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Treatability Study Construction Complete Summary

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This technical memorandum summarizes activities completed as part of the injection field efforts conducted at SWMUs 2B, 2C, and 2E, NAS Oceana, Virginia Beach, VA. The work plans for these sampling events were finalized in June 2004 and are entitled, *Groundwater Remediation Plan for SWMUs 2B and 2E* and *Groundwater Remediation Plan for SWMU 2C* (CH2M HILL). The objectives for this field effort identified in the work plans include:

- Installation of seven (7) new monitoring wells within SWMU 2C
- Remediation of chlorinated volatile organic compounds (CVOCs) in defined target areas within SWMUs 2B and 2E, and in the two plume areas and three defined target areas at SWMU 2C.
- Evaluation of the effectiveness of the remedial actions.
- Comparison of the three remedial technologies used [oxygen release compound (ORC[®]), hydrogen release compound (HRC[®]), and NewmanZone emulsified oil]

The field effort was initiated on July 14, 2004 and consisted of monitoring well installation and development, initial sampling, and injection of ORC[®] (manufactured by Regenesis), HRC[®] (manufactured by Regenesis), and NewmanZone (manufactured by RNAS, Inc.). The effort was completed on September 30, 2004. Each phase of the field effort is detailed below. The second two objectives defined in the work plan will be accomplished as part of the Draft and Final Treatability Study Reports to be completed after the September 2005 sampling event.

Monitoring Well Installation and Development

Prior to the baseline sampling event and injection of ORC[®] and NewmanZone emulsion, seven new monitoring wells were installed at SWMU 2C. Three new wells were installed in the northern plume area: one east of Building 404 (OW2C-MW26), and two south of OW2C-MW07 between Building 404 and Building 401 (OW2C-MW27 and OW2C-MW28) (Figure-1). These three wells were installed to a depth of 16 feet (ft) below ground surface (bgs) with a screened interval of 6-16' bgs. Four new wells were installed in the southern plume area: one south of OW2C-MW21 (OW2C-MW31), one west of the proposed OW2C-MW31 location (OW2C-MW30), one south of the proposed OW2C-MW31 location (OW2C-MW32)

and one between Building 420 and 419 (OW2C-MW33) (Figure 1). Wells within the southern plume were set at a depth of 20' bgs and screened from 10-20' bgs. Wells were installed using 4.25-inch interior diameter (ID) hollow-stem augers. Two-foot split spoon samples were collected every 5' from the well borings for lithologic characterization. Soils were logged according to the Unified Soil Classification System (USCS). Descriptions included color, grain size, density, hardness, USCS group symbol, moisture content, and any other observations. Columbia aquifer lithology encountered at the site consisted of clayey silt and clayey sand from 0'-7' bgs and medium to fine silty and clean sands from approximately 7' bgs to the total depth of each boring. Lithology was generally consistent with that logged during the installation of existing SWMU 2C wells. Boring logs for new wells are included as Appendix A.

The wells were constructed with 2-inch Schedule 40 polyvinyl chloride (PVC) and 0.010-inch slotted screens. The annular space surrounding the well was packed with sand to between 1 and 2 feet above the top of the well screen, and sealed with bentonite chips. All wells were completed with 8-inch stainless steel covers and a 24" diameter concrete pad. Monitoring well construction is consistent with that of the previously existing wells. Monitoring well construction details for new wells are summarized on Table 1. Well construction logs for the new monitoring wells are provided in Appendix B.

Following installation and prior to collection of groundwater samples, all new and existing wells were developed using a submersible Whale[®] pump. 110 gallons was purged from each well with the exception of OW2C-MW31. OW2C-MW31 went dry several times during development. Consequently, only 30 gallons was purged from this well. Average development time for wells was one hour. Final turbidity values averaged 30 ntu.

Baseline Sampling

Baseline sampling was initiated at SWMUs 2B, 2C and 2E on July 26, 2004. The monitoring wells in the sampling network for each SWMU is listed in Table 2. The locations of the monitoring network for SWMUs 2B and 2E are illustrated in Figures 2 and 3, respectively; and, the monitoring network for SWMU 2C is illustrated in Figure 1. The wells were sampled using a peristaltic pump and low-flow purge method. During purging, water quality parameters including pH, conductivity, turbidity, dissolved oxygen (DO), temperature, oxidation/reduction potential, and salinity, were monitored; well purging continued until these parameters stabilized. Results of the field water quality measurements are summarized in Table 3.

Following purging, groundwater samples were collected directly from disposable plastic tubing into laboratory prepared sample bottles and immediately packed on ice for overnight shipment to the laboratory. Table 4 shows analytical parameters for each sample. Appropriate QA/QC samples were collected to support validation of chlorinated volatile organic compound (CVOC) analytical results. QA/QC samples included one trip blank per CVOC analytical method per cooler containing VOCs, one field blank per CVOC analytical method per week, one equipment blank per CVOC analytical method per day, one duplicate sample per ten samples collected, and one MS/MSD per 20 samples collected.

Analytical Results

A summary of geochemical parameter analytical results is provided as Table 5. A summary of VOCs concentrations in groundwater during this round of sampling is provided as Table 6. Constituents exceeding screening criteria (tap water maximum contaminant levels [MCLs]) are highlighted.

SWMU 2B

Trichloroethene (TCE) was detected at a concentration of 60 ug/L in OW2B-MW01. Concentrations of cis-1,2-dichloroethene (cis-1,2 DCE), trans 1,2 dichloroethene (trans-1,2 DCE), and 1,1 dichloroethene (1,1 DCE) were 170 ug/L, 10 ug/L, and 1 ug/L respectively. The concentration of vinyl chloride (VC) detected in OW2B-MW01 was 14 ug/L.

The concentration of VC detected in the sample collected from OW2B-MW14 was 1.7 ug/L. This concentration is below the MCL of 2 ug/L.

SWMU 2C

Of the seventeen SWMU 2C samples, TCE was detected in concentrations ranging from 2 to 6 ug/L in samples from 6 wells. All of these wells were within the south plume injection area. Cis-1,2 DCE was detected in twelve wells. Three of these detections were from north plume area samples. Concentrations in the north plume ranged from 2 ug/L at OW2C-MW05 and OW2C-MW27 to 12 ug/L at OW2C-MW07. Cis-1,2 DCE was detected at all three target area wells at concentrations ranging from 5 to 15 ug/L. Cis-1,2 DCE was detected in all south plume wells with the exception of OW2C-MW04 and OW2C-MW09. Concentrations of cis-1,2 DCE in the south plume ranged from 3 ug/L to 27 ug/L. Trans-1,2 DCE was detected in two north plume wells (OW2C-MW07 and OW2C-MW25), three south plume wells (OW2C-MW13, OW2C-MW31, and OW2C-MW33) and one target area well (OW2C-MW24) at concentrations ranging from 1 to 3 ug/L. 1,1 DCE was not detected in any SWMU 2C wells. VC was detected in fourteen SWMU 2C wells at concentrations ranging from 8 ug/L (OW2C-MW30) to 160 ug/L (OW2C-MW25).

SWMU 2E

VC was detected at a concentration of 5 ug/L in the sample collected from OW2E-MW09. This concentration is in exceedance of the MCL of 2 ug/L.

