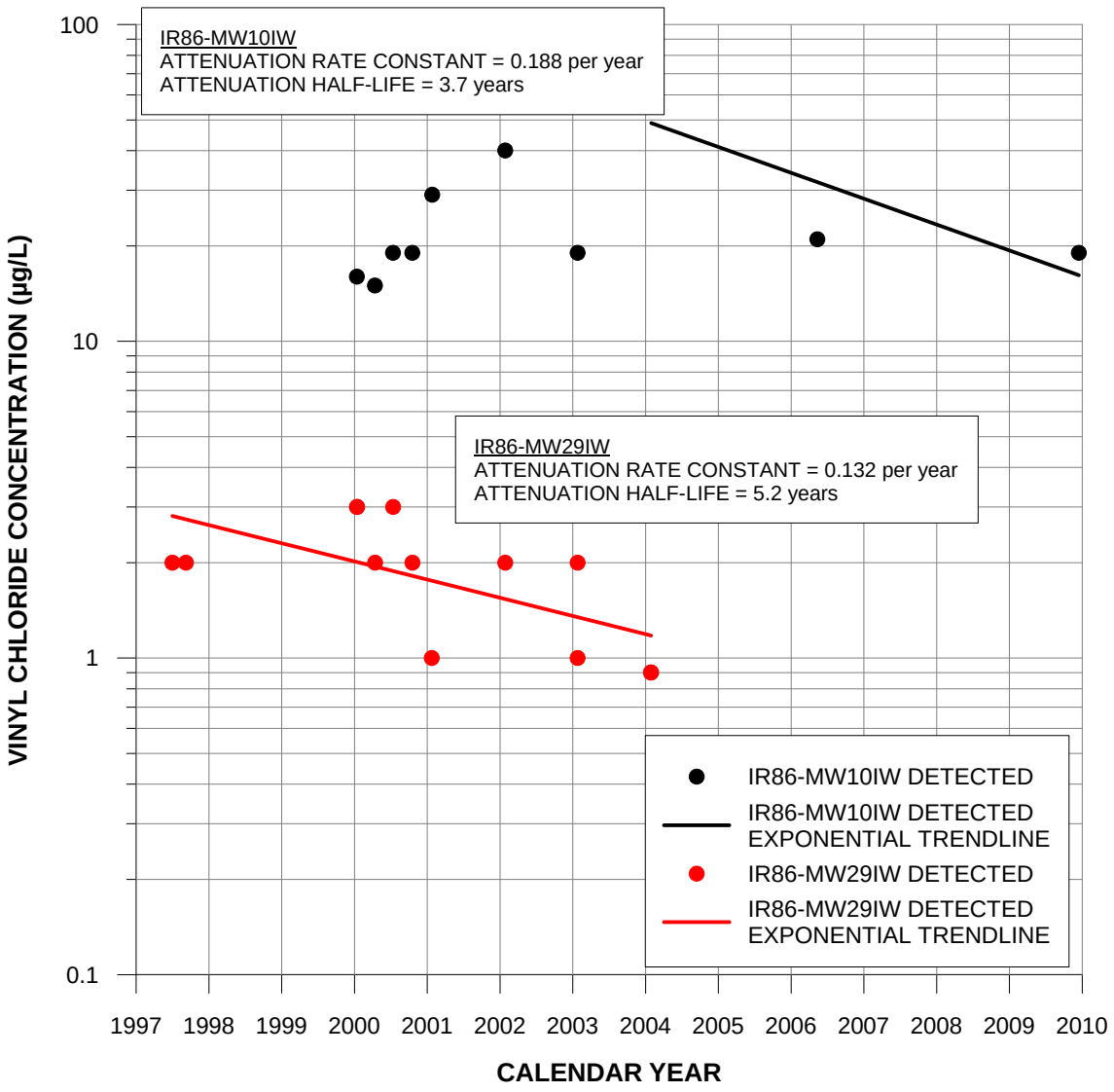

NOTE:

THE IR86-MW10IW TRENDLINE WAS FIT TO THE THREE MOST RECENT DATA POINTS ONLY.

Figure D-3
IR86-MW10IW and IR86-MW29IW Vinyl Chloride Concentration Data and Observed Trendlines
Numerical Modeling of Vinyl ChlorideTransport in Groundwater, Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

CH2MHILL

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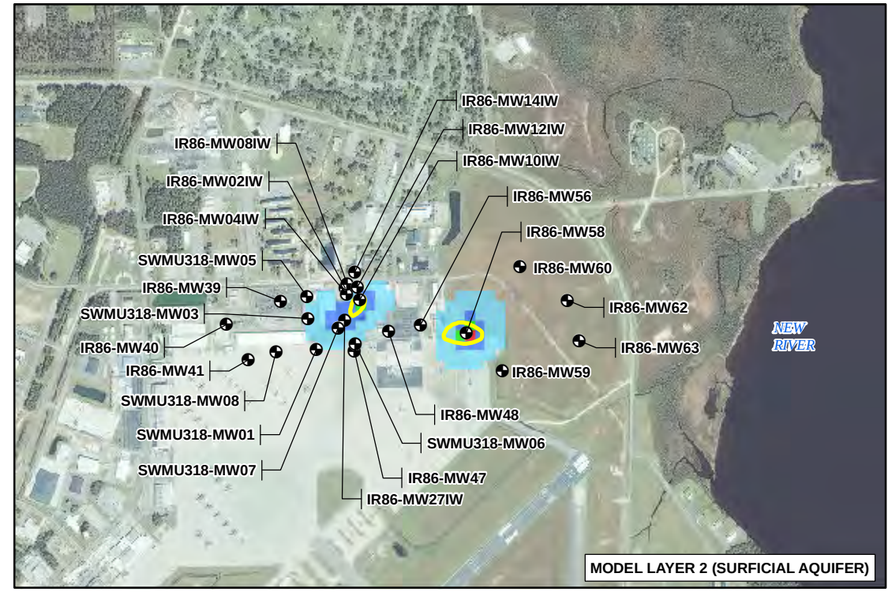

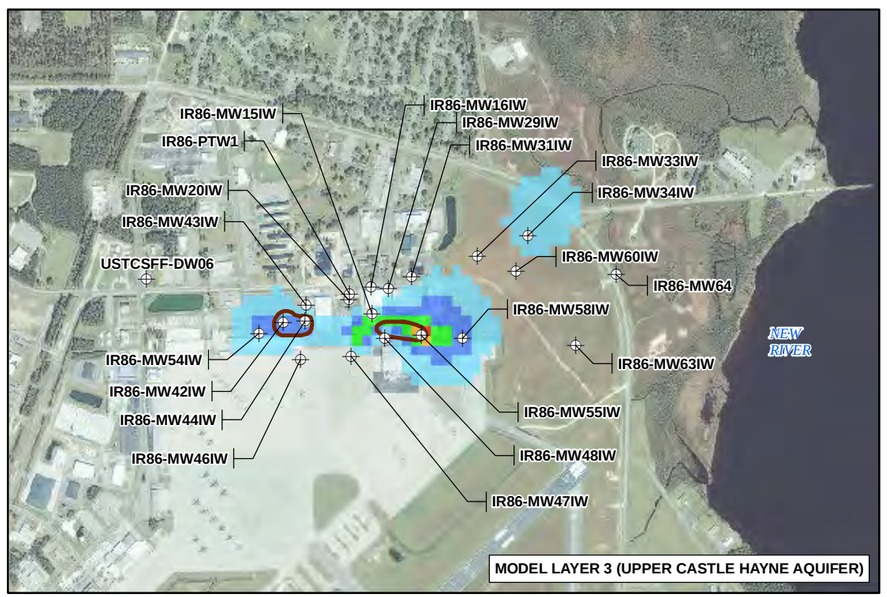

LEGEND

- SURFICIAL AQUIFER
- UPPER CASTLE HAYNE AQUIFER

INITIAL VINYL CHLORIDE CONCENTRATION (µg/L)

- 0.03 to 1
- 1 to 10
- 10 to 25
- 25 to 50
- 50 to 130

MODELED TARGET TREATMENT ZONES

- SURFICIAL AQUIFER
- UPPER CASTLE HAYNE AQUIFER

NOTES:

CONCENTRATIONS SHOWN WERE ASSIGNED TO BOTH THE MOBILE AND IMMOBILE POROSITIES OF THE TRANSPORT MODEL FOR SCENARIO 1 AND THE IMMOBILE POROSITY OF THE TRANSPORT MODEL FOR SCENARIO 2.

CONCENTRATIONS ASSIGNED TO THE MOBILE POROSITY OF THE TRANSPORT MODEL FOR SCENARIO 2 SHOWN ON FIGURE D-5.

NO VINYL CHLORIDE ASSIGNED TO MIDDLE OR LOWER CASTLE HAYNE AQUIFERS. THUS, DEEPER MODEL LAYERS NOT SHOWN.

DATE OF AERIAL PHOTOGRAPHY, OCTOBER 2006 (GeoEye 2006©).

SCENARIO 1 - NO FURTHER TREATMENT

SCENARIO 2 - ADDITIONAL IN SITU TREATMENT IN MODELED TARGET TREATMENT ZONES

SCENARIO 3 - MORE EFFECTIVE ADDITIONAL IN SITU TREATMENT IN MODELED TARGET TREATMENT ZONES

N

0 750 1,500 3,000 Feet

1 inch = 1,500 feet

Figure D-4
Initial Modeled Vinyl Chloride Concentrations-Scenario 1
Numerical Modeling of Vinyl ChlorideTransport
in Groundwater, Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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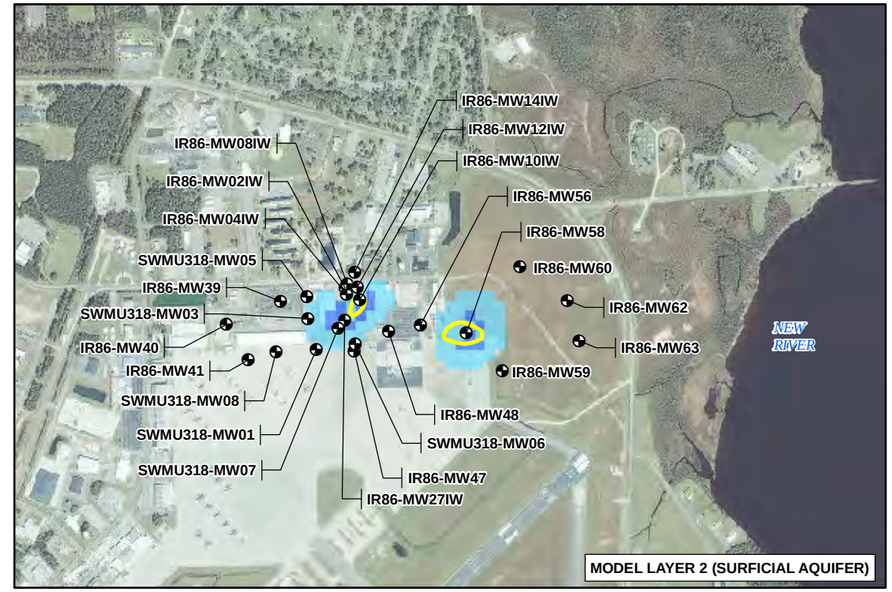

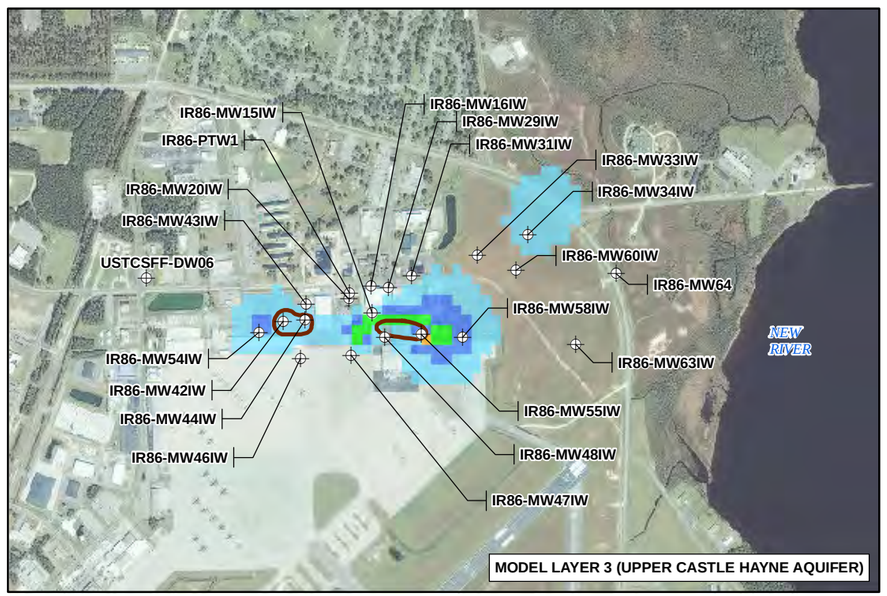

LEGEND

- SURFICIAL AQUIFER
- UPPER CASTLE HAYNE AQUIFER

INITIAL VINYL CHLORIDE CONCENTRATION (µg/L)

- 0.03 to 1
- 1 to 10
- 10 to 25
- 25 to 50
- 50 to 130

MODELED TARGET TREATMENT ZONES

- SURFICIAL AQUIFER
- UPPER CASTLE HAYNE AQUIFER

NOTES:

CONCENTRATIONS SHOWN WERE ASSIGNED TO THE MOBILE POROSITY OF THE TRANSPORT MODEL FOR SCENARIO 2 AND THE MOBILE AND IMMOBILE POROSITIES OF THE TRANSPORT MODEL FOR SCENARIO 3.

CONCENTRATIONS ASSIGNED TO THE IMMOBILE POROSITY OF THE TRANSPORT MODEL FOR SCENARIO 2 SHOWN ON FIGURE D-4.

NO VINYL CHLORIDE ASSIGNED TO MIDDLE OR LOWER CASTLE HAYNE AQUIFERS. THUS, DEEPER MODEL LAYERS NOT SHOWN.

DATE OF AERIAL PHOTOGRAPHY, OCTOBER 2006 (GeoEye 2006©).

SCENARIO 1 - NO FURTHER TREATMENT

SCENARIO 2 - ADDITIONAL IN SITU TREATMENT IN MODELED TARGET TREATMENT ZONES

SCENARIO 3 - MORE EFFECTIVE ADDITIONAL IN SITU TREATMENT IN MODELED TARGET TREATMENT ZONES

N

0 750 1,500 3,000 Feet

1 inch = 1,500 feet

Figure D-5
Initial Modeled Vinyl Chloride Concentrations-Scenarios 2 and 3
Numerical Modeling of Vinyl ChlorideTransport
in Groundwater, Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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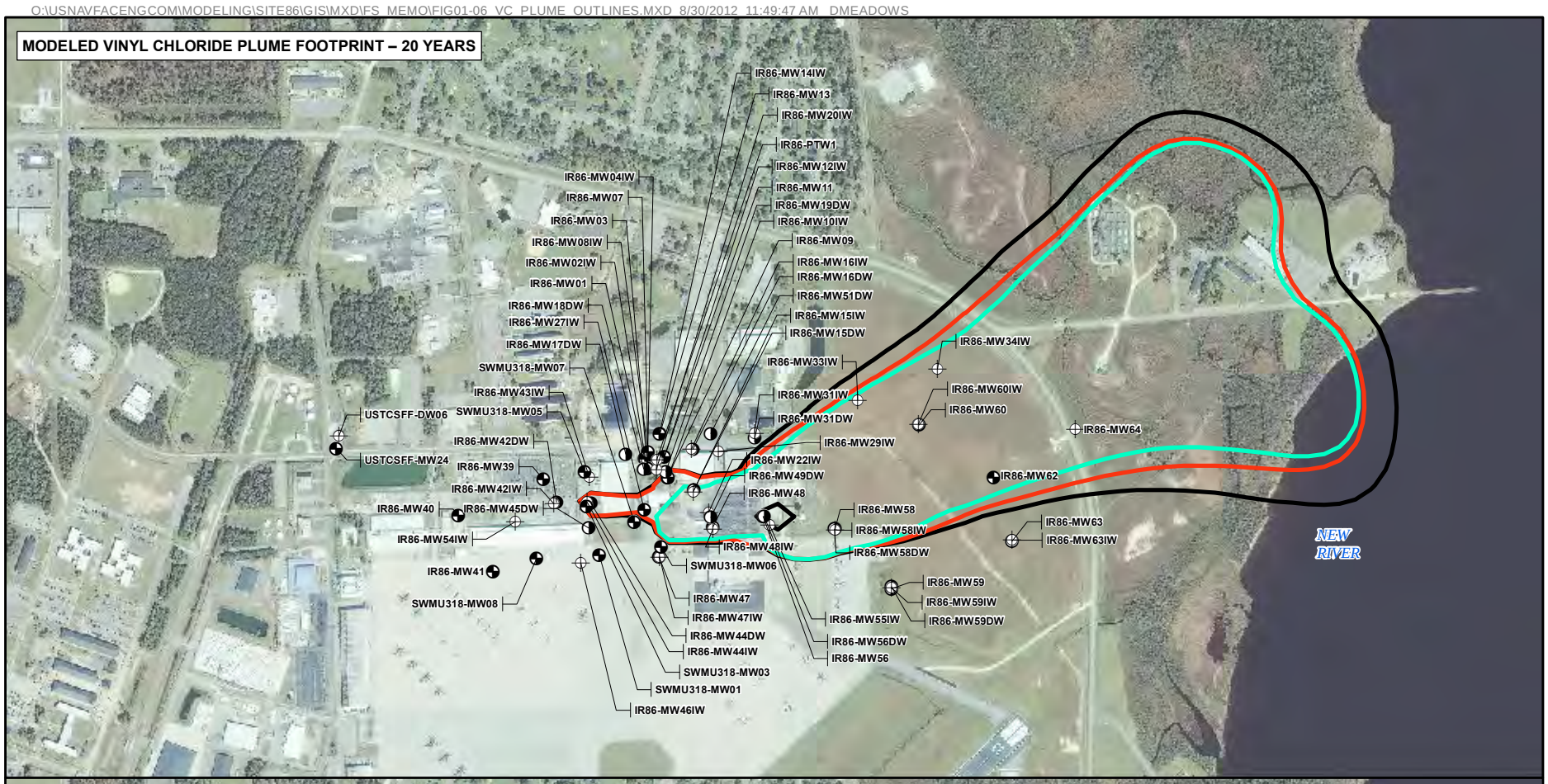