ORC[®] Injection

SWMU 2C

ORC[®] Injection was initiated on August 18, 2004. 171 injection locations were completed in the SWMU 2C North plume area at locations approximated in Figure 4. ORC[®] was also injected at 16 injection points within each of three target areas at SWMU 2C. These target areas are in the vicinities of monitoring wells OW2C-MW18, OW2C-MW19, and OW2C-MW24. The approximated injection grid for the three SWMU 2C target locations is shown as Figure 5. Injection locations were pre-marked using a Trimble surveying GPS unit programmed with the coordinates of the grid locations as indicated in the work plan. Direct-push injections were completed to a depth of 16' below ground surface (bgs). A mixture of 30% ORC[®] to 70% water was injected at 3lbs ORC[®]/ft at each injection location. The ORC[®] slurry was injected through direct-push drive rods across the contaminated saturated zone. The injection interval was 16' bgs to 6' bgs. This interval was selected to encompass the entire water column within the Columbia Aquifer. A total of 30 lbs of ORC[®]

was injected at each SWMU 2C injection location. 73 locations were moved a maximum of 5 feet from their plotted location due to the location of underground utilities or Geoprobe® refusal prior to reaching the necessary injection depth. At five grid locations, the aquifer could not accept the ORC® slurry at shallow depths (from 9 to 6 feet bgs) at the minimum pumping rate. Consequently, any ORC® not injected at these locations was injected at the same depth interval at a grid location immediately adjacent to the location in which ORC® refusal occurred. Borings completed in flightline concrete were filled with bentonite to a depth of approximately 14" bgs and patched with 5000 psi concrete to the surface. Borings completed in asphalt were filled with bentonite to just below the ground surface and patched with asphalt patch. ORC® Injection photographs are shown as Images 1 and 2.

SWMUs 2B and 2E

ORC® was injected at 14 injection points within one target area (OW2E-MW09) at SWMU 2E. The approximated grid for these injections is shown on Figure 6. Injection locations were pre-marked using a Trimble surveying GPS unit programmed with the coordinates of the grid locations as indicated in the work plan. Direct push injections were completed to a depth of 20' bgs. A mixture of 30% ORC® to 70% water was injected at 3lbs ORC®/ft at each injection location. The ORC® slurry was injected through direct-push drive rods across the contaminated saturated zone. The injection interval was 20' bgs to 5' bgs. This interval was selected to encompass the entire water column within the Columbia Aquifer.

Approximately 45 lbs of ORC® was injected at each injection location surrounding OW2E-MW09. 5 locations were moved a maximum of 5 feet from their plotted location due to the location of underground utilities or Geoprobe® refusal prior to reaching the necessary injection depth. Borings completed in flightline concrete were filled with bentonite to a depth of approximately 14" bgs and patched with 5000 psi concrete to the surface. Borings completed in asphalt were filled with bentonite to just below the ground surface and patched with asphalt patch. ORC® Injection photographs are shown as Images 1 and 2.

The workplan for SWMUs 2B and 2E included additional ORC® injection around OW2B-MW14. However, baseline groundwater data indicated that the concentration of VC, the only contaminant of concern, is below the maximum contaminant level (MCL) for this compound. The detected concentration was 1.7 ug/L compared to the MCL of 2 ug/L. Due to the location of high voltage power lines, steam lines, and fiber optic cables the NAS Oceana Partnering Team agreed that injection would not be completed in this area. In order to address the low levels of contamination, an ORC® "sock" was installed along the screened interval of the well. The sock will be removed at least three weeks prior to the final sampling event (12 months following injection) and the well will be sampled during the final sampling event in order to ensure that the concentration of VC in the well remains below the MCL.

HRC® Injection

HRC® injection was completed at 14 locations surrounding OW2B-MW01 on September 9, 2004. The location of OW2B-MW01 is shown on Figure-2. Injection locations were pre-marked using a Trimble surveying GPS unit programmed with the coordinates of the grid locations as indicated in the work plan. All injections were completed in the locations

shown in the workplan (Figure 7). HRC[®] was heated in a hot water bath in order to reduce viscosity prior to injection. HRC[®] was injected directly through direct-push drive rods at 4lbs/ft from 20' bgs to 7' bgs for a total of 52 lbs per location. All HRC[®] injection locations were located on flightline concrete and were filled with bentonite to a depth of 14" bgs and patched with 5000 psi concrete to the surface.

NewmanZone Emulsified Vegetable

Oil Injection

Injection of NewmanZone Emulsified Oil was completed through 208 temporary wells installed in the "core" and "non-core" areas as described in the work plan and shown on Figure-1. Injection locations were pre-marked using a Trimble surveying GPS unit programmed with the coordinates of the grid locations as indicated in the work plan. The injection locations are shown on Figure 8. 10 well locations planned to be installed on Hornet Drive were moved just upgradient of the road to avoid disrupting traffic. Approximately 20 other locations were moved due to the presence of subsurface utilities. Temporary wells were installed using Geoprobe[®] equipment. Wells were set at 18.5' bgs and screened from 8.5' bgs to 18.5' bgs. Wells were constructed of 2" diameter PVC casing and 2" diameter .010 slot PVC screen. Wells were sealed with hydrated bentonite chips prior to injection in order to prevent injection material from exiting at the ground surface. Injection was completed using a ten-channel injection system (Image 3). The manifold system discharge hoses and flow meters were attached to each of the ten wells using wellhead fittings with compression couplers (Image 4). A water supply was then connected to the ten channel injection system. The intake hoses of the feed pumps were placed into 5-gallon buckets of concentrated emulsion (Image 5) and the feed pumps were set to the 2% amendment setting (which resulted in 1% oil by volume). The flow meters (Image 6) were monitored until the desired volume of emulsion had been injected into each well. For wells in the "core" area, a total of 7.5 gallons (60 lbs) of pure emulsion, or 375 gallons of diluted emulsion was injected. For the "non-core" area, a total of 5.5 gallons (44 lbs) of pure emulsion, or 275 gallons of diluted emulsion was injected. Once injection volumes were achieved, temporary well materials were removed and holes were filled with 3/8" bentonite chips to the surface. Borings completed in asphalt or concrete were patched accordingly.

Post Injection Monitoring and Reporting

The first round of post-injection monitoring was conducted in November 2004. Lab results were received in early December 2004. Additional sampling will be conducted in January, May, and September of 2005. A summary technical memorandum will be completed for following each of the November, January, and May sampling events. A Draft and Final Treatability Study Report will be generated following the September sampling event. This document will summarize all of the analytical results and will evaluate the effectiveness of the treatment approaches.

Table 1
SWMU 2C New well Construction Details
SWMUs 2B, 2C, and 2E Groundwater Remediation
NAS Osceana, Virginia Beach, Virginia

| Well ID | Total Depth | Screened Interval | Sand Interval | Bentonite Interval | Date Completed | Ground Elevation (ft amsl) |
|----------------|--------------------|--------------------------|----------------------|---------------------------|-----------------------|-----------------------------------|
| OW2C-MW26 | 16' | 6'-16' | 4'-16' | 14"-4' | 7/21/2004 | 20.25 |
| OW2C-MW27 | 16' | 6'-16' | 4'-16' | 1'-4' | 7/20/2004 | 20.1 |
| OW2C-MW28 | 16' | 6'-16' | 4'-16' | 1'-4' | 7/20/2004 | 19.57 |
| OW2C-MW30 | 20' | 10'-20' | 8'-20' | 1'-8' | 7/19/2004 | 17.5 |
| OW2C-MW31 | 20' | 10'-20' | 8'-20' | 1'-8' | 7/19/2004 | 17.66 |
| OW2C-MW32 | 20' | 10'-20' | 8'-20' | 1'-8' | 7/20/2004 | 17.81 |
| OW2C-MW33 | 20' | 10'-20' | 8'-20' | 1'-8' | 7/20/2004 | 17.06 |