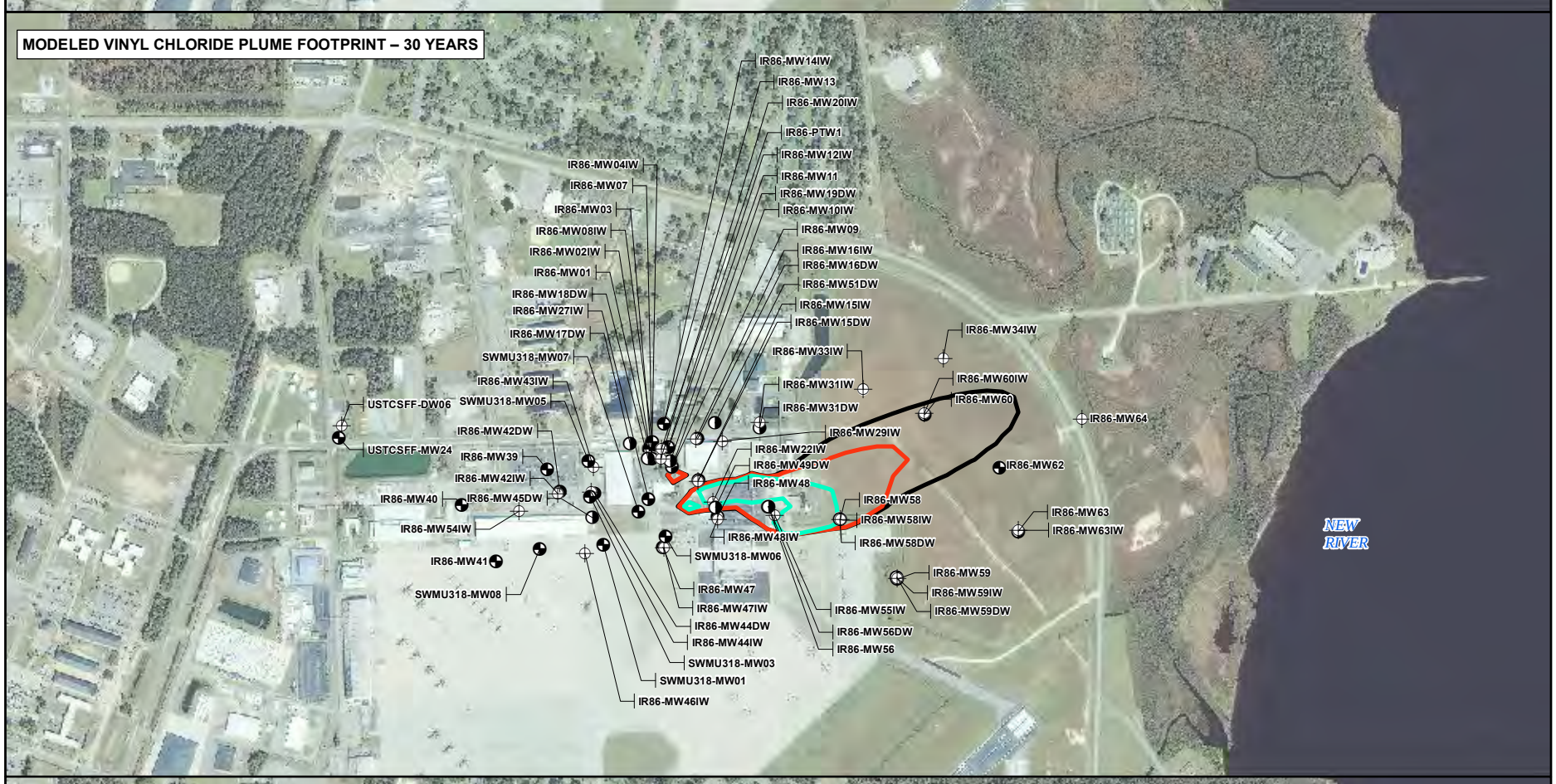

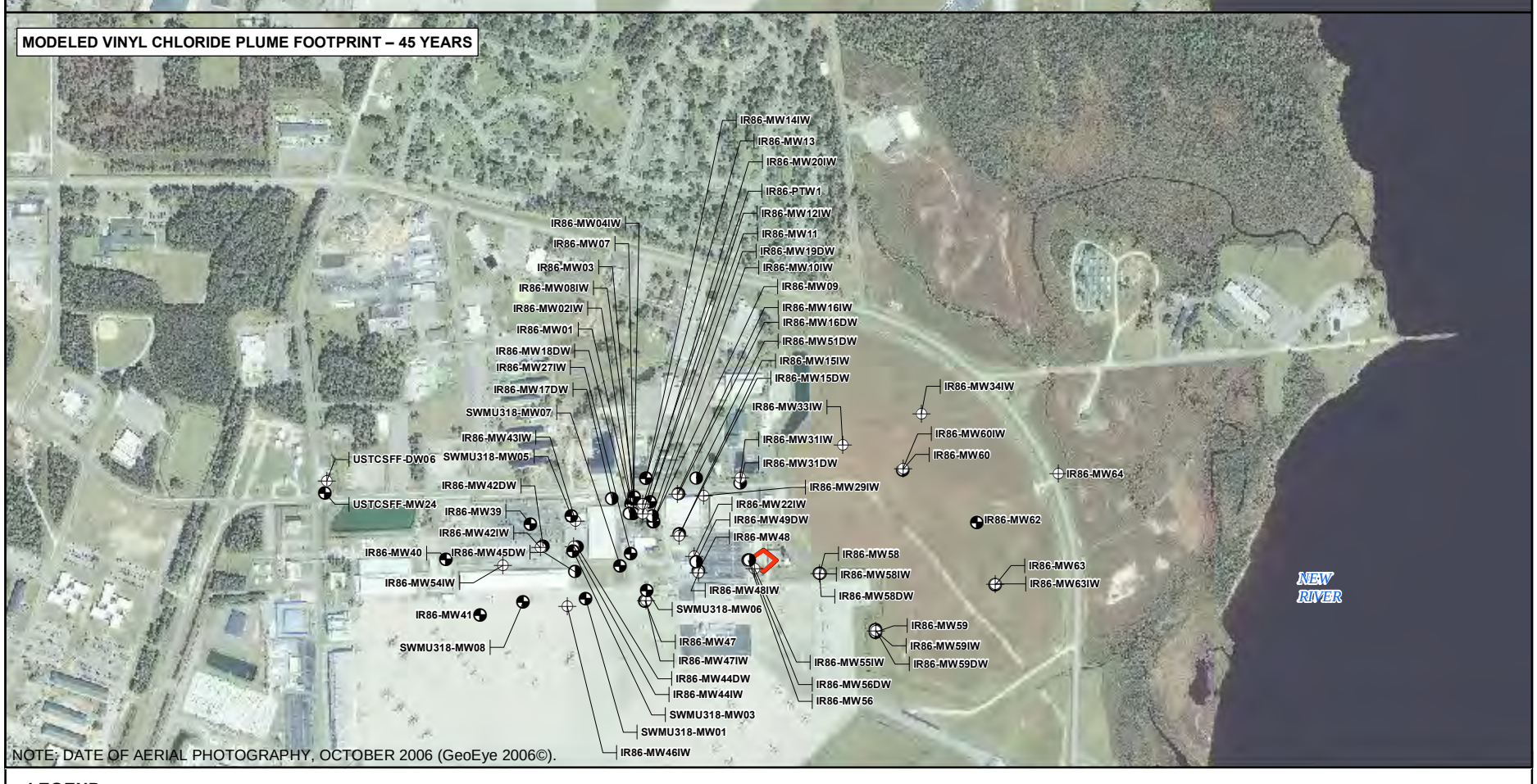

LEGEND

- SURFICIAL AQUIFER
- UPPER CASTLE HAYNE AQUIFER
- MIDDLE CASTLE HAYNE AQUIFER
- MODELED VINYL CHLORIDE PLUME FOOTPRINT (0.03 µg/L) SCENARIO 1
- MODELED VINYL CHLORIDE PLUME FOOTPRINT (0.03 µg/L) SCENARIO 2
- MODELED VINYL CHLORIDE PLUME FOOTPRINT (0.03 µg/L) SCENARIO 3

N

0 500 1,000 2,000 Feet

1 inch = 1,000 feet

Figure D-6
Modeled Mobile Phase Vinyl Chloride Plume Footprints for Scenarios 1 through 3
Numerical Modeling of Vinyl ChlorideTransport in Groundwater, Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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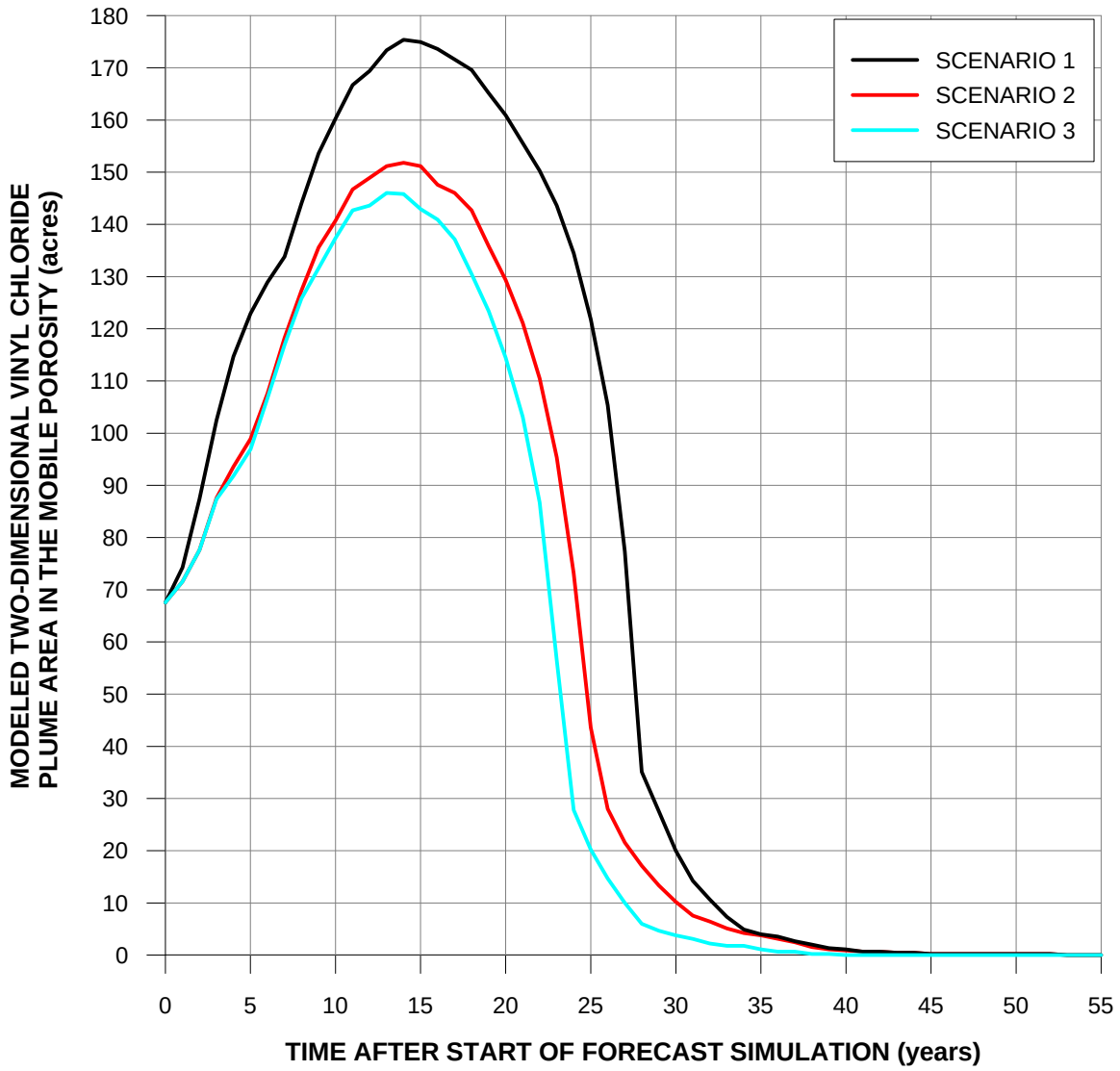

NOTES:

PLUME DEFINED BY 0.03 µg/L CONTOUR.

SCENARIO 1 - NO FURTHER TREATMENT

SCENARIO 2 - ADDITIONAL IN SITU TREATMENT IN MODELED TARGET TREATMENT ZONES

SCENARIO 3 - MORE EFFECTIVE ADDITIONAL IN SITU TREATMENT IN MODELED TARGET TREATMENT ZONES

Figure D-7
Modeled Vinyl Chloride Plume Area
Numerical Modeling of Vinyl ChlorideTransport
in Groundwater, Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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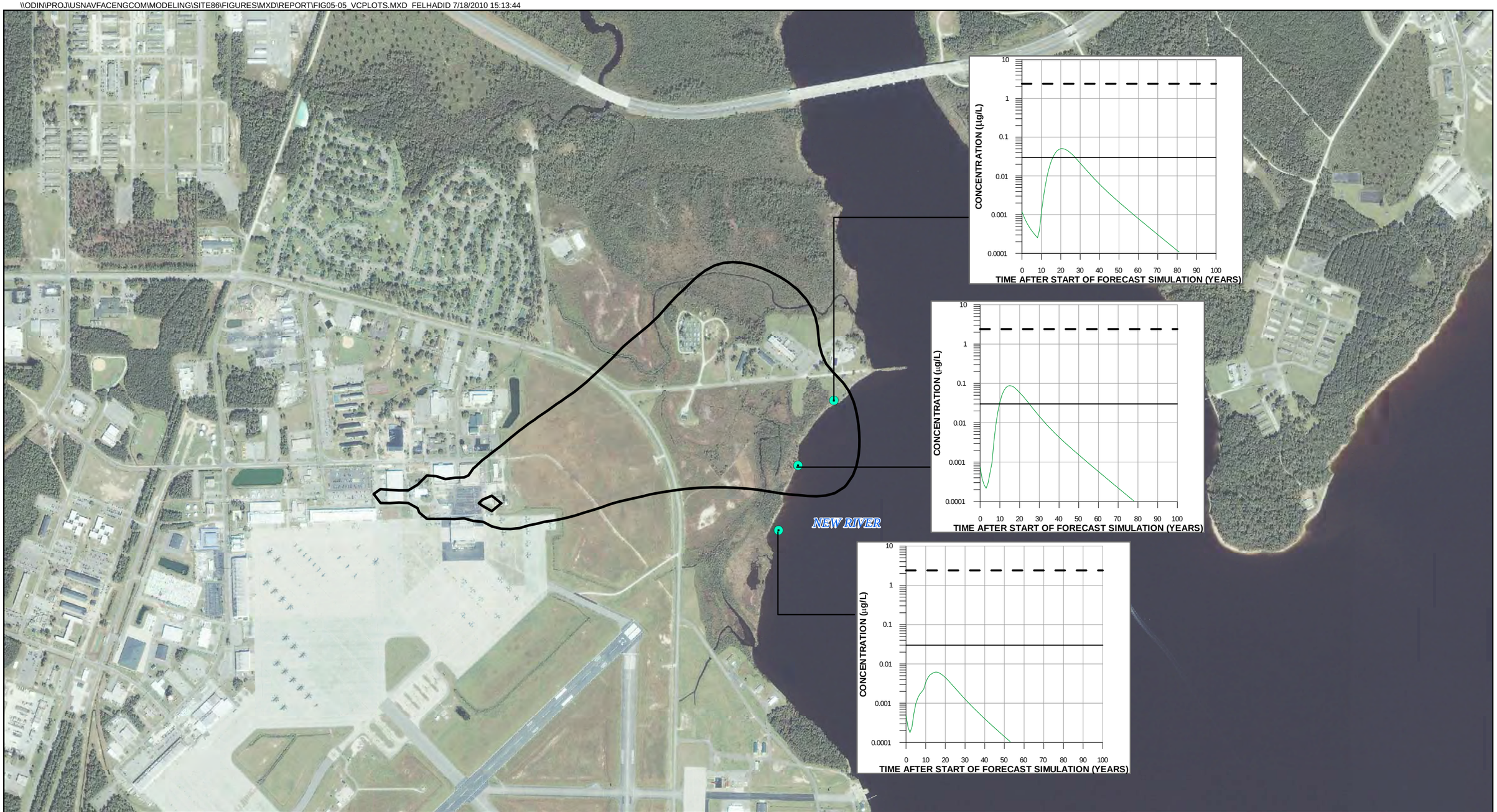

MAP LEGEND

- VIRTUAL MONITORING WELL
- MODELED VINYL CHLORIDE PLUME FOOTPRINT (0.03 µg/L) SCENARIO 1 - 20 YEARS

PLOT LEGEND

- MODELED VC CONCENTRATION
- NORTH CAROLINA GROUNDWATER QUALITY STANDARD (0.03 µg/L)
- NORTH CAROLINA SURFACE WATER QUALITY STANDARD (2.4 µg/L)

N

0 500 1,000 2,000 Feet

1 inch = 1,000 feet

NOTE:

PLOTTED CONCENTRATIONS REPRESENT MAXIMUM CONCENTRATION FROM ALL MODEL LAYERS.

Figure D-8
Modeled VC Chemographs under Scenario 1
Numerical Modeling of Vinyl Chloride Transport
in Groundwater, Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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LEGEND

- SURFICIAL AQUIFER
- UPPER CASTLE HAYNE AQUIFER
- MIDDLE CASTLE HAYNE AQUIFER

NOTES:

DATE OF AERIAL PHOTOGRAPHY, OCTOBER 2006 (GeoEye 2006©).

N

0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet

Figure D-9
Site 86 Monitoring Wells by Model Layer
Numerical Modeling of Vinyl Chloride Transport
in Groundwater, Operable Unit 20 (Site 86)
MCIEAST-MCB CAMLEJ
North Carolina

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Appendix E
Detailed Cost Estimates

COST ESTIMATE for Alternative 2 - MNA with LUCs
SITE 86 (Operable Unit No. 20) MCIEAST MCBCAMLEJ

Assumptions:
Assumes annual groundwater monitoring of 30 wells for VOCs and select NAIPs with PDBs for 53 years

CAPITAL AND OPERATIONAL COSTS					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Land Use Controls					
Site notification, sign maintanence, and site survey	1	LS	$20,000	$20,000	Engineer's Estimate
SUBTOTAL LAND USE CONTROLS COST				**$20,000**	
SUBTOTAL CAPITAL AND OPERATIONAL CAPITAL				**$20,000**	
Project Management			5%	$1,000	
G&A			13%	$2,600	Per Navy Clean contract
Contingency			15%	$3,000	
Profit			5.0%	$1,000	Per Navy Clean contract
TOTAL CAPITAL AND OPERATIONAL COST				**$27,600**	

GROUNDWATER MONITORING					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
See Groundwater Monitoring Present Worth Worksheet					

PRESENT WORTH ANALYSIS					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Number of Years of Operation =	53	years			
Effective Interest Rate =	7.0%				
			Total Cost	Present Worth	
Capital Cost =	$27,600		$27,600	$27,600	
Groundwater Monitoring Costs Years 1-53 =			$2,125,035	$556,913	
TOTAL PRESENT WORTH COST				**$584,513**	

This cost estimate represents a -30 To +50 percent range of accuracy. This estimate is limited to the conditions existing at its issuance and is not a guaranty of actual price or cost. Uncertain market conditions such as, but not limited to: local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions, may affect the accuracy of this estimate. CH2M HILL is not responsible for any variance from this estimate or actual prices and conditions obtained.

COST ESTIMATE for Alternative 3 - Air Sparge via Horizontal Injection
SITE 86 (Operable Unit No. 20) MCIEAST MCBCAMLEJ

Treatment Assumptions:
Treatment area - COC Concentrations > 100 times NCGWQS
Assumes four treatment areas (two surficial and two upper Castle Hayne)
Install six horizontal air sparge wells
Assume 6 days to install 1 injection well
Assumes radius of influence of 50 ft
AS Operation for 5 years

Assumes Semi-annual groundwater monitoring of 6 wells/treatment area for 5 years and annual groundwater monitoring for 35 years thereafter
Assumes installation of 3 soil vapor monitoring points per treatment area
Assumes semi-annual monitoring of 12 subslab vapor monitoring for 5 years

DESIGN COSTS					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Design, Work Plans					
Design, Work Plans	1	LS	$85,000	$115,000	Previous experience on similar project.
SUBTOTAL DESIGN, WORK PLANS COSTS				**$115,000**	
TOTAL DESIGN COST				**$115,000**	

TREATMENT CAPITAL AND OPERATIONAL COSTS					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Site Preparation					
Utility Location	1	LS	$10,000	$10,000	Engineer's Estimate
SUBTOTAL SITE PREPARATION COST				**$10,000**	
Construction - Subcontractor					
Mobilization/Demobilization	1	LS	$45,000	$45,000	Written quote from Directional Technologies. Assumes 4" FRE slotted pipe and casing and Total Well Lengths for all below:
Drilling	7,585	FT	$160	$1,213,600	Assumes depth of 70 ft for UCH aquifer treatment zones and 50 ft for surficial treatment zones.
Well Materials	7,585	FT	$15	$113,775	Written quote from Directional Technologies.
Well Development and Surface Grout Seal	6	EA	$3,500	$21,000	Written quote from Directional Technologies.
RDW Management	1	LS	$45,000	$45,000	Written quote from Directional Technologies.
AS Field Trenching and Piping	100	FT	$35	$3,500	Written quote from Directional Technologies.
Wellheads	6	EA	$1,500	$9,000	Above ground wellheads w/ bollards
Compressor,Manifold, Enclosure, Electronics	3	unit	$150,000	$450,000	Written quote Onion
Subslab vapor monitoring point installation	12	EA	$15,000	$180,000	Engineer's Estimate
VIMS Installation	4	EA	$50,000	$200,000	Concurence letter back up-CTO-WE24
SUBTOTAL				**$2,290,875**	
Field Oversight and Expenses					
Field Oversight and Expenses	50	day	$1,000	$50,000	Engineer's Estimate
SUBTOTAL FIELD OVERSIGHT AND EXPENSES COST				**$50,000**	
System Start-Up					
Technician 1	100	hr	$75	$7,500	Per Navy Clean Labor rates
Engineer 1	20	hr	$140	$2,800	Per Navy Clean Labor rates
Engineer 2	100	hr	$110	$11,000	Per Navy Clean Labor rates

COST ESTIMATE for Alternative 3 - Air Sparge via Horizontal Injection
SITE 86 (Operable Unit No. 20) MCIEAST MCBCAMLEJ

SUBTOTAL SYSTEM STARTUP COST				**$21,300**	
SUBTOTAL TREATMENT CAPITAL AND OPERATIONAL COST				**$2,477,175**	
Project Management			5%	$123,859	
G&A			13%	$322,033	
Contingency			15%	$371,576	
Profit			5%	$123,859	
TOTAL TREATMENT CAPITAL AND OPERATIONAL COST				**$3,418,502**	
OPERATIONS AND MAINTENANCE (YEARS 1-5)					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Routine System O&M					
Monthly O&M Labor + Travel	12	event	$2,500	$30,000	Engineer's Estimate
Quarterly "Heavy" Maintenance	4	event	$3,500	$14,000	Engineer's Estimate
Travel and Per Diem	4	event	$500	$2,000	Engineer's Estimate
O&M Supplies	1	LS	$5,000	$5,000	Engineer's Estimate
SUBTOTAL ROUTINE SYSTEM O&M COST				**$51,000**	
Consumables					
Electrical usage (400 hp total motor peak rating + 10% inefficiency)	1	LS	$286,441	$286,441	Engineer's Estimate, see Power Cost Analysis Spreadsheet
SUBTOTAL CONSUMABLES COST				**$286,441**	
SUBTOTAL OPERATIONS AND MAINTENANCE COST				**$338,000**	
Project Management			5%	$2,550	
G&A			13%	$6,783	
Contingency			15%	$7,650	
Profit			5%	$2,550	
TOTAL OPERATIONS AND MAINTENANCE COST/YEAR (YEARS 1-5)				**$357,533**	
GROUNDWATER MONITORING. YEARS 1-30					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
See Groundwater Monitoring Present Worth Worksheet					
PRESENT WORTH ANALYSIS					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Number of Years of Air Sparging =	5	years			
Number of Years of Post AS Monitoring =	35	years			
Effective Interest Rate =	7.0%				
			Total Cost	Present Worth	
Capital Cost =	$3,418,502		$3,418,502	$3,418,502	
Air Sparging Years 1-5 =	$357,533		$1,787,665	$1,465,956	
Monitoring Years 1-40 =			$1,654,425	$576,049	
TOTAL PRESENT WORTH COST				**$5,460,507**	

This cost estimate represents a -30 To +50 percent range of accuracy. This estimate is limited to the conditions existing at its issuance and is not a guaranty of actual price or cost. Uncertain market conditions such as, but not limited to: local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions, may affect the accuracy of this estimate. CH2M HILL is not responsible for any variance from this estimate or actual prices and conditions obtained.

COST ESTIMATE for Alternative 4 - ISCO via Vertical Injection and Recirculation
SITE 86 (Operable Unit No. 20) MCIEAST MCBCAMLEJ

Assumptions:
Treatment Area = COCs > 100 times NCGWQS
Assume four treament areas
Vertical Treatment Interval = 20 ft: Surficial 10 to 30 ft bgs and Upper Castle Hayne 35 to 55 ft bgs
Oxidant Demand = Surficial (Area 1 =275,024 lbs, Area 2=1,100,176 lbs) UCH (Area 1 =1,309,733 lbs, Area 2=1,091,444 lbs)
Injection Spacing = 6 injection-2 extraction well pattern (Surficial 50 ft and UCH 75 ft)
Number of Injection/Extraction Wells = Surficial (Area 1 =6 inj/ 2 ext, Area 2=15 inj/8 ext) UCH(Area 1 =15 inj/ 8 ext, Area 2=10 inj/4 ext)

Number of Monitoring Wells = Surficial (Area 1 =1 existing/ 5 new, Area 2=1 existing/ 5 new) UCH(Area 1 =2 existing/ 5 new, Area 2=1 existing/ 5 new)
Estimated Time to Complete Installation = 1.5 day/well
Estimated Time to Complete 1 injection/treatment area = Surficial (Area 1 =17 days, Area 2=67 days) UCH(Area 1 =59 days, Area 2=49 days) - Includes 15 days of recric for surficial grids and 10 days of recirc for UCH grids
Injection rates assumed to be 12 gpm/grid for 10 hrs/day. Recirc 24 hrs/day.
Assume 1 injection per treatment area
Assumes semi-annual groundwater monitoring during ISCO treatment for 5 years and annual monitoring thereafter

DESIGN COSTS					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Design, Work Plans					
Design, Work Plans	1	LS	$85,000	$115,000	Previous experience on similar projects
SUBTOTAL DESIGN, WORK PLANS COST				**$115,000**	
TOTAL DESIGN COST				**$115,000**	
TREATMENT CAPITAL AND OPERATIONAL COSTS					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Site Preparation					
Utility Location	1	LS	$10,000	$10,000	Engineer's Estimate
SUBTOTAL SITE PREPARATION COST				**$10,000**	
Well Installation					
Mobilizaton	1	LS	$8,000.00	$8,000.00	
Injection/Extraction Well Installation	2965	LF	$100	$296,500	Assume 31 wells to 30 ft and 37 wells to 55 ft - costs based on Pilot Study
4-inch 0.02-inch slot Vee-wire)	68	Each	$125	$8,500	
Monitoring Well Installation	750	LF	$75	$56,250	Assume 10 wells to 25 ft and 10 wells to 50 ft - costs based on Pilot Study
T&D	780	55 gal	$100	$78,000	Assumes 5 drums/monitoring well and 10 drums/inj-ext well of cuttings/purge water l - non-haz disposal
SUBTOTAL WELL INSTALLATION COST				**$447,250**	
Field Oversight and Expenses					
Field Oversight and Expenses	132	day	$1,000	$132,000	Engineer's Estimate - assumes well installation and development
SUBTOTAL FIELD OVERSIGHT AND EXPENSES COST				**$132,000**	
Land Use Controls Survey					
Land Use Controls Survey	1	LS	$15,000	$15,000	Engineer's Estimate
SUBTOTAL LAND USE CONTROLS SURVEY COST				**$15,000**	
Injection Supplies					
Injection/Extraction Trailer and Pumps	2	LS	$79,000	$158,000	Site 86 Pilot Study PO
Mixing Equipment/Piping	80	day	$500	$40,000	Site 88 Pilot Study PO
Permanganate Mixing (chemical	3,304,029	gallon	$0.29	$958,168	Site 88 Pilot Study PO
Permanganate Delivery	69	deliveries	$1,000	$69,000	Site 88 Pilot Study PO
Permanganate	1,102,885	lb	$2.55	$2,812,357	Carus Vendor quote 5-9-2012
SUBTOTAL SUPPLIES COST				**$4,037,525**	
Field Oversight and Expenses					
Field Oversight and Expenses	191	day	$3,000	$573,000	Engineer's Estimate, assumes 3 people to operate injection/extraction system
SUBTOTAL FIELD OVERSIGHT AND EXPENSES COST				**$573,000**	

COST ESTIMATE for Alternative 4 - ISCO via Vertical Injection and Recirculation
SITE 86 (Operable Unit No. 20) MCIEAST MCBCAMLEJ

Reporting					
Reporting	1	LS	$15,000	$15,000	Engineer's Estimate
SUBTOTAL REPORTING COST				**$15,000**	
SUBTOTAL TREATMENT CAPITAL AND OPERATIONAL COST				**$5,344,775**	
Project Management			5%	$267,239	
G&A			13%	$694,821	
Profit			5%	$267,239	
Contingency			15%	$801,716	
TOTAL TREATMENT CAPITAL AND OPERATIONAL COST				**$7,375,790**	
GROUNDWATER MONITORING. YEARS 1-30					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
See Groundwater Monitoring Present Worth Worksheet					
PRESENT WORTH ANALYSIS					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Number of Years of Monitoring =	40	years			
Effective Interest Rate =	7.0%				
			Total Cost	Present Worth	
Capital Cost =	$7,375,790		$7,375,790	$7,375,790	
Groundwater Monitoring Years 1-30 =			$1,604,475	$535,088	
TOTAL PRESENT WORTH COST				**$7,910,878**	

This cost estimate represents a -30 To +50 percent range of accuracy. This estimate is limited to the conditions existing at its issuance and is not a guaranty of actual price or cost. Uncertain market conditions such as, but not limited to: local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions, may affect the accuracy of this estimate. CH2M HILL is not responsible for any variance from this estimate or actual prices and conditions obtained.

COST ESTIMATE for Alternative 5 - ERD via Vertical Injection and Recirculation
SITE 86 (Operable Unit No. 20) MCIEAST MCBCAMLEJ

Assumptions:
Treatment Area = COCs > 100 times NCGWQS
Assume four treament areas
Vertical Treatment Interval = 20 ft: Surficial 10 to 30 ft bgs and Upper Castle Hayne 35 to 55 ft bgs
ERD = Surficial (Area 1 =17,550 lbs, Area 2=69,300 lbs) UCH (Area 1 =82,350 lbs, Area 2=68,850 lbs)
Injection Spacing = 6 injection-2 extraction well pattern (Surficial 50 ft and UCH 75 ft)
Number of Injection/Extraction Wells = Surficial (Area 1 =6 inj/ 2 ext, Area 2=15 inj/8 ext) UCH(Area 1 =15 inj/ 8 ext, Area 2=10 inj/4 ext)
Number of Monitoring Wells = Surficial (Area 1 =1 existing/ 5 new, Area 2=1 existing/ 5 new) UCH(Area 1 =2 existing/ 5 new, Area 2=1 existing/ 5 new)
Estimated Time to Complete Installation = 1.5 day/well
Estimated Time to Complete 1 injection/treatment area = Surficial (Area 1 =19 days, Area 2=75 days) UCH(Area 1 =58 days, Area 2=35 days) - Includes 15 days of recric for surficial grids and 10 days of recirc for UCH grids
Injection rates assumed to be 12 gpm/grid for 10 hrs/day. Recirc 24 hrs/day.
Assume 1 injection per treatment area
Assumes semi-annual groundwater monitoring during ERD treatmentfor 5 years and annual monitoring thereafter

DESIGN COSTS					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Design, Work Plans					
Design, Work Plans	1	LS	$85,000	$115,000	
SUBTOTAL DESIGN, WORK PLANS COST				**$115,000**	
TOTAL DESIGN COST				**$115,000**	
TREATMENT CAPITAL AND OPERATIONAL COSTS					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Site Preparation					
Utility Location	1	LS	$10,000	$10,000	Engineer's Estimate
SUBTOTAL SITE PREPARATION COST				**$10,000**	
Well Installation					
Injection/Extraction Well Installation	2965	LF	$200	$593,000	Assume 31 wells to 30 ft and 37 wells to 55 ft - costs based on Pilot Study
Monitoring Well Installation	750	LF	$150	$112,500	Assume 10 wells to 25 ft and 10 wells to 50 ft - costs based on Pilot Study
T&D	780	55 gal	$100	$78,000	Assumes 5 drums/monitoring well and 10 drums/inj-ext well of cuttings/purge water l - non-haz disposal
SUBTOTAL WELL INSTALATION COST				**$783,500**	
Field Oversight and Expenses					
Field Oversight and Expenses	132	day	$1,000	$132,000	Engineer's Estimate - assumes well installation and development
SUBTOTAL FIELD OVERSIGHT AND EXPENSES COST				**$132,000**	
Land Use Controls Survey					
Land Use Controls Survey	1	LS	$15,000	$15,000	Engineer's Estimate
SUBTOTAL LAND USE CONTROLS SURVEY COST				**$15,000**	
Injection Supplies					
Injection/Extraction Trailer and Pumps	1	LS	$79,000	$79,000	Site 86 Pilot Study PO
Mixing Equipment/Piping	171	day	$500	$85,500	Site 88 Pilot Study PO
LactOil	240,704	lb	$1.39	$334,579	Vendor quote 5-7-2012
Bioaugmentation Culture	428	liter	$135.78	$58,114	Site 86 Pilot Study PO - 1,650 ft^3/liter of culture
SUBTOTAL SUPPLIES COST				**$557,192**	
Field Oversight and Expenses					
Field Oversight and Expenses	171	day	$3,000	$513,000	Engineer's Estimate, assumes 3 people to operate injection/extraction system
SUBTOTAL FIELD OVERSIGHT AND EXPENSES COST				**$513,000**	
Reporting					
Reporting	1	LS	$15,000	$15,000	Engineer's Estimate
SUBTOTAL REPORTING COST				**$15,000**	
SUBTOTAL TREATMENT CAPITAL AND OPERATIONAL COST				**$2,140,692**	

COST ESTIMATE for Alternative 5 - ERD via Vertical Injection and Recirculation
SITE 86 (Operable Unit No. 20) MCIEAST MCBCAMLEJ

Project Management			5%	$107,035	
G&A			13%	$278,290	
Contingency			15%	$321,104	
Profit			5%	$107,035	
TOTAL TREATMENT CAPITAL AND OPERATIONAL COST				**$2,954,156**	
GROUNDWATER MONITORING. YEARS 1-30					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
See Groundwater Monitoring Present Worth Worksheet					
PRESENT WORTH ANALYSIS					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Number of Years of Monitoring =	40	years			
Effective Interest Rate =	7.0%				
			Total Cost	Present Worth	
Capital Cost =	$2,954,156		$2,954,156	$2,954,156	
Groundwater Monitoring Years 1-30 =			$1,801,575	$696,718	
TOTAL PRESENT WORTH COST				**$3,650,874**	

This cost estimate represents a -30 To +50 percent range of accuracy. This estimate is limited to the conditions existing at its issuance and is not a guaranty of actual price or cost. Uncertain market conditions such as, but not limited to: local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions, may affect the accuracy of this estimate. CH2M HILL is not responsible for any variance from this estimate or actual prices and conditions obtained.