Table 2
Monitoring Well Network
SMWUs 2B, 2C and 2E Groundwater Remediation
NAS Oceana, Virginia Beach, Virginia

| Sampling Point | Relative Location | Total Depth (ft bgs) | Depth of Screened Interval (ft bgs) |
|---------------------|------------------------------|----------------------|-------------------------------------|
| SWMU 2B | | | |
| TARGET AREA | | | |
| 2B-MW01 | Treatment Area | 19 | 9-19 |
| 2B-MW14 | Treatment Area | 20 | 10-20 |
| SWMU 2C | | | |
| NORTH PLUME | | | |
| 2C-MW-05 | Up-gradient | 16 | 6-16 |
| 2C-MW-25 | Core area | 18 | 3-18 |
| 2C-MW-26 | West lateral, non-core area | 16 | 6-16 |
| 2C-MW-07 | Down-gradient, non-core area | 19 | 9-19 |
| 2C-MW-27 | Down-gradient | 16 | 6-16 |
| 2C-MW-28 | Down-gradient | 16 | 6-16 |
| SOUTH PLUME | | | |
| 2C-MW-04 | Up-gradient | 18 | 8-18 |
| 2C-MW-09 | Core area | 17.5 | 7.5-17.5 |
| 2C-MW-21 | Core area | 18 | 3-18 |
| 2C-MW-31 | Core area | 20 | 10-20 |
| 2C-MW-32 | Core area | 20 | 10-20 |
| 2C-MW-30 | West lateral, non-core area | 20 | 10-20 |
| 2C-MW-33 | Down-gradient, non-core area | 20 | 10-20 |
| 2C-MW-13 | Down-gradient | 21 | 11-21 |
| TARGET AREAS | | | |
| 2C-MW-18 | Treatment Area | 19 | 9-19 |
| 2C-MW-19 | Treatment Area | 20 | 9-19 |
| 2C-MW-24 | Treatment Area | 18 | 3-18 |
| SWMU 2E | | | |
| TARGET AREA | | | |
| 2E-MW09 | Treatment Area | 18.5 | 3.5-18.5 |

Table 3
 Field Groundwater Quality Parameters
 SWMUs 2B, 2C, and 2E Groundwater Remediation Field Effort
 NAS Osceana, Virginia Beach, Virginia

| SWMU 2B - TARGET AREA | | |
|------------------------------------|---------------|---------------|
| Station ID | OW2B-MW01 | OW2B-MW14 |
| Sample ID | OW2B-MW01-04C | OW2B-MW14-04C |
| Sample Date | 07/29/2004 | 07/29/2004 |
| Field Parameters | | |
| Dissolved Oxygen (mg/L) | 1.82 | 1.62 |
| Oxidation Reduction Potential (mV) | -16 | -34 |
| pH | 5.83 | 6 |
| Specific Conductance (ms/cm) | 0.282 | 0.258 |
| Temperature (C) | 21.6 | 24.84 |
| Turbidity (NTU) | 19 | 20.6 |

| SWMU 2C - NORTH PLUME | | | | | | |
|------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Station ID | OW2C-MW05 | OW2C-MW07 | OW2C-MW25 | OW2C-MW26 | OW2C-MW27 | OW2C-MW28 |
| Sample ID | OW2C-MW05-04C | OW2C-MW07-04C | OW2C-MW25-04C | OW2C-MW26-04C | OW2C-MW27-04C | OW2C-MW28-04C |
| Sample Date | 07/28/2004 | 07/28/2004 | 07/28/2004 | 07/28/2004 | 07/28/2004 | 07/27/2004 |
| Field Parameters | | | | | | |
| Dissolved Oxygen (mg/L) | 1.76 | 1.84 | 1.75 | 1.99 | 1.7 | 1.44 |
| Oxidation Reduction Potential (mV) | -85 | -92 | -108 | -73 | -144 | -122 |
| pH | 6.32 | 6.27 | 6.2 | 6.22 | 6.41 | 6.64 |
| Specific Conductance (ms/cm) | 0.597 | 0.656 | 0.698 | 0.913 | 0.745 | 0.652 |
| Temperature (C) | 24.23 | 23.16 | 22.03 | 22.39 | 24.19 | 23.98 |
| Turbidity (NTU) | 9.9 | 1.5 | 6.7 | 31.2 | 5.9 | 5.7 |

| SWMU 2C - SOUTH PLUME | | | | | | | | | |
|------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Station ID | OW2C-MW04 | OW2C-MW09 | OW2C-MW11 | OW2C-MW13 | OW2C-MW21 | OW2C-MW30 | OW2C-MW31 | OW2C-MW32 | OW2C-MW33 |
| Sample ID | OW2C-MW04-04C | OW2C-MW09-04C | OW2C-MW11-04C | OW2C-MW13-04C | OW2C-MW21-04C | OW2C-MW30-04C | OW2C-MW31-04C | OW2C-MW32-04C | OW2C-MW33-04C |
| Sample Date | 07/26/2004 | 07/27/2004 | 07/27/2004 | 07/27/2004 | 07/27/2004 | 07/26/2004 | 07/27/2004 | 07/26/2004 | 07/26/2004 |
| Field Parameters | | | | | | | | | |
| Dissolved Oxygen (mg/L) | 1.85 | 2.22 | | 1.79 | 1.9 | 1.81 | 1.45 | 2.28 | 2.2 |
| Oxidation Reduction Potential (mV) | -57 | -36 | | -83 | -47 | -52 | -105 | -44 | -65 |
| pH | 6.05 | 6.14 | | 6.14 | 5.8 | 5.92 | 6.4 | 6.01 | 6.08 |
| Specific Conductance (ms/cm) | 0.454 | 0.081 | | 0.648 | 0.6 | 0.713 | 0.923 | 0.571 | 0.704 |
| Temperature (C) | 21.15 | 23.2 | | 20.28 | 21.18 | 19.58 | 25.27 | 19.42 | 21.88 |
| Turbidity (NTU) | 27.6 | 4 | | 49.7 | 8.8 | 19.1 | 37.8 | 27.6 | 28.5 |

| SWMU 2C - TARGET AREA | | | |
|------------------------------------|---------------|---------------|---------------|
| Station ID | OW2C-MW18 | OW2C-MW19 | OW2C-MW24 |
| Sample ID | OW2C-MW18-04C | OW2C-MW19-04C | OW2C-MW24-04C |
| Sample Date | 07/29/2004 | 07/29/2004 | 07/29/2004 |
| Field Parameters | | | |
| Dissolved Oxygen (mg/L) | 1.95 | 1.65 | 1.7 |
| Oxidation Reduction Potential (mV) | -89 | -120 | -108 |
| pH | 6.12 | 6.31 | 6.1 |
| Specific Conductance (ms/cm) | 0.632 | 0.598 | 0.716 |
| Temperature (C) | 21.3 | 22.12 | 21.69 |
| Turbidity (NTU) | 2.6 | 14.5 | 14.2 |

| SWMU 2C - TARGET AREA | |
|------------------------------------|---------------|
| Station ID | OW2E-MW09 |
| Sample ID | OW2E-MW09-04C |
| Sample Date | 07/29/2004 |
| Field Parameters | |
| Dissolved Oxygen (mg/L) | 1.54 |
| Oxidation Reduction Potential (mV) | -133 |
| pH | 6.32 |
| Specific Conductance (ms/cm) | 0.748 |
| Temperature (C) | 21.43 |
| Turbidity (NTU) | 5 |

Notes:
 NA - Not analyzed

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Table 4
 Monitoring Parameters
 SWMUs 2B, 2C, and 2E Groundwater Remediation
 NAS Osceana, Virginia Beach, Virginia

| Parameter | Method | SWMU 2B Target Areas (aerobic) | SWMU 2C North Plume & Target Areas (aerobic) | SWMU 2C South Plume (anaerobic) | SWMU 2E Target Area (anaerobic) |
|----------------------------------|------------------------------|--------------------------------------|--|---------------------------------------|---------------------------------------|
| VOCs | OLM04 or OLC03 as applicable | X | X | X | X |
| Methane, Ethane, Ethene | EAP RS Kerr Lab SOP-175 | | | X | X |
| Alkalinity | EPA 310.1 | X | X | X | X |
| Nitrate | EPA 300.0 | X | X | X | X |
| Ferrous Iron (or dissolved iron) | SM3500-FeD | X | X | X | X |
| Sulfate | EPA 300.0 | X | X | X | X |
| Sulfide | EPA 376.2 | | | X | X |
| Chloride | EPA 300.0 | X | X | X | X |
| Total organic carbon | EPA 9060 | X | X | X | X |
| VFAs | HPLC method | | | X | X |