Appendix F
SiteWise Results

APPENDIX F

Sustainability Analysis for Site 86

Introduction

This appendix presents the approach taken and results obtained from a sustainability analysis that CH2M HILL performed for Operable Unit (OU) No. 20, Site 86 on Marine Corps Air Station (MCAS) New River located aboard Marine Corps Installations East-Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ) in Onslow County, North Carolina. Approximately half of Site 86 is developed with buildings, parking lots, landscaped areas, and the flightline. Soil and groundwater impacted with chlorinated volatile organic compounds (CVOCs) were initially discovered as part of an above ground storage tank (AST) investigation in the early 1990's.

Alternatives are presented to address Site 86 contaminants of concern (COCs) in groundwater in the surficial and the Upper Castle Hayne aquifers. A detailed summary of the remedial alternatives is provided in Section 4 of the Site 86 Feasibility Study (FS). A sustainability analysis was performed by CH2M HILL using SiteWise™ Version 2.0 (Battelle, 2011) for the following remedial alternatives:

- Alternative 1 - No Action
- Alternative 2 –Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs)
- Alternative 3 – Air Sparging (AS) with LUCs and MNA
- Alternative 4 –*In Situ* Chemical Oxidation (ISCO) with LUCs and MNA
- Alternative 5 –Enhanced Reductive Dechlorination (ERD) with LUCs and MNA

Method and Assumptions

The SiteWise™ tool consists of a series of Excel-based spreadsheets used to conduct a baseline assessment of sustainability metrics. The assessment is carried out using a spreadsheet-based building block approach, where every remedial alternative is first broken down into modules that mirror the phases of remedial action work, specifically: remedial investigation (RI), remedial action construction (RAC), remedial action operation (RAO), and long-term monitoring (LTM).

SiteWise™ uses various emission factors from governmental or non-governmental research sources to determine the environmental impact of each activity. The quantitative metrics calculated by the tool include:

1. Greenhouse gases (GHGs) reported as carbon dioxide equivalents (CO_2e), consisting of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O);
2. Energy usage (expressed as British Thermal Units [BTU]);
3. Water usage (gallons of water);
4. Air emissions of criteria pollutants consisting of nitrogen (NO_x), sulfur oxides (SO_x), and particulate matter (PM_{10}); and
5. Accident risk (risk of injury and risk of fatality).

For the purpose of this discussion the term footprint will be used to describe the quantified emissions or quantities for each metric. To estimate the sustainability footprint for each remedial alternative, only those elements of the RI, RAC, RAO, and LTM possessing important sustainability elements were included in the assessment. The footprints of each remedial phase are combined into overall footprints for each remedial action. It should be noted that SiteWise only tracks NOx, SOx, and PM for electricity and fuel and does not track it for consumables. Additionally, water impacts are only reflective of water used in electricity production and identified by the user and entered manually.

A lower environmental footprint indicates lower deleterious impacts to environmental and social metrics, which collectively make up the SiteWise™ sustainability metrics. Conversely, a higher environmental footprint indicates higher deleterious impacts associated with the SiteWise™ metrics. The major conclusions of this sustainability

analysis are incorporated into the short-term effectiveness criteria evaluation of the FS report. The No Action alternative is not analyzed because there are no impacts to environmental and social metrics.

Detailed assumptions for groundwater alternatives are provided in **Tables F-1** through **F-4**. The following is a description of the major activities for each alternative covered under the respective remedial action phase.

- RI: No actions for any alternative.
- RAC: Material production, transportation of personnel, materials and equipment, equipment use, water consumption for well installation and development, onsite labor hours, and residual handling.
  - Alternative 2 includes the periodic monitoring of groundwater using existing infrastructure. LUC field work consists of site surveys and oversight, which include personnel transportation and onsite labor hours.
  - Alternative 3 involves the installation of an air sparge treatment system, 6 horizontal air sparge wells, and conveyance piping. It includes production of materials, transportation of personnel and equipment, equipment use, residual soil handling, water consumption for well installation and development, and onsite labor hours.
  - Alternative 4 involves in situ chemical oxidation by injecting and subsequently re-circulating potassium permanganate in a network of injection/extraction wells. This alternative assumes the installation of 46 vertical injection wells, 22 vertical extraction wells, and 20 monitoring wells in the four treatment areas.
  - Alternative 5 involves enhanced *in situ* bioremediation by injecting and subsequently re-circulating LactOil® (a vegetable oil based substrate) and KB-1 bioaugmentation culture into a network of injection/extraction wells. The proposed well network is the same as with Alternative 4.
- RAO: Material production, transportation of personnel, materials and equipment, equipment use, water consumption, and onsite labor hours
  - Alternative 2 has no RAO
  - Alternative 3 involves air sparging in four treatment areas over a five-year period. Monthly and quarterly operations and maintenance includes transportation of personnel and onsite labor hours. Equipment use is also assumed to account for power consumption to operate the air sparge system.
  - Alternative 4 and 5 involve a one-time injection event using a modular treatment mechanism to treat each of the individual grids consecutively. Alternative 4 assumes the delivery of a 4% potassium permanganate solution (1,102,885 lbs over the entire treatment area). Alternative 5 assumes 240,704 lbs of LactOil® and 428 liters of KB-1culture are delivered. Both alternatives use water to dilute the amendments, and require power to run the injection/re-circulation delivery system.
- LTM: Transportation of personnel and onsite labor hours.
  - Alternative 2 involves semiannual LUC inspections and annual monitoring of 30 wells for 30 years.
  - Alternative 3 requires semiannual LUC inspections, semiannual groundwater monitoring of 24 wells and 12 subslab vapor monitoring points for 5 years, and annual monitoring of 30 wells for 25 years.
  - Alternatives 4 and 5 require semiannual LUC inspections, semiannual groundwater monitoring of 27 wells for 5 years, and annual monitoring of 30 wells for 29 years.

General Assumptions

The specific assumptions made for the individual remedies are presented in **Tables F-1** through **F-4**. The following overall assumptions are used for the SiteWise™ tool evaluation:

- Distance to IDW landfill: Assume all non-hazardous waste will be transported to a landfill located 200 miles away from MCB CamLej.
- Water IDW is disposed of at a local waste water treatment plant (WWTP), transportation is negligible.

- IDW volume assumptions are as follows:
  - Soil = 1.2 times the volume of the borehole
  - Development water = 50 gallons per well (monitoring wells or vertical injection wells). 3 well volumes for horizontal injection wells, estimated by multiplying the entire well length by 0.653 gallons per foot for a 4-inch well.
- The distances per trip for materials shipped onsite and IDW shipped offsite were included at full weight going one way and empty weight going one way.
- The complete environmental footprint for production of equipment used, or production of the vehicles used for transportation, is not considered in this analysis.
- For materials being shipped onsite, the transportation of these materials was captured using the EQUIPMENT TRANSPORTATION sections.
- The following density conversions were used:
  - Soil : 1.5 tons/cy
  - Sand : 1.5 tons / cy
- The following average distances traveled were used unless specific distances were known:
  - Oversight/Monitoring Support – 500 miles roundtrip
  - Utility Location – 500 miles roundtrip
  - Surveying – 500 miles roundtrip
  - General Heavy Equipment – 50 miles roundtrip
  - O&M or Inspections – 50 miles roundtrip
  - Monitoring and Vertical Injection Well Drillers/Rig – 800 miles roundtrip
  - Horizontal Directional Drilling Drillers/Rig – 1,340 miles roundtrip
  - Injection Support – 500 miles roundtrip

Results and Conclusions

The overall quantitative footprints and the relative impact of each alternative is provided in **Table F-5**. The relative impact is a qualitative assessment of the relative footprint of each alternative, a rating of high, medium, or low is assigned to each alternative based on its performance against the other alternatives. The tool assigns a ranking of high to the highest footprint in each category and assigns the rankings of other alternatives based on the difference in the data between alternatives. The ranking is based on a 30 percent difference, if the footprints of two alternatives are within 30 percent of each other they will be given the same rating and there is essentially no difference between the alternatives. This allows for some uncertainty inherent in life cycle impact assessments and the assumptions used in the model.

It should be noted that while this analysis compares the environmental footprints of each of the alternatives, the alternatives provide different end-uses. Therefore, a comparison of the results of the alternatives needs to be made in the context of the benefits (e.g., ARAR compliance, contaminant reduction, cost effectiveness, and etc.) of each of the alternatives.

A comparative analysis for Alternatives 2 through 5 is summarized in **Figure F-1**. **Table F-5** presents a comparison of the quantitative environmental footprint metrics evaluated for each of the groundwater remedial alternatives. Alternative 3 (AS) had higher footprints in all categories except PM_{10}, and accident risk footprints which were within 30 percent of Alternative 4 (ISCO) and 5 (ERD). Alternatives 4 and 5 had high PM_{10} and higher accident footprints as compared to other alternatives.

- **Alternative 1 - No Action**

  This alternative has no sustainability impacts because no action occurs.

- **Alternative 2 –MNA and LUCs**

  Of the alternatives evaluated Alternative 2 had the lowest relative sustainability impacts, given the limited remedial construction and operation actions assumed. Approximately 97 percent of emissions and energy use impacts are related to transportation of personnel as part of LTM activities. LTM onsite labor and transportation are also the major contributors to risk footprint. **Table F-6 and Figure F-2** presents a summary of SiteWise™ results for Alternative 2.

- **Alternative 3 – AS with LUCs and MNA**

  Actions proposed under Alternative 3 resulted in the highest emissions, energy use and water consumption impacts as compared to the other proposed alternatives. Electricity used to power the compressor operating the AS system during the RAO phase contributed to over 95 percent of GHG, NO_x and SO_x emissions, energy use and water consumption impacts. Drilling activities during AS well installation as part of the RAC phase accounted for approximately 88 percent of the PM_{10} footprint, and personnel transportation during operations and long term monitoring contributed to the remainder. LTM onsite labor and transportation of personnel contributed to approximately 50 percent of accident footprint estimates. The results for this alternative are summarized in **Table F-9** and on **Figure F-3**.

- **Alternative 4 –ISCO with LUCs and MNA**

  RAC phase consumables (ISCO chemical manufacturing) accounted for over 70 percent of the GHG and total energy footprints. As previously discussed, additional metrics from chemical manufacturing are not accounted for in SiteWise™. Dilution water for injections accounted for almost 100 percent of the water consumption footprint with a small quantity of water used during drilling. Drilling activities accounted for approximately 70 percent of NO_X, and SO_X footprints, and approximately 40 percent of the PM_{10} footprint. Approximately 50 percent of the PM_{10} footprint is related transportation and operation of the generator for amendment distribution and recirculation as part of the RAO phase. Alternative 4 is considered to have a high accident footprint as compared to Alternatives 2 and 3. Personnel and equipment transportation accounted for over 70 percent of the accident risk fatality and injury footprints with approximately 60 percent of the impacts from personnel transportation during the RAC and LTM phases. The results for this alternative are summarized in **Table F-8** and on **Figure F-4**.

- **Alternative 5 –ERD with LUCs and MNA**

  RAC phase consumables (EVO chemical manufacturing) accounted for only 13 and 22 percent of the GHG and total energy footprints (lower as compared to ISCO), respectively. Dilution water for injections accounted for almost 100 percent of the water consumption footprint with a small quantity during well installation. Drilling activities accounted for over 80 percent of NO_X, SO_X and PM_{10} footprints. As with Alternative 4, Alternative 5 is also considered to have a high accident footprint as compared to Alternatives 2 and 3. On site labor and LTM transportation are the primary contributors to the accident footprint. The results for this alternative are summarized in **Table F-9** and on **Figure F-5**.

Uncertainty Assessment

The SiteWise™ tool does not include emissions factors for HDD rigs. A hollow stem auger rig was assumed as a proxy for horizontal well installation activities, emissions may be underestimated. Additionally, an average emission factor for drilling used but in reality, there is a wide range of emissions from heavy equipment based on age and condition of the equipment, and the intensity of the activity.

A generic ERD substrate (Vegetable Oil) was used in the SiteWise™ tool, however there is a wide range of products that use different types of substrates (emulsified vegetable oil, molasses, or sodium lactate for example) that have different feedstocks (corn, soybeans, sorghum) that have different life-cycle impacts. LactOil® was assumed to be 45% emulsified vegetable oil by weight, however it is important to note the actual composition is uncertain given publically available information.

The SiteWise™ tool does not include an option for the injection of potassium permanganate. Hydrogen peroxide was the closest to the sodium permanganate in composition and therefore used in this analysis. SiteWise™ does not track the water use, NO_x, SO_x, and PM_{10} footprints for chemical manufacturing which may underestimate the overall footprints for ISCO alternatives. For personnel transportation during LTM, current emissions rates and automobile efficiencies were used; however, transportation technologies may change significantly over the 30 year projected time frame.

Recommendations

The estimates from the SiteWise™ tool were used to estimate the environmental footprint of the alternatives. Once the alternative is selected, it is recommended the footprint of the selected alternative be further evaluated in the design phase of the projects to explore opportunities to optimize the environmental footprint of the project and integrate sustainable remediation best practices in the design, construction, and operation of the alternative.

Tables

TABLE F-1

Alternative 2 Monitored Natural Attenuation and Land Use Controls

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Sitewise Tab	**Assumptions**
Remedial Investigation	No Actions
Remedial Action Construction	**LUC: Survey and Oversight**
Personnel Transportation - Road	Oversight - 1 person, 500 miles R/T from Charlotte (1 trip) Surveying - 2 people, 500 miles R/T from Charlotte (1 trip)
Labor Hours Onsite	LUCs - 24 hours (3 people for 1 day, 8 hrs per day) - Labor type = operating engineers
Remedial Action Operations	No Actions
Longterm Monitoring	
Personnel Transportation - Road	**LUC: Semi-annual Inspections 30 years** Local travel - 1 person, 50 mile R/T (60 trips) **MNA: Annual groundwater monitoring of 30 wells for 30 years for VOCs with PDBs (negligible IDW)** Field staff - 2 people, 2 vehicles, 500 miles R/T from Charlotte (60 trips)
Labor Hours Onsite	**LUCs** - 600 hours (1 person for 2 days per year, 10 hrs per day over 30 years) - Labor type = operating engineers **MNA sampling** - 1,200 hours (2 people for 2 days, 10 hrs per day over 30 years) - Labor type = operating engineers

Notes:

IDW = Investigation Derived Waste

LUC = Land Use Controls

MNA = Monitored Natural Attenuation

PDB = Passive Diffusion Bag sampling

R/T = round trip

VOC = Volatile Organic Compound

TABLE F-2

Alternative 3 Air Sparge via Horizontal Injection with Monitored Natural Attenuation and Land Use Controls

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

GENERAL ASSUMPTIONS/CONVERSIONS

Assumes four treatment areas (two surficial and two upper Castle Hayne)
Install six horizontal air sparge wells
SVE is not included
Air Sparge system operation for 5 years

Sitewise Tab	Assumptions
Remedial Investigation	No Actions
Remedial Action Construction	**Install 6 Horizontal wells**
Material Production - Well Materials	6, 4" diameter Sch 80 HDPE horizontal direction drilled wells HSW-1 (1,165 ft), HSW-2 (1,186 ft), HSW-3 (1,974 ft), HSW-4 (2,076 ft), HSW-5 (595 ft), and HSW-6 (589 ft) = 7,585 total feet. Air Sparge conveyance piping: 100 ft, DR 11 HDPE piping, 1"
Personnel Transportation - Road	Utility locate - 1 person, 500 miles R/T from Charlotte (1 trip) Drilling support - 1 heavy duty vehicle, 2 people, 1,340 miles R/T Oversight - 1 person, 500 miles R/T from Charlotte (1 trip) Surveying - 2 people, 500 miles R/T from Charlotte (1 trip)
Equipment Transportation - Road	HDD Rig - 30 tons transported 1,340 miles R/T Drilling supplies, heavy duty truck- 20 tons of equipment, tooling, well construction materials (sand, grout, bentonite) 670 miles full, 670 miles w/10 tons on return trip Piping/well materials - 7,585 ft x 4" diameter Sch 80 HDPE (1.92 lb/ft) = 14,570 lbs (approx 7.3 tons) shipped 50 miles one way from Wilmington, NC, 1 empty trip Air Sparge System Supplies (compressor, housing, control panel, etc) - 800 miles one way, 7 tons. Empty - 800 miles back, 0 tons. (1 trip for AS system supplies)
Equipment Use - Drilling	HDD Drilling (assume HSA in SiteWise). Assume 40 hours of drilling time to install 1 injection well 240 hours total
Residual Handling - Soil	Soil IDW - borehole volume plus 20% for soil residuals (8" diameter borehole, 7,585 ft of borehole = 177 tons 19.5 tons per load, 10 trips, 200 miles to non hazardous waste landfill Empty IDW trips - 10 trips 200 miles
Resource Consumption - Water	Water IDW - 3 well volumes purged per horizontal well (7,585 feet of 4" well x 0.653 gallons/ft x 3) = 1,300 gallons to WWTP Water transported to WWTP 200 miles away (same location as soil) 1,300 gallons x 8.34 lb/gal = 10,840 lbs = 5.4 tons Water Use 6,000 gallons for well installation (assume approx 1,000 gallons per well, 6 wells)
Labor Hours Onsite	Utility locate - 10 hours (1 person for 1 day, 10 hrs per day) - Labor type = operating engineers Drilling support - 720 hours (Assume 6 days to install 1 injection well; 2 people for 36 days, 10 hrs per day) - Labor type = Construction laborers Oversight - 580 hours (Assume 6 days to install 1 injection well and 22 hours for system startup; 1 person for 58 days, 10 hrs per day) - Labor type = operating engineers Surveying - 16 hours (2 people for 1 day, 8 hrs per day) - Labor type = operating engineers