Table 5
Groundwater Screening Criteria for Wet Chemistry Parameters
SWMUs 2B, 2C, and 2E
NAS Oceana, Virginia Beach, Virginia

| SWMU 2B - TARGET AREA | | | |
|-----------------------------|---------------------|---------------|---------------|
| Station ID | MCL- Groundwater | OW2B-MW01 | OW2B-MW14 |
| Sample ID | | OW2B-MW01-04C | OW2B-MW14-04C |
| Sample Date | | 07/29/04 | 07/29/04 |
| Chemical Name | | | |
| Wet Chemistry (MG/L) | | | |
| Acetate | -- | 1 U | NA |
| Alkalinity | -- | 72.6 | 62.1 |
| Chloride | -- | 8.47 | 8.31 |
| Ethane | -- | 0.002 U | NA |
| Ethene | -- | 0.0002 J | NA |
| Ferrous iron | -- | 5.91 | 5.96 |
| Lactate | -- | 25 UM | NA |
| Methane | -- | 0.011 B | NA |
| Nitrate | 10 | 0.007 U | 0.007 U |
| Nitrite | 1 | 0.04 J | 0.045 J |
| Sulfate | -- | 37.9 | 22.9 J |
| Sulfide | -- | 0.6 | NA |
| Total organic carbon (TOC) | -- | 6.75 | 3.81 J |

| SWMU 2C - NORTH PLUME | | | | | | | |
|-----------------------------|---------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Station ID | MCL- Groundwater | OW2C-MW05 | OW2C-MW07 | OW2C-MW25 | OW2C-MW26 | OW2C-MW27 | OW2C-MW28 |
| Sample ID | | OW2C-MW05-04C | OW2C-MW07-04C | OW2C-MW25-04C | OW2C-MW26-04C | OW2C-MW27-04C | OW2C-MW28-04C |
| Sample Date | | 07/28/04 | 07/28/04 | 07/28/04 | 07/28/04 | 07/28/04 | 08/27/04 |
| Chemical Name | | | | | | | |
| Wet Chemistry (MG/L) | | | | | | | |
| Acetate | -- | NA | NA | NA | NA | NA | NA |
| Alkalinity | -- | 286 | 322 | 300 | 469 | 330 | 289 |
| Chloride | -- | 6.68 | 15.7 | 14.4 | 14.3 | 12.8 | 10.5 |
| Ethane | -- | NA | NA | NA | NA | NA | NA |
| Ethene | -- | NA | NA | NA | NA | NA | NA |
| Ferrous iron | -- | 16.3 | 17.7 | 19.6 | 12.8 | 19.6 | 9.02 |
| Lactate | -- | NA | NA | NA | NA | NA | NA |
| Methane | -- | NA | NA | NA | NA | NA | NA |
| Nitrate | 10 | 0.11 J | 0.095 J | 0.09 | 0.095 | 0.135 | 0.09 |
| Nitrite | 1 | 0.04 J |
| Sulfate | -- | 0.74 J | 8.81 J | 0.145 J | 13 | 0.26 J | 0.695 J |
| Sulfide | -- | NA | NA | NA | NA | NA | NA |
| Total organic carbon (TOC) | -- | 10.7 | 15.1 | 20 | 109 | 20.2 | 11.2 |

| SWMU 2C - SOUTH PLUME | | | | | | | | | | |
|-----------------------------|---------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|---------------|
| Station ID | MCL- Groundwater | OW2C-MW04 | OW2C-MW09 | OW2C-MW13 | OW2C-MW21 | OW2C-MW30 | OW2C-MW31 | OW2C-MW32 | | OW2C-MW33 |
| Sample ID | | OW2C-MW04-04C | OW2C-MW09-04C | OW2C-MW13-04C | OW2C-MW21-04C | OW2C-MW30-04C | OW2C-MW31-04C | OW2C-MW32-04C | OW2C-MW32P-04C | OW2C-MW33-04C |
| Sample Date | | 07/26/04 | 07/27/04 | 07/27/04 | 08/27/04 | 07/26/04 | 07/27/04 | 07/26/04 | 07/26/04 | 07/26/04 |
| Chemical Name | | | | | | | | | | |
| Wet Chemistry (MG/L) | | | | | | | | | | |
| Acetate | -- | 1 U | 1 U | 1 U | 1 U | 1.2 | 1 U | 0.65 J | 1 U | 1 U |
| Alkalinity | -- | 115 | 114 | 164 | 123 | 129 | 338 | 189 | 174 | 185 |
| Chloride | -- | 14.5 | 8.53 | 18.4 | 17.5 | 30.2 | 18.5 | 16.6 | 16.1 | 25 |
| Ethane | -- | 0.0005 J | 0.002 U | 0.002 U | 0.004 | 0.0010 J | 0.007 | 0.002 | 0.003 | 0.0007 J |
| Ethene | -- | 0.002 U | 0.002 U | 0.002 U | 0.0003 J | 0.002 U | 0.004 | 0.0005 J | 0.0007 J | 0.0007 J |
| Ferrous iron | -- | 13.9 | 1.38 | 19.6 | 17.1 | 15.7 | 15.8 | 11.2 | 11 | 11.8 |
| Lactate | -- | 25 UM | 25 UM | 25 UM | 11 JM | 25 UM | 25 UM | 25 UM | 25 UM | 25 UM |
| Methane | -- | 0.075 | 0.17 | 0.0004 J | 0.14 | 0.054 | 0.22 | 0.058 | 0.1 | 0.049 |
| Nitrate | 10 | 0.007 U | 0.007 U |
| Nitrite | 1 | 0.014 U | 0.014 U |
| Sulfate | -- | 13.2 | 5.12 | 59.6 | 96.9 | 155 | 39.3 | 53.5 | 53.4 | 95.2 |
| Sulfide | -- | 0.6 | 0.9 | 0.4 J | 0.6 | 0.6 | 0.7 | 0.3 J | 0.6 | 0.5 |
| Total organic carbon (TOC) | -- | 14.6 | 3.43 J | 11 | 10.8 | 13.9 | 12.9 | 12.6 | 10.6 | 9.39 |

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Table 5
Groundwater Screening Criteria for Wet Chemistry Parameters
SWMUs 2B, 2C, and 2E
NAS Oceana, Virginia Beach, Virginia

Table 5

| SWMU 2C - TARGET AREAS | | | | |
|-----------------------------|---------------------|---------------|---------------|---------------|
| Station ID | MCL- Groundwater | OW2C-MW18 | OW2C-MW19 | OW2C-MW24 |
| Sample ID | | OW2C-MW18-04C | OW2C-MW19-04C | OW2C-MW24-04C |
| Sample Date | | 07/29/04 | 07/29/04 | 07/29/04 |
| Chemical Name | | | | |
| Wet Chemistry (MG/L) | | | | |
| Acetate | -- | NA | NA | NA |
| Alkalinity | -- | 275 | 245 | 227 |
| Chloride | -- | 20.1 | 15.6 | 34.4 |
| Ethane | -- | NA | NA | NA |
| Ethene | -- | NA | NA | NA |
| Ferrous Iron | -- | 14.4 | 19.6 | 19.6 |
| Lactate | -- | NA | NA | NA |
| Methane | -- | NA | NA | NA |
| Nitrate | 10 | 0.007 U | 0.05 J | 0.007 U |
| Nitrite | 1 | 0.045 J | 0.04 J | 0.055 J |
| Sulfate | -- | 0.585 J | 0.695 J | 2.47 J |
| Sulfide | -- | NA | NA | NA |
| Total organic carbon (TOC) | -- | 15.2 | 10.2 | 21.7 |

| SWMU 2E - TARGET AREAS | | |
|-----------------------------|---------------------|---------------|
| Station ID | MCL- Groundwater | OW2E-MW09 |
| Sample ID | | OW2E-MW09-04C |
| Sample Date | | 07/29/04 |
| Chemical Name | | |
| Wet Chemistry (MG/L) | | |
| Acetate | -- | NA |
| Alkalinity | -- | 291 |
| Chloride | -- | 12 |
| Ethane | -- | NA |
| Ethene | -- | NA |
| Ferrous Iron | -- | 19.6 |
| Lactate | -- | NA |
| Methane | -- | NA |
| Nitrate | 10 | 0.007 U |
| Nitrite | 1 | 0.045 J |
| Sulfate | -- | 5.07 J |
| Sulfide | -- | NA |
| Total organic carbon (TOC) | -- | 17.3 |

Notes:

Shaded cells represent exceedances of screening criteria

NA - Not analyzed

J - Reported value is estimated

U - Not detected

Table 6
Groundwater Screening Criteria for VOCs
SWMUs 2B, 2C, and 2E
NAS Oceana, Virginia Beach, Virginia

| SWMU 2B - TARGET AREAS | | | | |
|--|---------------------|---------------|----------------|---------------|
| Station ID | MCL- Groundwater | OW2B-MW01 | OW2B-MW14 | |
| Sample ID | | OW2B-MW01-04C | OW2B-MW14P-04C | OW2B-MW14-04C |
| Sample Date | | 07/29/04 | 07/29/04 | 07/29/04 |
| Chemical Name | | | | |
| Volatile Organic Compounds (UG/L) | | | | |
| 1,1-Dichloroethene | 7 | 1 J | NA | NA |
| Trichloroethene | 5 | 80 | NA | NA |
| Vinyl chloride | 2 | 14 | 1.7 | 1.7 |
| cis-1,2-Dichloroethene | 70 | 170 | NA | NA |
| trans-1,2-Dichloroethene | 100 | 10 | NA | NA |

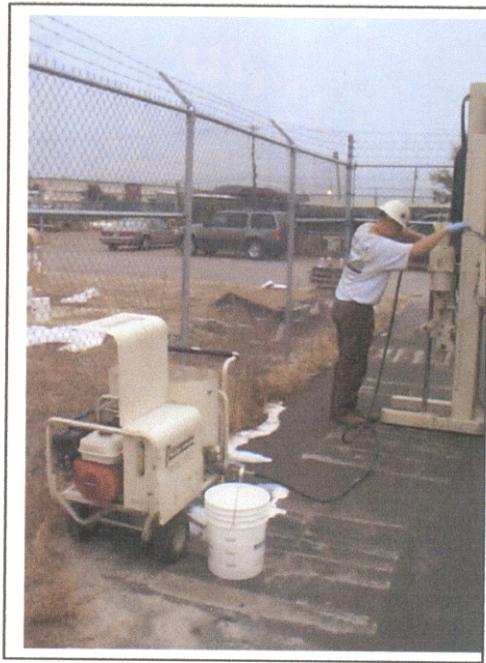
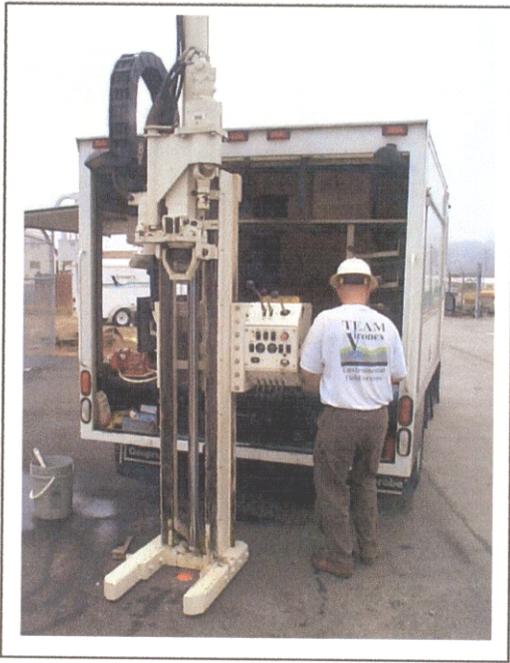
| SWMU 2C - NORTH PLUME | | | | | | | | | |
|--|---------------------|---------------|---------------|----------------|---------------|---------------|---------------|---------------|-----------|
| Station ID | MCL- Groundwater | OW2C-MW05 | OW2C-MW07 | | | OW2C-MW25 | OW2C-MW26 | OW2C-MW27 | OW2C-MW28 |
| Sample ID | | OW2C-MW05-04C | OW2C-MW07-04C | OW2C-MW07P-04C | OW2C-MW25-04C | OW2C-MW26-04C | OW2C-MW27-04C | OW2C-MW28-04C | |
| Sample Date | | 07/29/04 | 07/29/04 | 07/29/04 | 07/29/04 | 07/29/04 | 07/29/04 | 08/27/04 | |
| Chemical Name | | | | | | | | | |
| Volatile Organic Compounds (UG/L) | | | | | | | | | |
| 1,1-Dichloroethene | 7 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | |
| Trichloroethene | 5 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | |
| Vinyl chloride | 2 | 51 | 54 | 53 | 160 | 19 | 9 J | 10 U | |
| cis-1,2-Dichloroethene | 70 | 2 J | 12 | 12 | 10 U | 10 U | 2 J | 10 U | |
| trans-1,2-Dichloroethene | 100 | 10 U | 2 J | 2 J | 3 J | 10 U | 10 U | 10 U | |

| SWMU 2C - SOUTH PLUME | | | | | | | | | | |
|--|---------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|---------------|
| Station ID | MCL- Groundwater | OW2C-MW04 | OW2C-MW09 | OW2C-MW13 | OW2C-MW21 | OW2C-MW30 | OW2C-MW31 | OW2C-MW32 | | OW2C-MW33 |
| Sample ID | | OW2C-MW04-04C | OW2C-MW09-04C | OW2C-MW13-04C | OW2C-MW21-04C | OW2C-MW30-04C | OW2C-MW31-04C | OW2C-MW32-04C | OW2C-MW32P-04C | OW2C-MW33-04C |
| Sample Date | | 07/26/04 | 07/27/04 | 07/27/04 | 08/27/04 | 07/29/04 | 07/27/04 | 07/26/04 | 07/28/04 | 07/26/04 |
| Chemical Name | | | | | | | | | | |
| Volatile Organic Compounds (UG/L) | | | | | | | | | | |
| 1,1-Dichloroethene | 7 | 10 U | 10 U |
| Trichloroethene | 5 | 10 U | 10 U | 4 J | 3 J | 2 J | 4 J | 5 J | 5 J | 4 J |
| Vinyl chloride | 2 | 10 U | 10 U | 21 | 8 J | 8 J | 24 | 10 | 11 | 28 |
| cis-1,2-Dichloroethene | 70 | 10 U | 10 U | 18 | 5 J | 3 J | 26 | 8 J | 9 J | 27 |
| trans-1,2-Dichloroethene | 100 | 10 U | 10 U | 2 J | 10 U | 10 U | 1 J | 10 U | 10 U | 3 J |

| SWMU 2C - TARGET AREAS | | | | |
|--|---------------------|---------------|---------------|---------------|
| Station ID | MCL- Groundwater | OW2C-MW18 | OW2C-MW19 | OW2C-MW24 |
| Sample ID | | OW2C-MW18-04C | OW2C-MW19-04C | OW2C-MW24-04C |
| Sample Date | | 07/29/04 | 07/29/04 | 07/29/04 |
| Chemical Name | | | | |
| Volatile Organic Compounds (UG/L) | | | | |
| 1,1-Dichloroethene | 7 | 10 U | 10 U | 10 U |
| Trichloroethene | 5 | 10 U | 10 U | 10 U |
| Vinyl chloride | 2 | 38 | 14 | 37 |
| cis-1,2-Dichloroethene | 70 | 10 | 15 | 5 J |
| trans-1,2-Dichloroethene | 100 | 10 U | 10 U | 2 J |

| SWMU 2E - TARGET AREA | | |
|--|---------------------|---------------|
| Station ID | MCL- Groundwater | OW2E-MW09 |
| Sample ID | | OW2E-MW09-04C |
| Sample Date | | 07/29/04 |
| Chemical Name | | |
| Volatile Organic Compounds (UG/L) | | |
| 1,1-Dichloroethene | 7 | NA |
| Trichloroethene | 5 | NA |
| Vinyl chloride | 2 | 8 |
| cis-1,2-Dichloroethene | 70 | NA |
| trans-1,2-Dichloroethene | 100 | NA |