TABLE F-2

Alternative 3 Air Sparge via Horizontal Injection with Monitored Natural Attenuation and Land Use Controls

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

GENERAL ASSUMPTIONS/CONVERSIONS

Assumes four treatment areas (two surficial and two upper Castle Hayne)
Install six horizontal air sparge wells
SVE is not included
Air Sparge system operation for 5 years

Sitewise Tab	**Assumptions**
Remedial Action Operations	**Running air sparge system for 5 years**
Personnel Transportation - Road	**Monthly routine O&M** (Local travel) - 1 person, 50 mile R/T, 5 years (60 trips) **Quarterly "Heavy" Maintenance** - 2 people, 2 vehicles, 4 events per year, over 5 years, 500 miles R/T from Charlotte (40 trips)
Equipment Use	Power for compressor/blower for the AS system: 11,756,621 kw-hr (400 hp total motor peak rating + 10% inefficiency)
Labor Hours Onsite	**Monthly routine O&M** - 600 hours (1 person for 12 days, 10 hrs per day over 5 years) - Labor type = operating engineers **Quarterly "Heavy" Maintenance** - 400 hours (2 people for 4 days, 10 hrs per day over 5 years) - Labor type = operating engineers
Longterm Monitoring	**LUC: Semi-annual Inspections 30 years**
Personnel Transportation - Road	Local travel - 1 person, 50 mile R/T (60 trips) **Treatment Area: Semi-annual groundwater monitoring of 6 wells per treatment area and 12 subslab vapor monitoring points for 5 years** Field staff - 2 people, 2 vehicles, 500 miles R/T from Charlotte (20 trips) **MNA: Annual groundwater monitoring of 30 wells for 25 years for VOCs with PDBs (negligible IDW)** Field staff - 2 people, 2 vehicles, 500 miles R/T from Charlotte (50 trips)
Labor Hours Onsite	**LUCs** - 600 hours (1 person for 2 days per year, 10 hrs per day over 30 years) - Labor type = operating engineers **MNA sampling** - 1,000 hours (2 people for 2 days, 10 hrs per day over 25 years) - Labor type = operating engineers **Treatment Area sampling** - 600 hours (2 people for 6 days, 10 hrs per day over 5 years) - Labor type = operating engineers

Notes:

AS = air sparge
ft = feet
HDD = horizontal directional drilling
HDPE - high density polyethylene
HSA = hollow stem auger
IDW = investigation derived waste
kw-hr = kilowatt hour
lb = pound
O&M = operations and maintenance
PDB = passive diffusion bag
R/T = round trip
SVE = soil vapor extraction
WWTP = wastewater treatment plant

TABLE F-3

Alternative 4 ISCO via Vertical Injection and Recirculation with Monitored Natural Attenuation and Land Use Controls

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

GENERAL ASSUMPTIONS/CONVERSIONS

Assumes four treatment areas (two Surficial and two Upper Castle Hayne)

Sitewise Tab	**Assumptions**
Remedial Investigation	No Actions
Remedial Action Construction	**Installing a total of 46 vertical injection wells and 22 vertical extraction wells in the four treatment areas.**
Material Production - Well Materials	68 Injection/Extraction wells, 4" diameter Sch 80 PVC wells, 2965 total linear feet. Assumes 31 wells to 30 ft and 37 wells to 55 ft. The vertical treatment interval is 10 to 30 ft bgs for the Surficial area, and 35 to 55 ft bgs for the Upper Castle Hayne area 20 Monitoring Wells, 2" diameter Sch 40 PVC wells, 750 total linear feet. Assumes 10 wells to 25 ft and 10 wells to 50 ft
Personnel Transportation - Road	Utility locate - 1 person, 500 miles R/T from Charlotte (1 trip) Drilling support - 1 heavy duty vehicle, 2 people, 800 miles R/T Oversight - 1 person, 500 miles R/T from Charlotte (1 trip) Surveying - 2 people, 500 miles R/T from Charlotte (1 trip)
Equipment Transportation - Road	Drill rig - 800 miles R/T, weighs 15 tons Drilling Supplies - 800 miles R/T, weighs 5 tons
Equipment Use - Drilling	Injection/Extraction/Monitoring wells: 88 drilling locations, sonic drilling method, 4 hours drilling at each location, diesel powered rig (352 hours)
Residual Handling - Soil	Soil IDW = 319 tons. Volume assumes 5 55-gallon drums per monitoring well and 10 55-gallon drums per injection/extraction well. 19.5 tons per load, 17 trips, 200 miles to non hazardous waste landfill. Empty IDW trips - 17 trips 200 miles
Resource Consumption - Water	Water IDW - 1 drum (50 gallons) per well for development, 4,400 gallons x 8.34 lb/gal = 36,700 lb (18.35 tons) to WWTP located 200 miles away Water Consumption - assume 2 times borehole volume for sonic installation (430 gallons), 200 gallons for decontamination = 630 gallons total
Labor Hours Onsite	Utility locate - 10 hours (1 person for 1 day, 10 hrs per day) - Labor type = operating engineers Drilling support - 2,640 hours (Assume 1.5 days per well, 2 people for 132 days, 10 hrs per day) - Labor type = Construction laborers Oversight - 1,320 hours (Assume 1.5 days per well, 1 person for 132 days, 10 hrs per day) - Labor type = operating engineers Surveying - 16 hours (2 people for 1 day, 8 hrs per day) - Labor type = operating engineers

TABLE F-3

Alternative 4 ISCO via Vertical Injection and Recirculation with Monitored Natural Attenuation and Land Use Controls

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

GENERAL ASSUMPTIONS/CONVERSIONS

Assumes four treatment areas (two Surficial and two Upper Castle Hayne)

Sitewise Tab	**Assumptions**
Remedial Action Operations	**Assumes one injection event**
Material Production - Treatment Chemicals and Materials	Inject 1,102,885 lbs of 100% potassium permanganate per injection, proxy hydrogen peroxide in SiteWise
Personnel Transportation - Road	Injection oversight - 1 person, 500 miles R/T from Charlotte (1 trip) Injection support crew - 2 people, 2 vehicles, 500 miles R/T, (4 trips total)
Equipment Transportation - Road	Potassium permanganate (4% solution = 3,304,029 gal) shipped from Cary (125 miles one way). Assume 69 substrate deliveries, 195 tons/delivery (8,625 miles) Injection equipment: 15 tons, 500 miles R/T, 1 trip
Equipment Use - Generator	One 6.5 hp gas generator to power injections and recirculation, running 10 hrs per day, 191 days per injection. (1,910 hours)
Resource Consumption - Water	Water use for dilution: 3.2 million gallons
Labor Hours Onsite	**Injection oversight** - 1,910 hours (3 people for 64 days (191 days total), 10 hrs per day) - Labor type = operating engineers
Longterm Monitoring	**LUC: Semi-annual Inspections 30 years**
Personnel Transportation - Road	Local travel - 1 person, 50 mile R/T (60 trips) **Treatment Area: Semi-annual groundwater monitoring of 7 existing and 20 new monitoring wells for 5 years** Field staff - 2 people, 2 vehicles, 500 miles R/T from Charlotte (20 trips) **MNA: Annual groundwater monitoring of 30 wells for 29 years for VOCs with PDBs (negligible IDW)** Field staff - 2 people, 2 vehicles, 500 miles R/T from Charlotte (58 trips)
Labor Hours Onsite	**LUCs** - 600 hours (1 person for 2 days per year, 10 hrs per day over 30 years) - Labor type = operating engineers **MNA sampling** - 1,160 hours (2 people for 2 days, 10 hrs per day over 29 years) - Labor type = operating engineers **Treatment Area sampling** - 450 hours (2 people for 4.5 days, 10 hrs per day over 5 years) - Labor type = operating engineers

Notes:

ft = feet

gal = gallons

hp = horsepower

IDW = investigation derived waste

lb = pound

PDB = passive diffusion bag

PVC = polyvinyl chloride

R/T = round trip

WWTP = wastewater treatment plant

TABLE F-4

Alternative 5 ERD via Vertical Injection and Recirculation with Monitored Natural Attenuation and Land Use Controls

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

GENERAL ASSUMPTIONS/CONVERSIONS

Assumes four treatment areas (two Surficial and two Upper Castle Hayne)

Sitewise Tab	**Assumptions**
Remedial Investigation	No Actions
Remedial Action Construction	**Installing a total of 46 vertical injection wells and 22 vertical extraction wells in the four treatment areas.**
Material Production - Well Materials	68 Injection/Extraction wells, 4" diameter Sch 80 PVC wells, 2965 total linear feet. Assumes 31 wells to 30 ft and 37 wells to 55 ft. The vertical treatment interval is 10 to 30 ft bgs for the Surficial area, and 35 to 55 ft bgs for the Upper Castle Hayne area
	20 Monitoring Wells, 2" diameter Sch 40 PVC wells, 750 total linear feet. Assumes 10 wells to 25 ft and 10 wells to 50 ft
Personnel Transportation - Road	Utility locate - 1 person, 500 miles R/T from Charlotte (1 trip)
	Drilling support - 1 heavy duty vehicle, 2 people, 800 miles R/T
	Oversight - 1 person, 500 miles R/T from Charlotte (1 trip)
	Surveying - 2 people, 500 miles R/T from Charlotte (1 trip)
Equipment Transportation - Road	Drill rig - 800 miles R/T, weighs 15 tons
	Drilling Supplies - 800 miles R/T, weighs 5 tons
Equipment Use - Drilling	Injection/Extraction/Monitoring wells: 88 drilling locations, sonic drilling method, 4 hours drilling at each location, diesel powered rig (352 hours)
Residual Handling - Soil	Soil IDW = 319 tons. Volume assumes 5x 55-gallon drums per monitoring well and 10x55-gallon drums per injection/extraction well. 19.5 tons per load, 17 trips, 200 miles to non hazardous waste landfill.
	Empty IDW trips - 17 trips 200 miles
Resource Consumption - Water	Water IDW - 1 drum (50 gallons) per well for development, 4,400 gallons x 8.34 lb/gal = 36,700 lb (18.35 tons) to WWTP located 200 miles away
	Water Consumption - assume 2 times borehole volume for sonic installation (430 gallons), 200 gallons for decontamination = 630 gallons total
Labor Hours Onsite	Utility locate - 10 hours (1 person for 1 day, 10 hrs per day) - Labor type = operating engineers
	Drilling support - 2,640 hours (Assume 1.5 days per well, 2 people for 132 days, 10 hrs per day) - Labor type = Construction laborers
	Oversight - 1,320 hours (Assume 1.5 days per well, 1 person for 132 days, 10 hrs per day) - Labor type = operating engineers
	Surveying - 16 hours (2 people for 1 day, 8 hrs per day) - Labor type = operating engineers

TABLE F-4

Alternative 5 ERD via Vertical Injection and Recirculation with Monitored Natural Attenuation and Land Use Controls

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

GENERAL ASSUMPTIONS/CONVERSIONS

Assumes four treatment areas (two Surficial and two Upper Castle Hayne)

Sitewise Tab	**Assumptions**
Remedial Action Operations	**Assumes one injection event**
Material Production - Treatment Chemicals and Materials	240,704 lbs of LactOil® (Assuming 45% by weight vegetable oil = 108,316 lbs EVO)
	428 liters of KB-1® Bioaugmentation Culture (negligible impacts)
Personnel Transportation - Road	Injection oversight - 1 person, 500 miles R/T from Charlotte (1 trip)
	Injection support crew - 2 people, 2 vehicles, 500 miles R/T, (4 trips total)
Equipment Transportation - Road	LactOil® - Assume 240,704 pounds (120 tons) transported 1,230 miles one way (from Lenexa, Kansas), empty for 1,230 miles return, diesel (3 trips, 40 tons each)
	KB-1® Bioaugmentation Culture - Assume negligible weight, shipped by truck from Guelph Canada, diesel, 1,000 miles R/T (1 trip)
	Injection equipment: 15 tons, 500 miles R/T, 1 trip
Equipment Use - Generator	One 6.5 hp gas generator to power injections and recirculation, running 10 hrs per day, 171 days per injection. (1,710 hours)
Resource Consumption - Water	Water use for dilution: 230,891 gallons per injection
Labor Hours Onsite	**Injection oversight** - 1,710 hours (3 people for 57 days (171 days total), 10 hrs per day) - Labor type = operating engineers
Longterm Monitoring	**LUC: Semi-annual Inspections 30 years**
Personnel Transportation - Road	Local travel - 1 person, 50 mile R/T (60 trips)
	Treatment Area: Semi-annual groundwater monitoring of 7 existing and 20 new monitoring wells for 5 years
	Field staff - 2 people, 2 vehicles, 500 miles R/T from Charlotte (20 trips)
	MNA: Annual groundwater monitoring of 30 wells for 29 years for VOCs with PDBs (negligible IDW)
	Field staff - 2 people, 2 vehicles, 500 miles R/T from Charlotte (58 trips)
Labor Hours Onsite	**LUCs** - 600 hours (1 person for 2 days per year, 10 hrs per day over 30 years) - Labor type = operating engineers
	MNA sampling - 1,160 hours (2 people for 2 days, 10 hrs per day over 29 years) - Labor type = operating engineers
	Treatment Area sampling - 450 hours (2 people for 4.5 days, 10 hrs per day over 5 years) - Labor type = operating engineers

Notes:

EVO = Emulsified Vegetable Oil
lb = pound
ft = feet
PDB = passive diffusion bag
gal = gallons
PVC = polyvinyl chloride
hp = horsepower
R/T = round trip
IDW = investigation derived waste
WWTP = wastewater treatment plant

TABLE F-5

Summary of Overall Results

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Remedial Alternatives	GHG Emissions	Total energy Used	Water Consumption	NO_x emissions	SO_x Emissions	PM_{10} Emissions	Accident Risk Fatality	Accident Risk Injury
	metric ton	MMBTU	gallons	metric ton	metric ton	metric ton		
Alternative 1 - No Action	0	0	0	0	0	0	0	0
Alternative 2 - Monitored Natural Attenuation and Land Use Controls	1.9E+01	2.4E+02	0.0E+00	7.8E-03	2.4E-04	1.1E-03	3.7E-04	6.4E-02
Alternative 3 - Air Sparge via Horizontal Injection with Monitored Natural Attenuation and Land Use Controls	6.6E+03	1.2E+05	6.0E+06	8.8E+00	3.1E+01	2.2E-02	8.7E-04	1.6E-01
Alternative 4 - ISCO via Vertical Injection and Recirculation with Monitored Natural Attenuation and Land Use Controls	9.1E+02	1.4E+04	3.2E+06	3.3E-01	4.0E-02	4.9E-02	1.4E-03	2.6E-01
Alternative 5 - ERD via Vertical Injection and Recirculation with Monitored Natural Attenuation and Land Use Controls	1.3E+02	1.8E+03	2.3E+05	2.8E-01	3.1E-02	2.7E-02	1.1E-03	2.3E-01

Relative Impact

Remedial Alternatives	GHG Emissions	Total energy Used	Water Consumption	NO_x emissions	SO_x Emissions	PM_{10} Emissions	Accident Risk Fatality	Accident Risk Injury
	metric ton	MMBTU	gallons	metric ton	metric ton	metric ton		
Alternative 1 - No Action	Low	Low	Low	Low	Low	Low	Low	Low
Alternative 2 - Monitored Natural Attenuation and Land Use Controls	Low	Low	Low	Low	Low	Low	Low	Low
Alternative 3 - Air Sparge via Horizontal Injection with Monitored Natural Attenuation and Land Use Controls	High	High	High	High	High	Medium	Medium	Medium
Alternative 4 - ISCO via Vertical Injection and Recirculation with Monitored Natural Attenuation and Land Use Controls	Low	Low	Medium	Low	Low	High	High	High
Alternative 5 - ERD via Vertical Injection and Recirculation with Monitored Natural Attenuation and Land Use Controls	Low	Low	Low	Low	Low	Medium	High	High

The relative impact is a qualitative assessment of the relative footprint of each alternative, a rating of High for an alternative is assigned if it is 70% of the maximum footprint, a rating of Medium is assigned if it is between 30 and 70% of the maximum footprint, and a rating of Low is assigned if it is less than 30% of the maximum footprint.