Notes:
 Shaded cells represent exceedances of screening criteria
 NA - Not analyzed
 J - Reported value is estimated
 U - Not detected



Images 1 and 2: Injection of ORC®

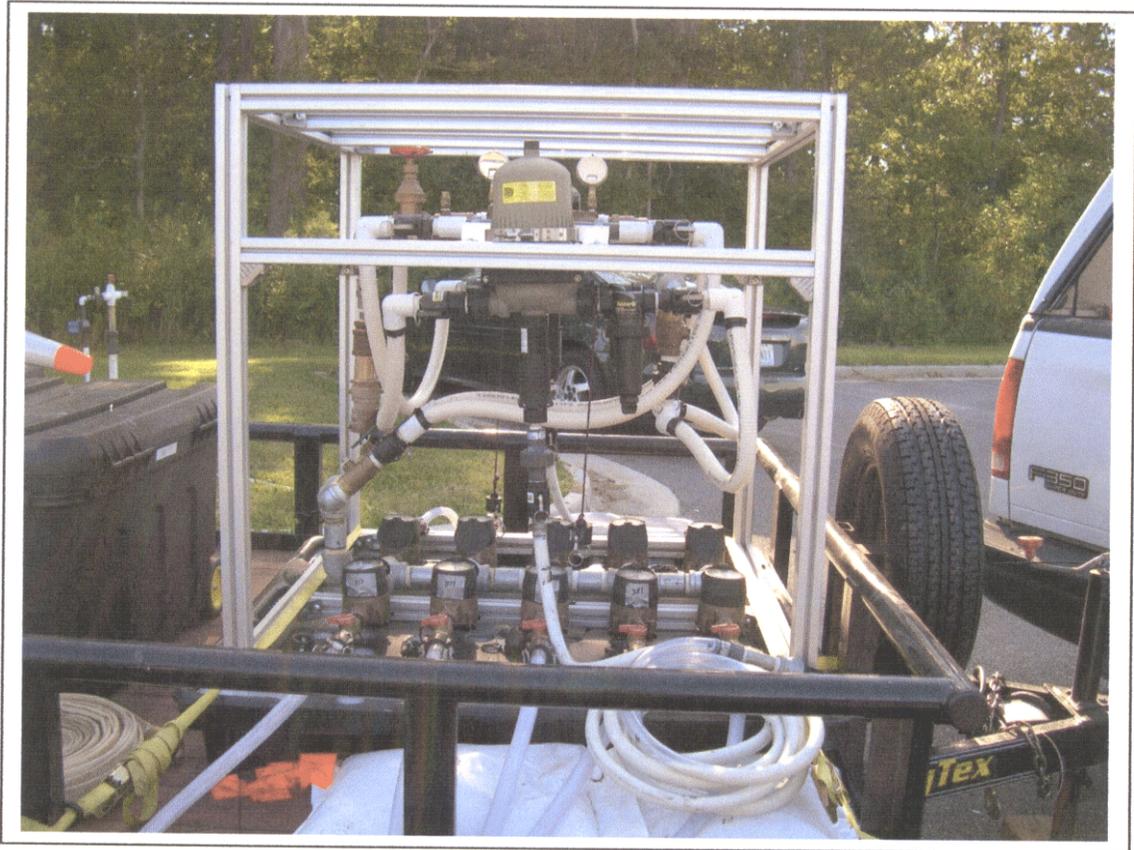


Image 3: Ten channel injection system

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Image 4: Well attached to manifold system discharge hose



Image 5: The intake hoses of the feed pumps are placed in 5-gallon buckets of emulsion



Image 6: Flow meter reading zero (prior to the beginning of injection)

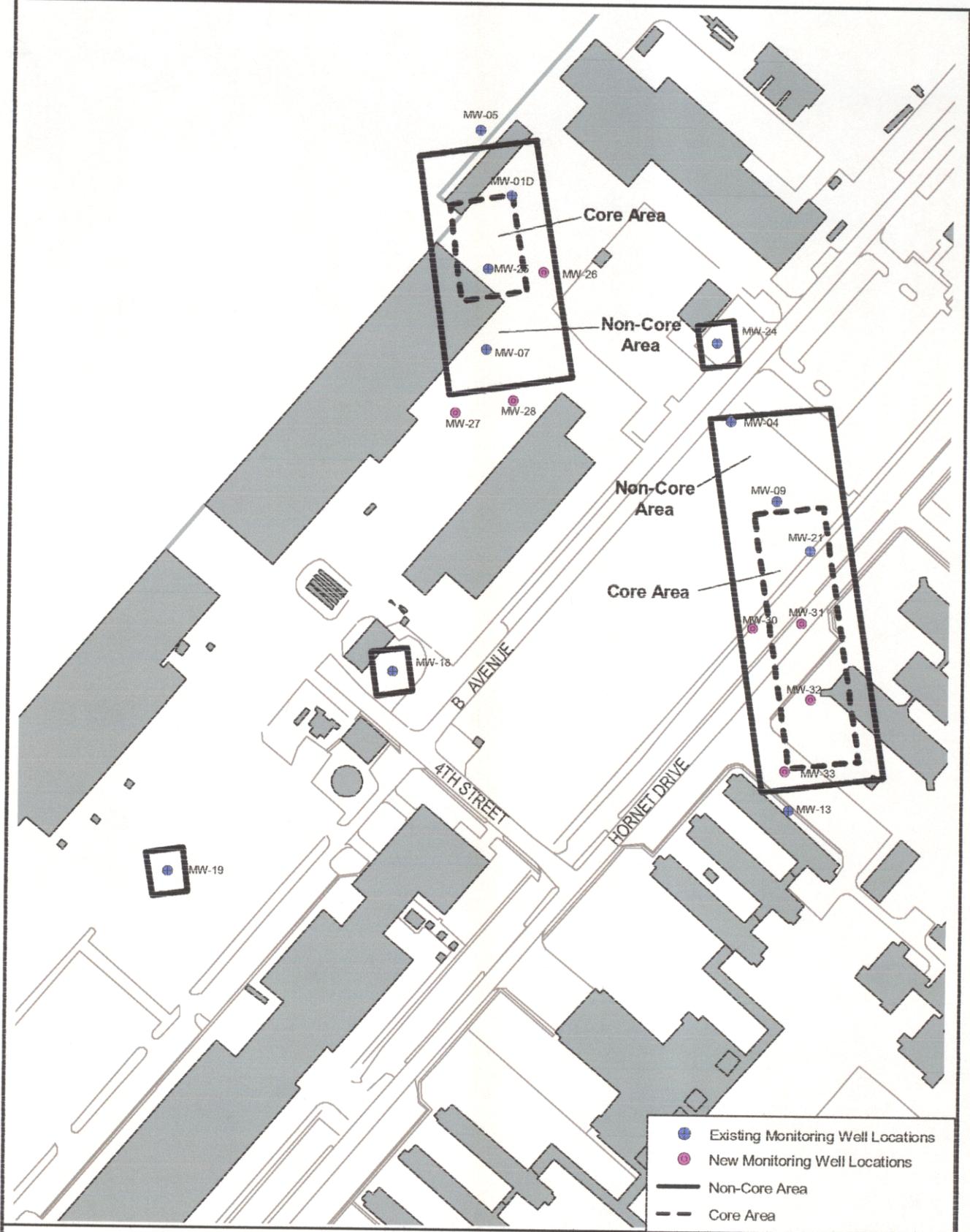


Figure 1
Monitoring Well Sampling Network - SWMU 2C
NAS Oceana, Virginia Beach, Virginia