Notes:

MMBTU - million British Thermal Unit

NOx - Nitrogen Oxides

SOx - Sulfur Oxides

PM10 - Particulate Matter

GHG - Greenhouse Gases

TABLE F-6

Alternative 2 Monitored Natural Attenuation and Land Use Controls Results

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Phase	Activities	GHG Emissions	Total Energy Used	Water Used	NO_x Emissions	SO_x Emissions	PM_{10} Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	metric ton	metric ton	metric ton		
Remedial Action Construction	Consumables	0.0E+00	0.0E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	5.5E-01	7.0E+00	NA	2.3E-04	7.2E-06	3.3E-05	1.2E-05	9.4E-04
	Transportation-Equipment	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-06	5.5E-04
	Residual Handling	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	5.5E-01	7.0E+00	0.0E+00	2.3E-04	7.2E-06	3.3E-05	1.3E-05	1.5E-03
Remedial Action Operation	Consumables	0.0E+00	0.0E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Longterm Monitoring	Consumables	0.0E+00	0.0E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	1.8E+01	2.3E+02	NA	7.6E-03	2.4E-04	1.1E-03	2.6E-04	2.1E-02
	Transportation-Equipment	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.6E-05	4.1E-02
	Residual Handling	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	1.8E+01	2.3E+02	0.0E+00	7.6E-03	2.4E-04	1.1E-03	3.5E-04	6.2E-02
Total		**1.9E+01**	**2.4E+02**	**0.0E+00**	**7.8E-03**	**2.4E-04**	**1.1E-03**	**3.7E-04**	**6.4E-02**

Notes:

MMBTU - million British Thermal Unit

NOx - Nitrogen Oxides

SOx - Sulfur Oxides

PM10 - Particulate Matter

NA - Not Applicable

GHG - Greenhouse Gases

TABLE F-7

Alternative 3 Air Sparge via Horizontal Injection with Monitored Natural Attenuation and Land Use Controls Results

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Phase	Activities	GHG Emissions	Total Energy Used	Water Used	NO_x Emissions	SO_x Emissions	PM_{10} Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	metric ton	metric ton	metric ton		
Remedial Action Construction	Consumables	4.1E+01	3.6E+02	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	2.7E+00	3.6E+01	NA	9.4E-04	3.5E-05	9.7E-05	3.7E-05	2.9E-03
	Transportation-Equipment	8.1E+00	1.1E+02	NA	2.6E-03	4.5E-05	2.3E-04	3.4E-05	2.7E-03
	Equipment Use and Misc	2.1E+01	2.5E+02	6.0E+03	2.1E-01	2.6E-02	1.9E-02	1.2E-04	3.6E-02
	Residual Handling	7.1E+00	9.3E+01	NA	2.2E-03	4.0E-05	2.0E-04	3.4E-05	2.8E-03
	Sub-Total	7.9E+01	8.4E+02	6.0E+03	2.1E-01	2.6E-02	2.0E-02	2.3E-04	4.4E-02
Remedial Action Operation	Consumables	0.0E+00	0.0E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	1.3E+01	1.6E+02	NA	5.3E-03	1.7E-04	7.5E-04	1.8E-04	1.4E-02
	Transportation-Equipment	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	6.5E+03	1.2E+05	6.0E+06	8.6E+00	3.1E+01	0.0E+00	5.4E-05	2.3E-02
	Residual Handling	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	6.5E+03	1.2E+05	6.0E+06	8.6E+00	3.1E+01	7.5E-04	2.3E-04	3.7E-02
Longterm Monitoring	Consumables	0.0E+00	0.0E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	2.1E+01	2.6E+02	NA	8.7E-03	2.7E-04	1.2E-03	3.0E-04	2.4E-02
	Transportation-Equipment	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-04	5.1E-02
	Residual Handling	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	2.1E+01	2.6E+02	0.0E+00	8.7E-03	2.7E-04	1.2E-03	4.1E-04	7.4E-02
Total		**6.6E+03**	**1.2E+05**	**6.0E+06**	**8.8E+00**	**3.1E+01**	**2.2E-02**	**8.7E-04**	**1.6E-01**

Notes:

MMBTU - million British Thermal Unit

NOx - Nitrogen Oxides

SOx - Sulfur Oxides

PM10 - Particulate Matter

NA - Not Applicable

GHG - Greenhouse Gases

TABLE F-8

Alternative 4 ISCO via Vertical Injection and Recirculation with Monitored Natural Attenuation and Land Use Controls Results

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Phase	Activities	GHG Emissions	Total Energy Used	Water Used	NO_x Emissions	SO_x Emissions	PM_{10} Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	metric ton	metric ton	metric ton		
Remedial Action Construction	Consumables	1.7E+01	1.5E+02	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	1.9E+00	2.5E+01	NA	7.0E-04	2.5E-05	7.8E-05	2.8E-05	2.3E-03
	Transportation-Equipment	2.6E+00	3.4E+01	NA	8.3E-04	1.5E-05	7.3E-05	1.2E-05	1.0E-03
	Equipment Use and Misc	2.3E+01	2.7E+02	6.3E+02	2.3E-01	2.9E-02	2.1E-02	3.5E-04	1.0E-01
	Residual Handling	1.2E+01	1.6E+02	NA	3.7E-03	6.6E-05	3.3E-04	5.6E-05	4.5E-03
	Sub-Total	5.6E+01	6.4E+02	6.3E+02	2.3E-01	2.9E-02	2.2E-02	4.4E-04	1.1E-01
Remedial Action Operation	Consumables	6.7E+02	1.1E+04	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	1.4E+00	1.7E+01	NA	5.7E-04	1.8E-05	8.2E-05	2.0E-05	1.6E-03
	Transportation-Equipment	1.3E+02	1.8E+03	NA	4.3E-02	1.8E-03	3.5E-03	3.4E-04	2.7E-02
	Equipment Use and Misc	2.2E+01	4.0E+02	3.2E+06	4.8E-02	9.2E-03	2.3E-02	1.0E-04	4.4E-02
	Residual Handling	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	8.3E+02	1.3E+04	3.2E+06	9.2E-02	1.1E-02	2.6E-02	4.6E-04	7.3E-02
Longterm Monitoring	Consumables	0.0E+00	0.0E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	2.3E+01	2.9E+02	NA	9.6E-03	3.0E-04	1.4E-03	3.3E-04	2.6E-02
	Transportation-Equipment	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-04	5.1E-02
	Residual Handling	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	2.3E+01	2.9E+02	0.0E+00	9.6E-03	3.0E-04	1.4E-03	4.5E-04	7.7E-02
Total		**9.1E+02**	**1.4E+04**	**3.2E+06**	**3.3E-01**	**4.0E-02**	**4.9E-02**	**1.4E-03**	**2.6E-01**

Notes:

MMBTU - million British Thermal Unit

NOx - Nitrogen Oxides

SOx - Sulfur Oxides

PM10 - Particulate Matter

NA - Not Applicable

GHG - Greenhouse Gases

TABLE F-9

Alternative 5 ERD via Vertical Injection and Recirculation with Monitored Natural Attenuation and Land Use Controls Results

Feasibility Study

Operable Unit No. 20 (Site 86)

MCIEAST-MCB CAMLEJ, North Carolina

Phase	Activities	GHG Emissions	Total Energy Used	Water Used	NO_x Emissions	SO_x Emissions	PM_{10} Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	metric ton	metric ton	metric ton		
Remedial Action Construction	Consumables	1.7E+01	1.5E+02	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	1.9E+00	2.5E+01	NA	7.0E-04	2.5E-05	7.8E-05	2.8E-05	2.3E-03
	Transportation-Equipment	2.6E+00	3.4E+01	NA	8.3E-04	1.5E-05	7.3E-05	1.2E-05	1.0E-03
	Equipment Use and Misc	2.3E+01	2.7E+02	6.3E+02	2.3E-01	2.9E-02	2.1E-02	3.5E-04	1.0E-01
	Residual Handling	1.2E+01	1.6E+02	NA	3.7E-03	6.6E-05	3.3E-04	5.6E-05	4.5E-03
	Sub-Total	5.6E+01	6.4E+02	6.3E+02	2.3E-01	2.9E-02	2.2E-02	4.4E-04	1.1E-01
Remedial Action Operation	Consumables	1.6E+01	4.0E+02	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	8.3E-01	1.0E+01	NA	3.4E-04	1.1E-05	4.9E-05	1.2E-05	9.4E-04
	Transportation-Equipment	1.9E+01	2.5E+02	NA	6.0E-03	1.1E-04	5.3E-04	6.9E-05	5.6E-03
	Equipment Use and Misc	1.4E+01	1.9E+02	2.3E+05	3.2E-02	2.2E-03	3.2E-03	9.1E-05	3.9E-02
	Residual Handling	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	5.0E+01	8.4E+02	2.3E+05	3.8E-02	2.4E-03	3.8E-03	1.7E-04	4.6E-02
Longterm Monitoring	Consumables	0.0E+00	0.0E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	2.3E+01	2.9E+02	NA	9.6E-03	3.0E-04	1.4E-03	3.3E-04	2.6E-02
	Transportation-Equipment	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-04	5.1E-02
	Residual Handling	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	2.3E+01	2.9E+02	0.0E+00	9.6E-03	3.0E-04	1.4E-03	4.5E-04	7.7E-02
Total		**1.3E+02**	**1.8E+03**	**2.3E+05**	**2.8E-01**	**3.1E-02**	**2.7E-02**	**1.1E-03**	**2.3E-01**

Notes:

MMBTU - million British Thermal Unit

NOx - Nitrogen Oxides

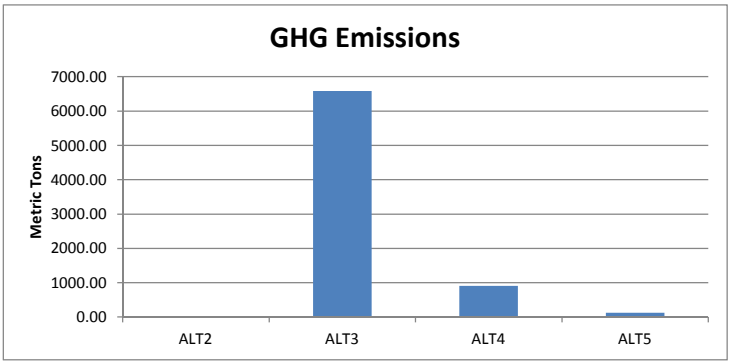
SOx - Sulfur Oxides

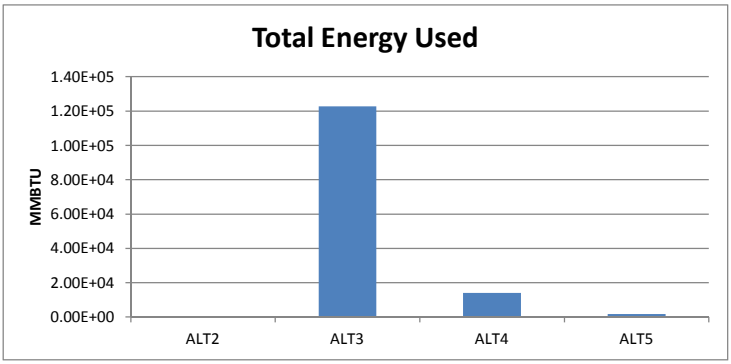
PM10 - Particulate Matter

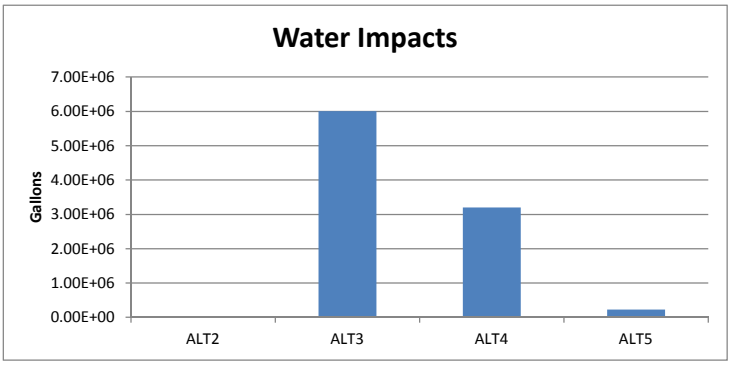
NA - Not Applicable

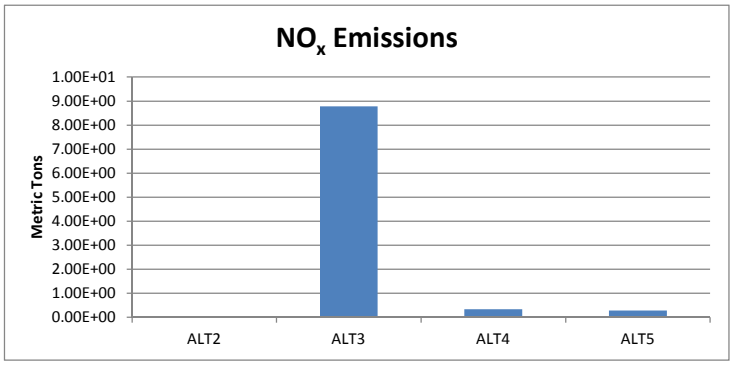
GHG - Greenhouse Gases

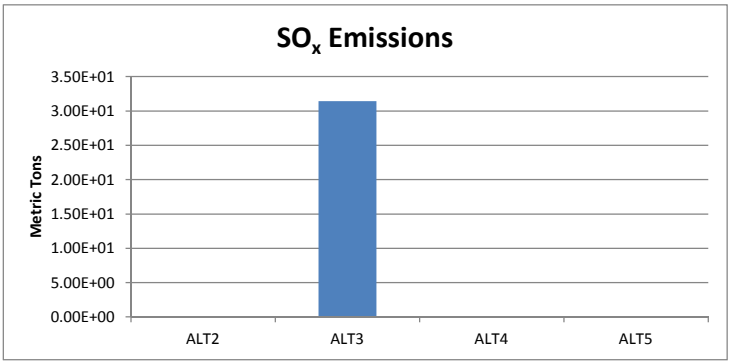
Figures

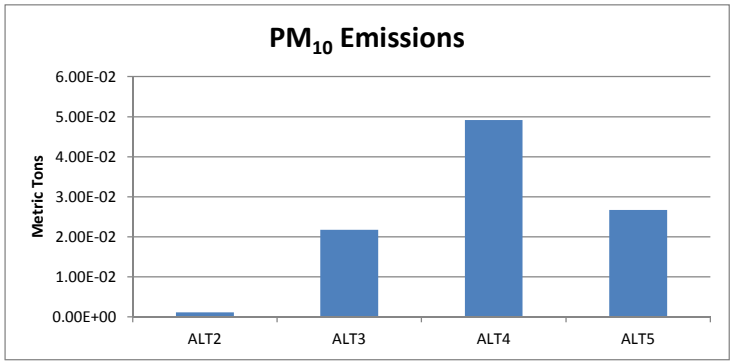

GHG Emissions
Metric Tons
7000.00
6000.00
5000.00
4000.00
3000.00
2000.00
1000.00
0.00
ALT2
ALT3
ALT4
ALT5

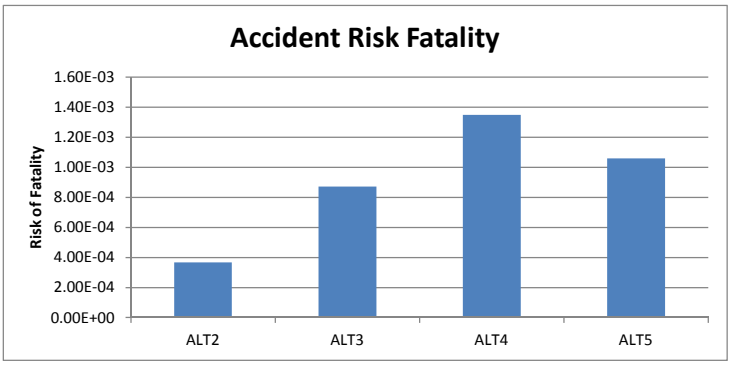

Total Energy Used
MMBTU
1.40E+05
1.20E+05
1.00E+05
8.00E+04
6.00E+04
4.00E+04
2.00E+04
0.00E+00
ALT2
ALT3
ALT4
ALT5

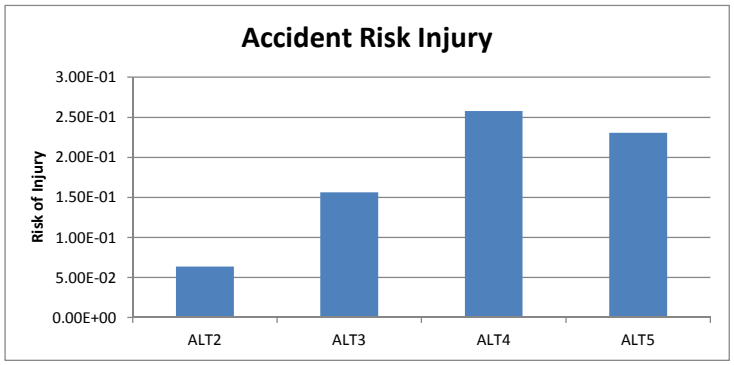

Water Impacts
Gallons
7.00E+06
6.00E+06
5.00E+06
4.00E+06
3.00E+06
2.00E+06
1.00E+06
0.00E+00
ALT2
ALT3
ALT4
ALT5

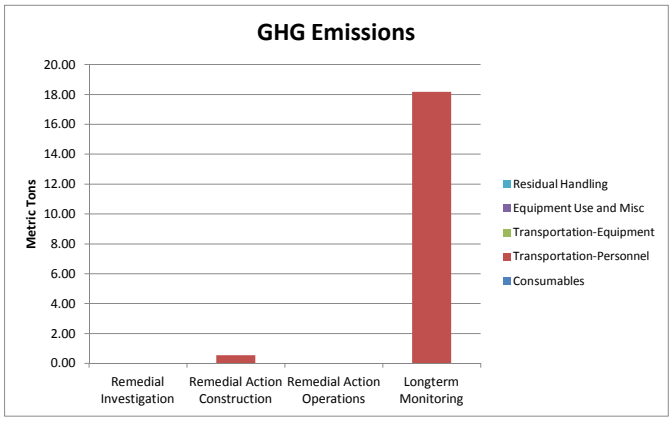

NOx Emissions
Metric Tons
1.00E+01
9.00E+00
8.00E+00
7.00E+00
6.00E+00
5.00E+00
4.00E+00
3.00E+00
2.00E+00
1.00E+00
0.00E+00
ALT2
ALT3
ALT4
ALT5