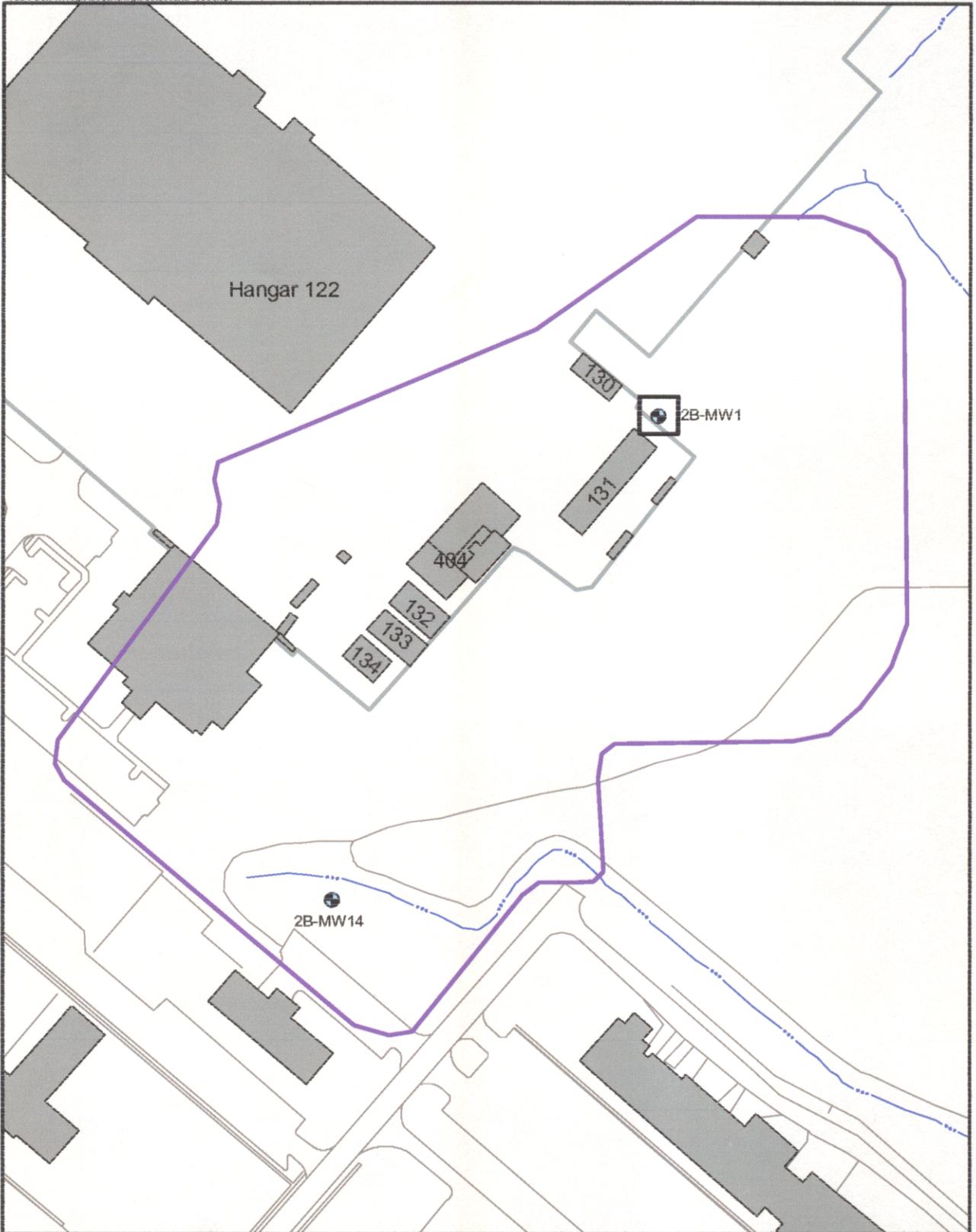
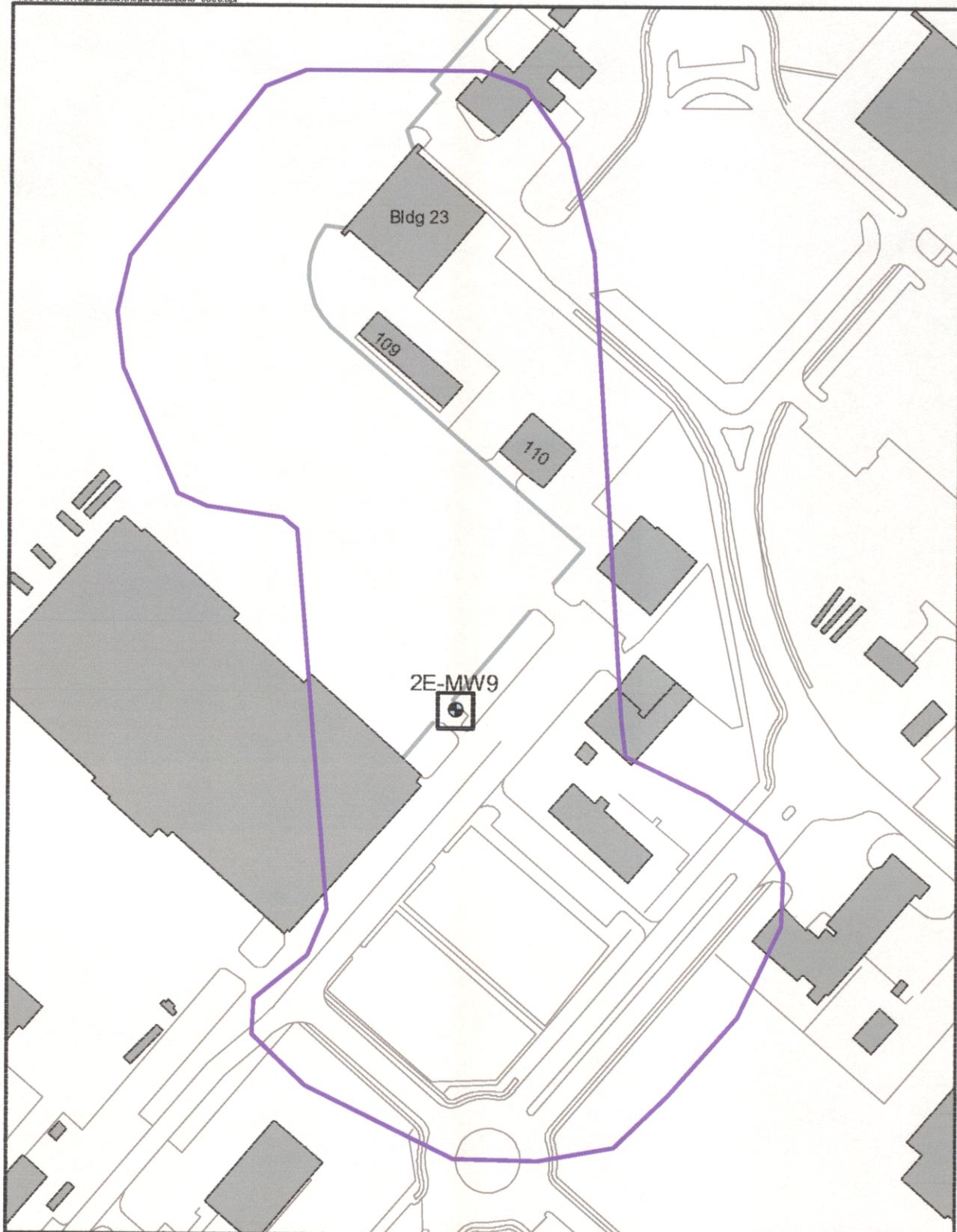
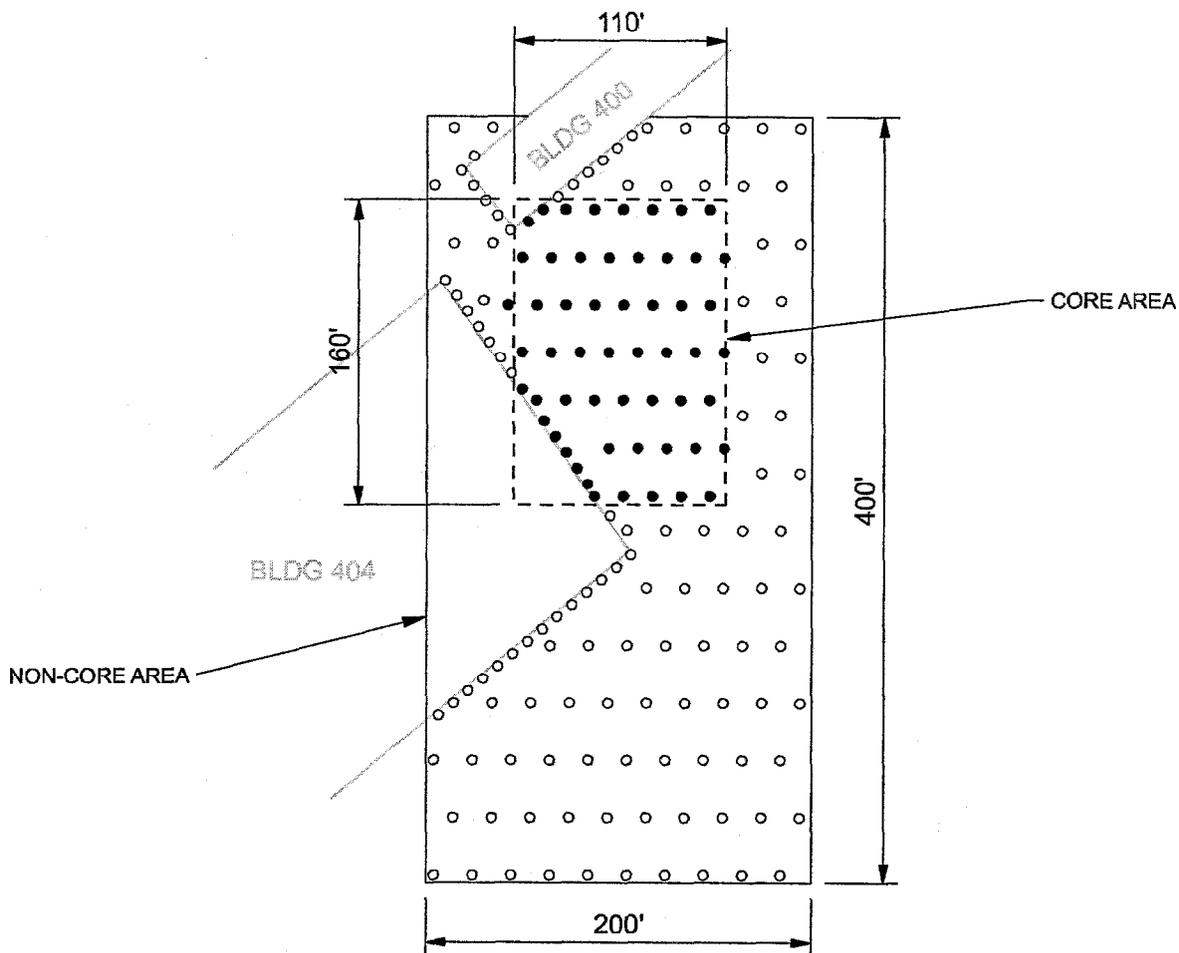