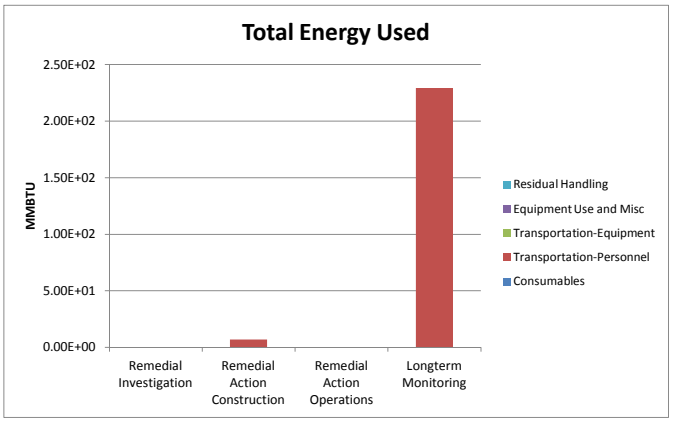

SOx Emissions
Metric Tons
3.50E+01
3.00E+01
2.50E+01
2.00E+01
1.50E+01
1.00E+01
5.00E+00
0.00E+00
ALT2
ALT3
ALT4
ALT5

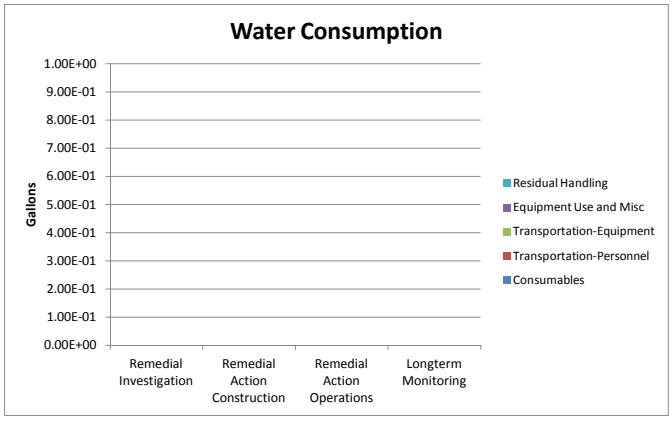

PM10 Emissions
Metric Tons
6.00E-02
5.00E-02
4.00E-02
3.00E-02
2.00E-02
1.00E-02
0.00E+00
ALT2
ALT3
ALT4
ALT5

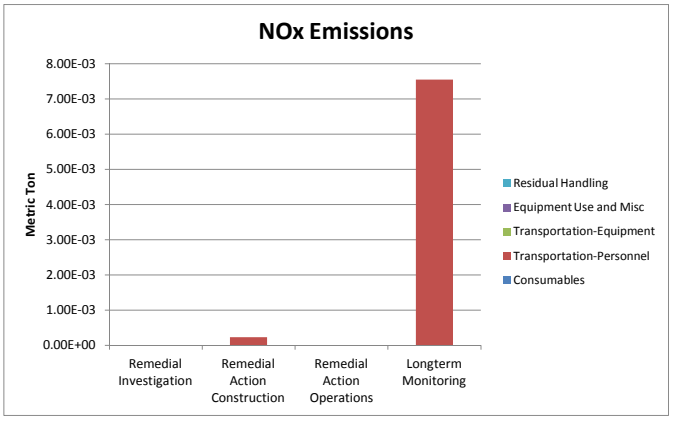

Accident Risk Fatality
Risk of Fatality
1.60E-03
1.40E-03
1.20E-03
1.00E-03
8.00E-04
6.00E-04
4.00E-04
2.00E-04
0.00E+00
ALT2
ALT3
ALT4
ALT5

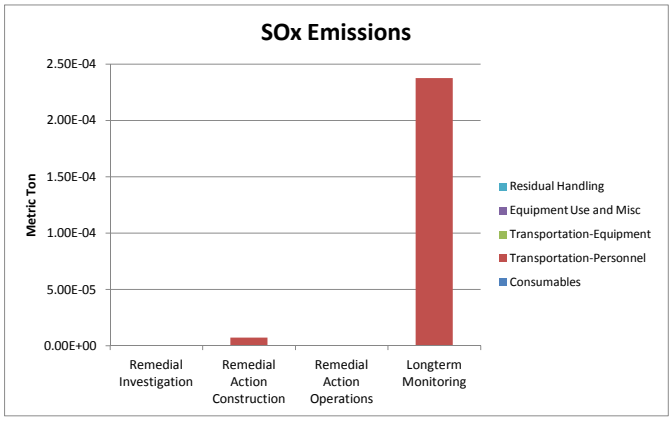

Accident Risk Injury
Risk of Injury
3.00E-01
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
ALT2
ALT3
ALT4
ALT5

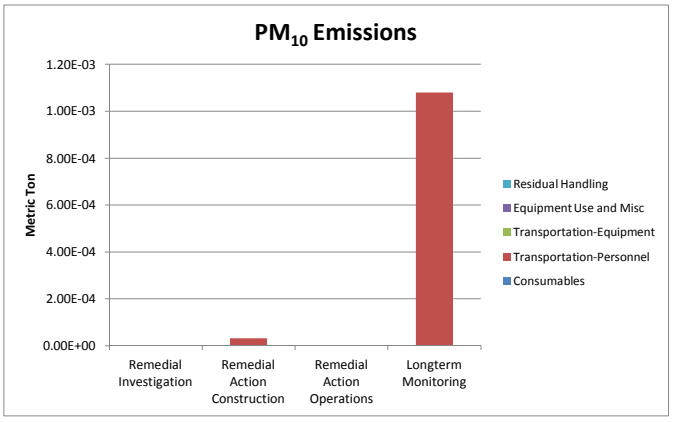

GHG Emissions
Metric Tons
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

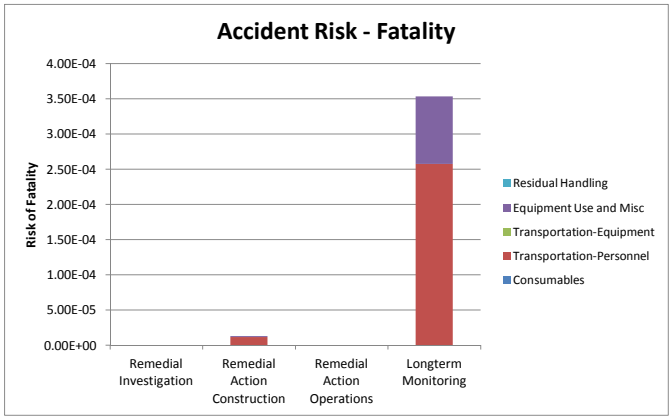

Total Energy Used
MMBTU
2.50E+02
2.00E+02
1.50E+02
1.00E+02
5.00E+01
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

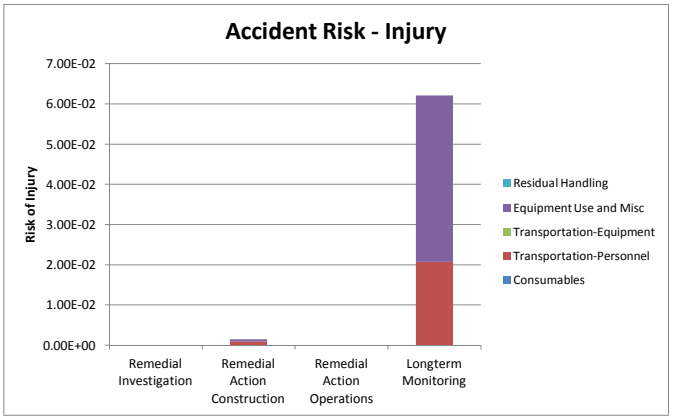

Water Consumption
Gallons
1.00E+00
9.00E-01
8.00E-01
7.00E-01
6.00E-01
5.00E-01
4.00E-01
3.00E-01
2.00E-01
1.00E-01
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

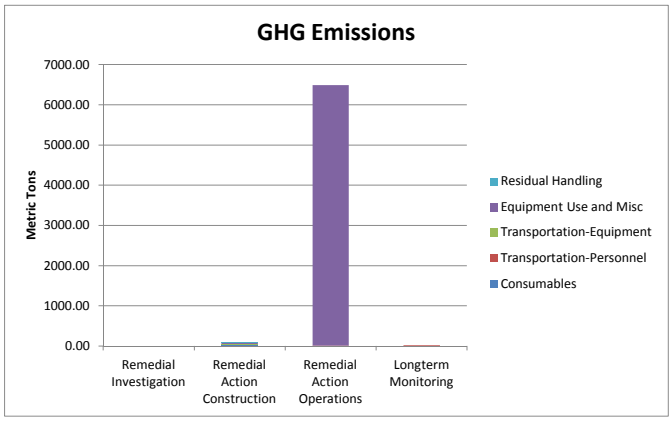

NOx Emissions
Metric Ton
8.00E-03
7.00E-03
6.00E-03
5.00E-03
4.00E-03
3.00E-03
2.00E-03
1.00E-03
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

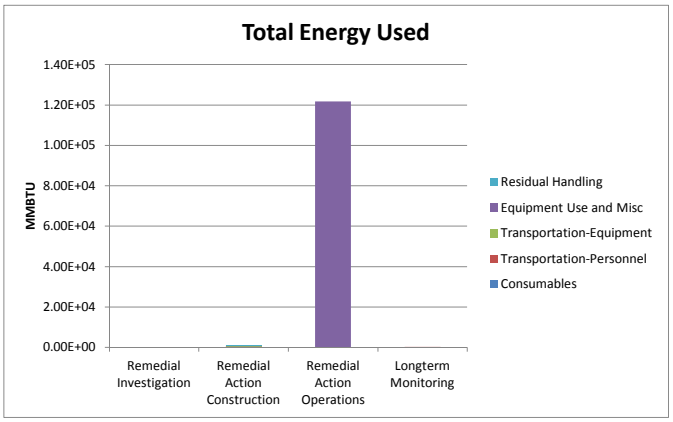

SOx Emissions
Metric Ton
2.50E-04
2.00E-04
1.50E-04
1.00E-04
5.00E-05
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

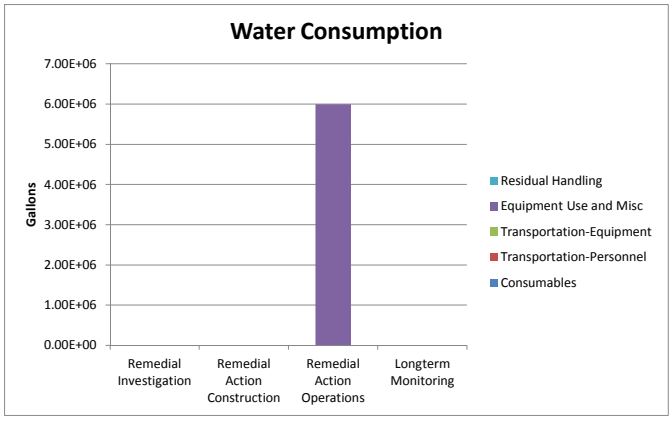

PM10 Emissions
Metric Ton
1.20E-03
1.00E-03
8.00E-04
6.00E-04
4.00E-04
2.00E-04
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

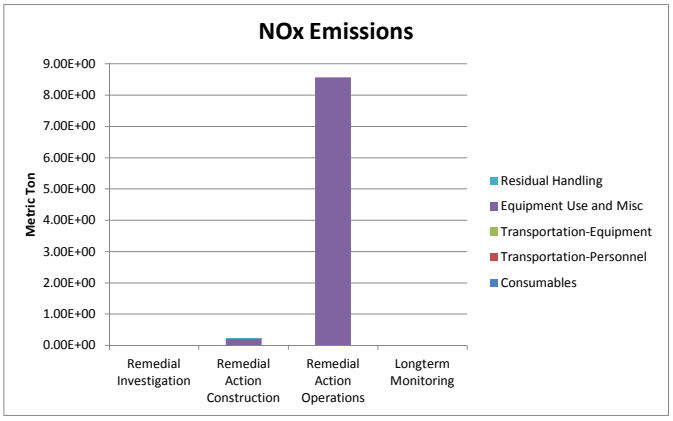

Accident Risk - Fatality
Risk of Fatality
4.00E-04
3.50E-04
3.00E-04
2.50E-04
2.00E-04
1.50E-04
1.00E-04
5.00E-05
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

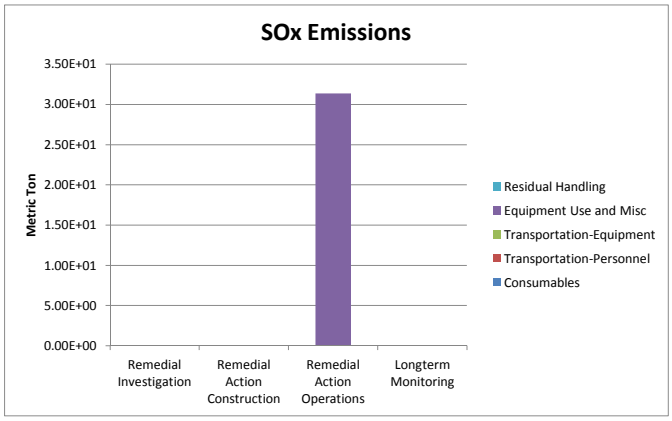

Accident Risk - Injury
Risk of Injury
7.00E-02
6.00E-02
5.00E-02
4.00E-02
3.00E-02
2.00E-02
1.00E-02
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

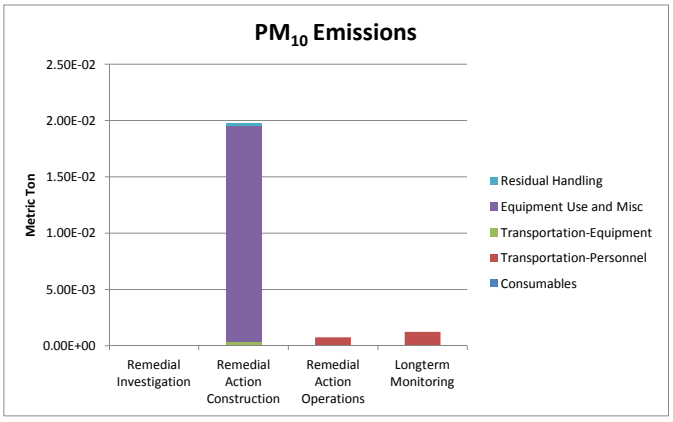

GHG Emissions
Metric Tons
7000.00
6000.00
5000.00
4000.00
3000.00
2000.00
1000.00
0.00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

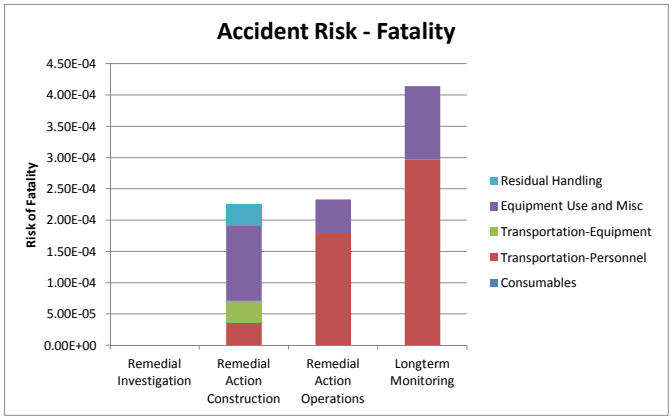

Total Energy Used
MMBTU
1.40E+05
1.20E+05
1.00E+05
8.00E+04
6.00E+04
4.00E+04
2.00E+04
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

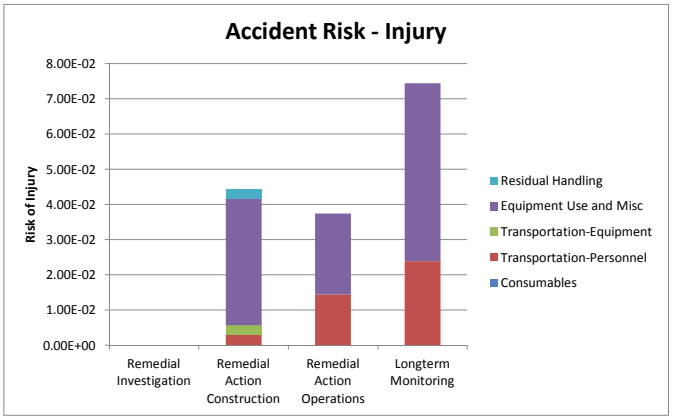

Water Consumption
Gallons
7.00E+06
6.00E+06
5.00E+06
4.00E+06
3.00E+06
2.00E+06
1.00E+06
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

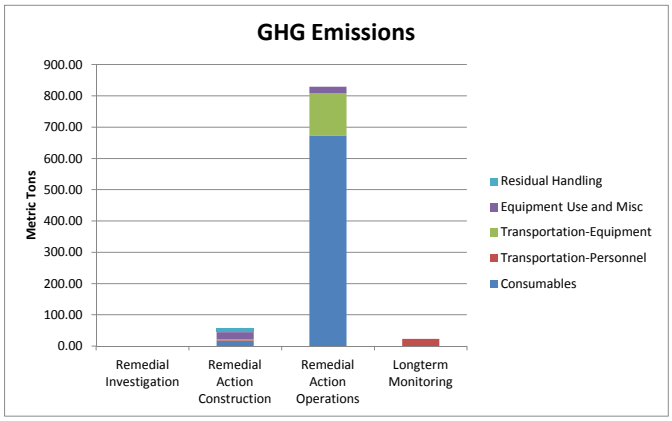

NOx Emissions
Metric Ton
9.00E+00
8.00E+00
7.00E+00
6.00E+00
5.00E+00
4.00E+00
3.00E+00
2.00E+00
1.00E+00
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

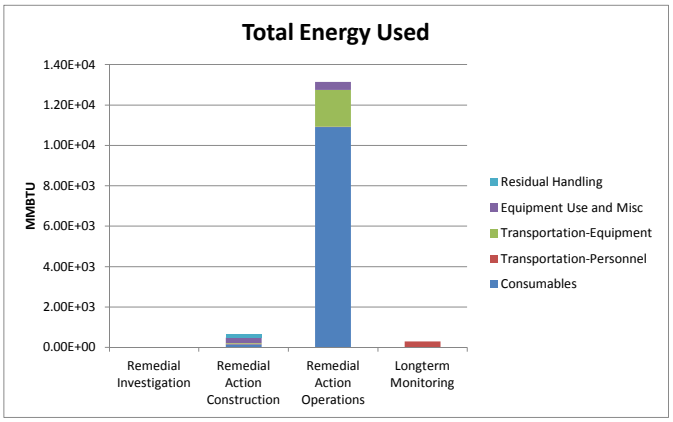

SOx Emissions
Metric Ton
3.50E+01
3.00E+01
2.50E+01
2.00E+01
1.50E+01
1.00E+01
5.00E+00
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

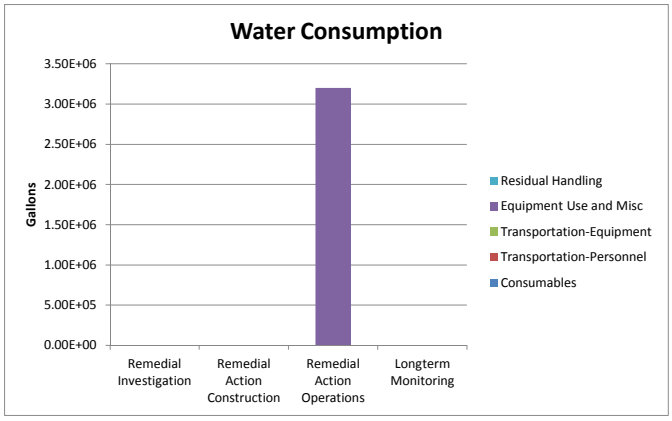

PM10 Emissions
Metric Ton
2.50E-02
2.00E-02
1.50E-02
1.00E-02
5.00E-03
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

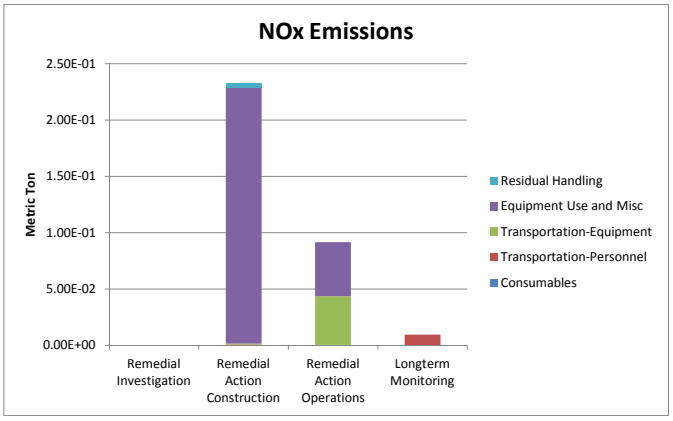

Accident Risk - Fatality
Risk of Fatality
4.50E-04
4.00E-04
3.50E-04
3.00E-04
2.50E-04
2.00E-04
1.50E-04
1.00E-04
5.00E-05
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

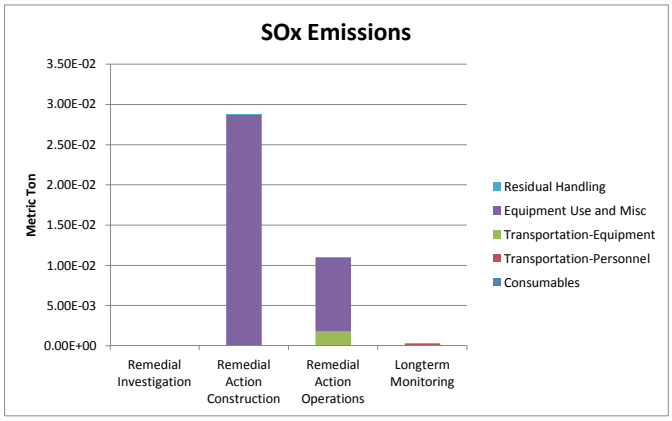

Accident Risk - Injury
Risk of Injury
8.00E-02
7.00E-02
6.00E-02
5.00E-02
4.00E-02
3.00E-02
2.00E-02
1.00E-02
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

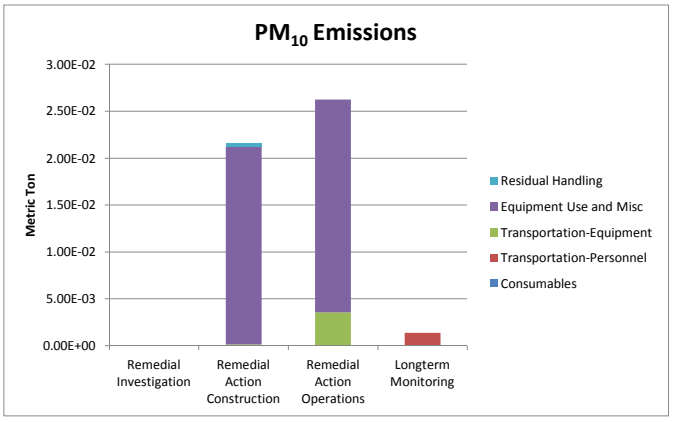

GHG Emissions
Metric Tons
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

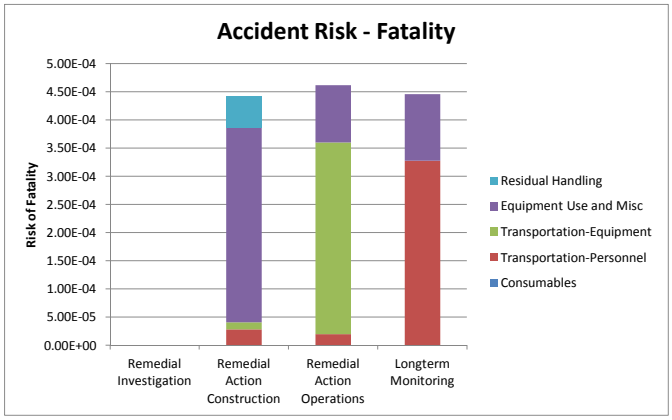

Total Energy Used
MMBTU
1.40E+04
1.20E+04
1.00E+04
8.00E+03
6.00E+03
4.00E+03
2.00E+03
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

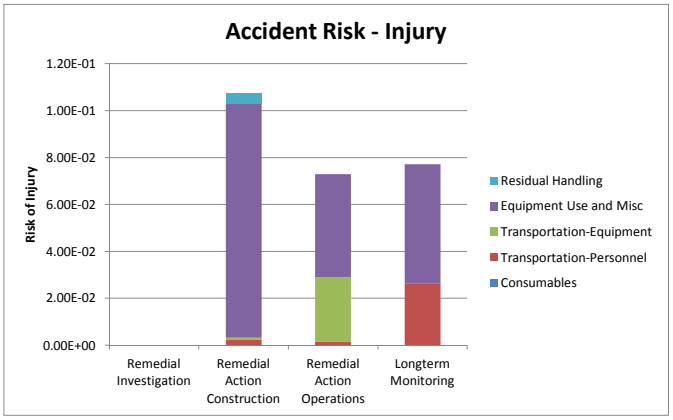

Water Consumption
Gallons
3.50E+06
3.00E+06
2.50E+06
2.00E+06
1.50E+06
1.00E+06
5.00E+05
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

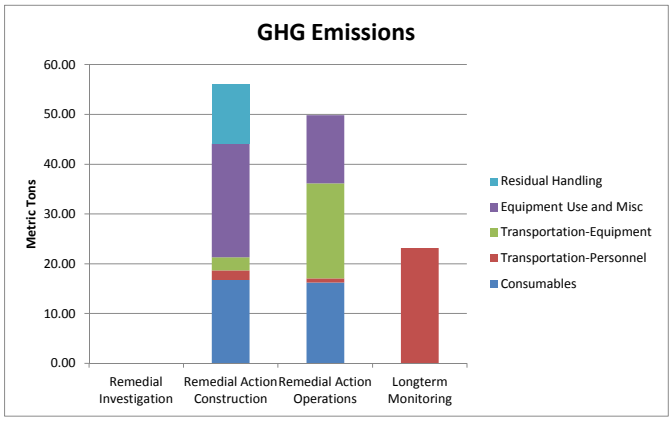

NOx Emissions
Metric Ton
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

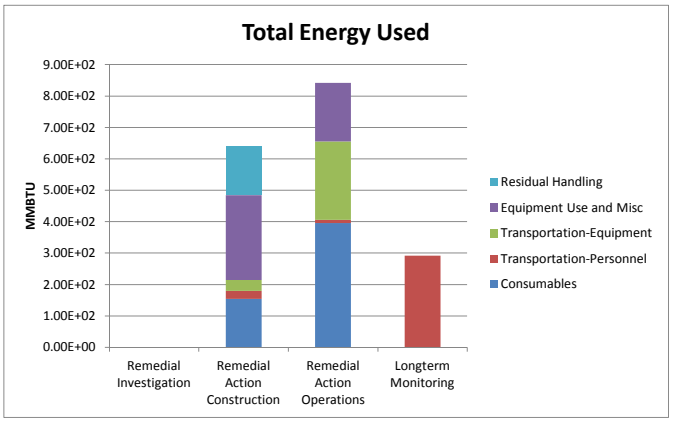

SOx Emissions
Metric Ton
3.50E-02
3.00E-02
2.50E-02
2.00E-02
1.50E-02
1.00E-02
5.00E-03
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


PM10 Emissions
Metric Ton
3.00E-02
2.50E-02
2.00E-02
1.50E-02
1.00E-02
5.00E-03
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Accident Risk - Fatality
Risk of Fatality
5.00E-04
4.50E-04
4.00E-04
3.50E-04
3.00E-04
2.50E-04
2.00E-04
1.50E-04
1.00E-04
5.00E-05
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Accident Risk - Injury
Risk of Injury
1.20E-01
1.00E-01
8.00E-02
6.00E-02
4.00E-02
2.00E-02
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


GHG Emissions
Metric Tons
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Total Energy Used
MMBTU
9.00E+02
8.00E+02
7.00E+02
6.00E+02
5.00E+02
4.00E+02
3.00E+02
2.00E+02
1.00E+02
0.00E+00
Remedial Investigation
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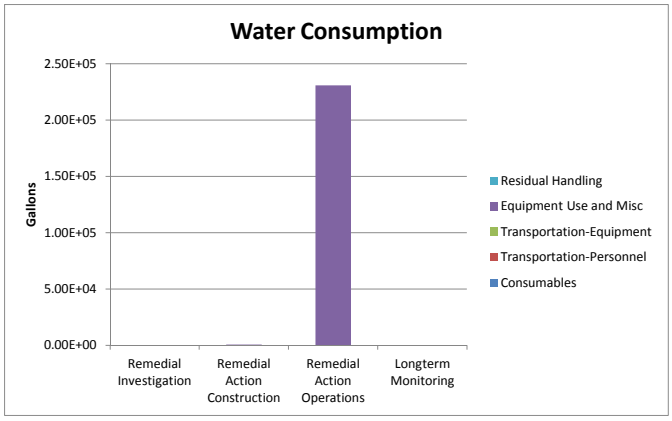
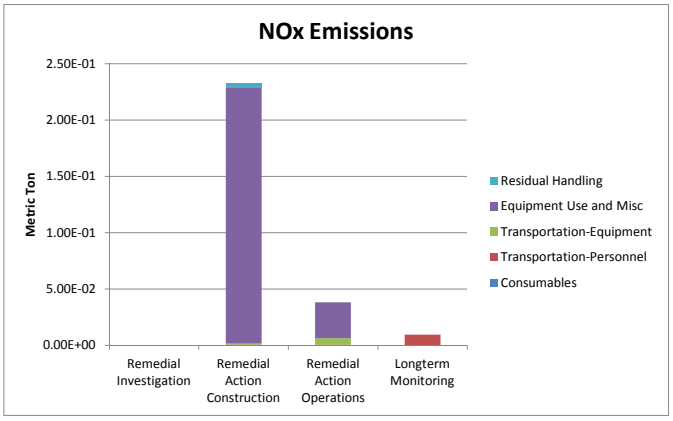

Water Consumption
Gallons
2.50E+05
2.00E+05
1.50E+05
1.00E+05
5.00E+04
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


NOx Emissions
Metric Ton
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
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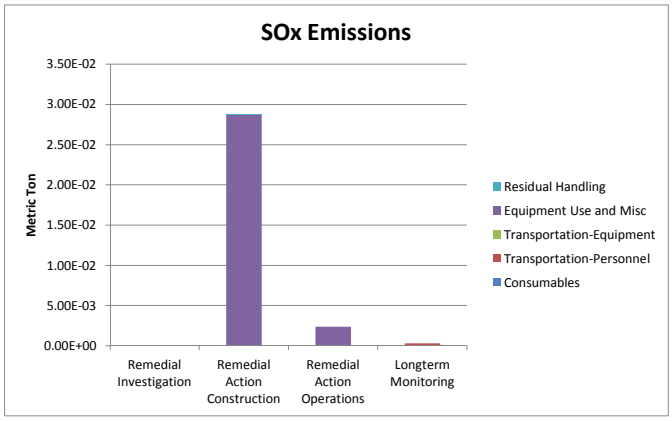
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


SOx Emissions
Metric Ton
3.50E-02
3.00E-02
2.50E-02
2.00E-02
1.50E-02
1.00E-02
5.00E-03
0.00E+00
Remedial Investigation
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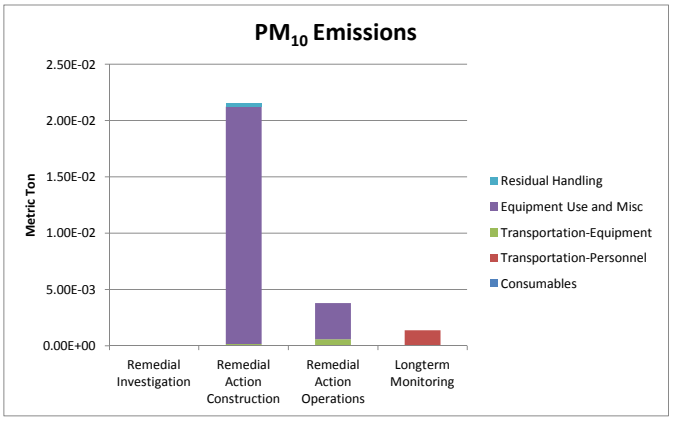
PM10 Emissions
Metric Ton
2.50E-02
2.00E-02
1.50E-02
1.00E-02
5.00E-03
0.00E+00
Remedial Investigation
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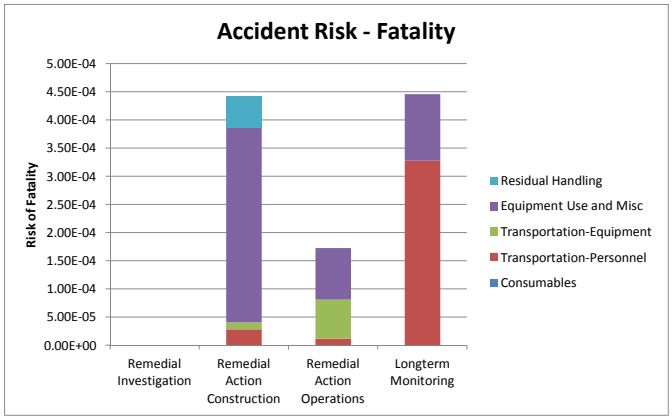
Accident Risk - Fatality
Risk of Fatality
5.00E-04
4.50E-04
4.00E-04
3.50E-04
3.00E-04
2.50E-04
2.00E-04
1.50E-04
1.00E-04
5.00E-05
0.00E+00
Remedial Investigation
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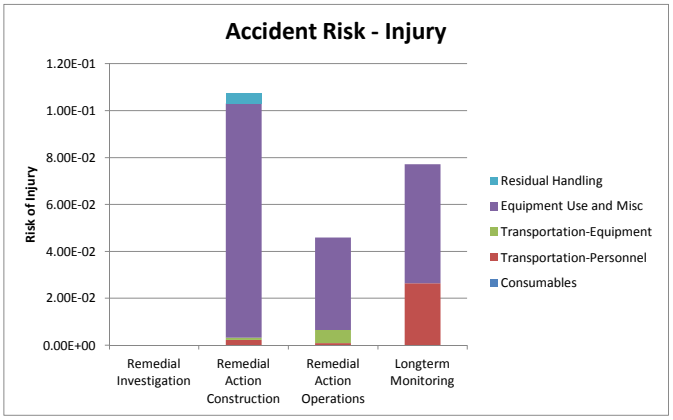
Accident Risk - Injury
Risk of Injury
1.20E-01
1.00E-01
8.00E-02
6.00E-02
4.00E-02
2.00E-02
0.00E+00
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Remedial Action Construction
Remedial Action Operations
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Transportation-Equipment
Transportation-Personnel
Consumables