Figure 2
Monitoring Well Sampling Network - SWMU 2B
NAS Oceana, Virginia Beach, Virginia



0 100 200 300 Feet

Figure 3
Monitoring Well Sampling Network - SWMU 2E
NAS Oceana, Virginia Beach, Virginia



LEGEND

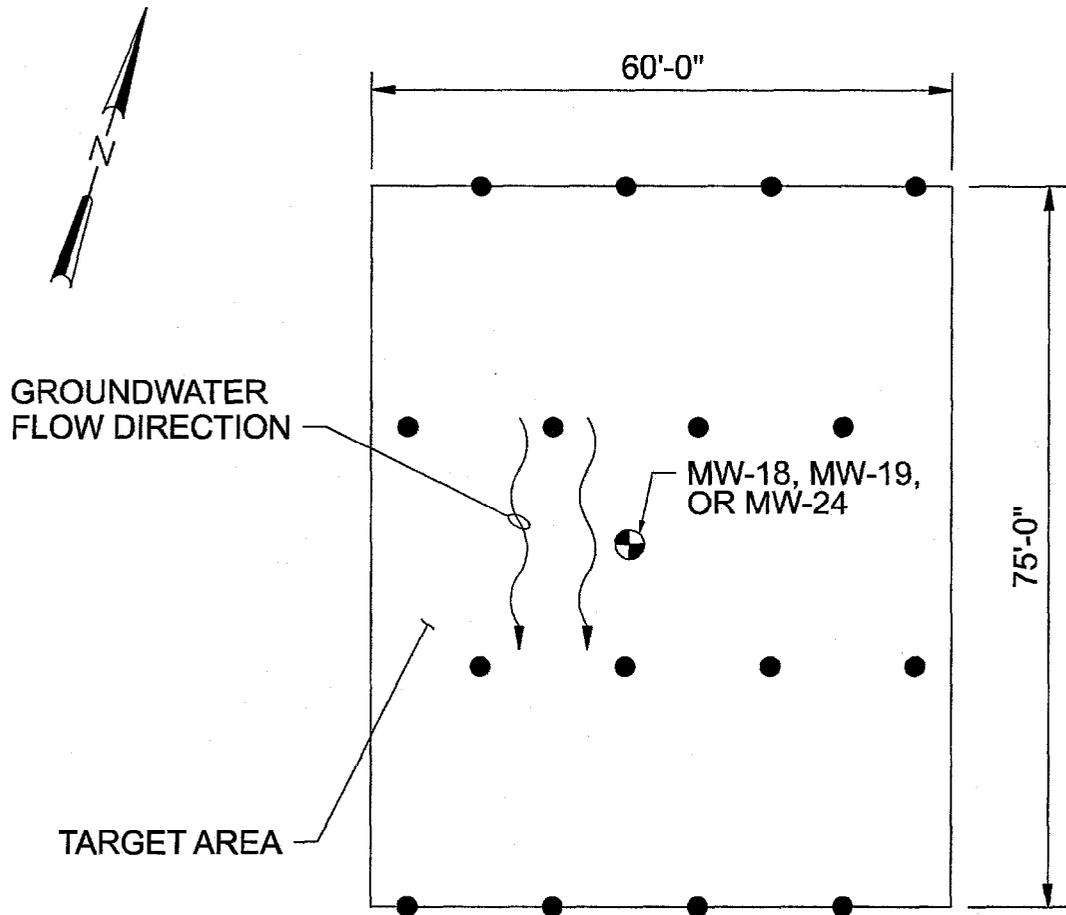
- CORE AREA INJECTION POINT
- NON-CORE AREA INJECTION POINT
- CORE AREA
- NON-CORE AREA

NOTES

1. SEE FIGURE 1 FOR SPACIAL ORIENTATION RELATIVE TO SWMU 2C.
2. INJECTION POINT SPACING IN THE CORE AREA ARE 15 FEET WITHIN ROWS WITH ROWS 25 FEET APART.
3. INJECTION POINT SPACING IN THE NON-CORE AREA ARE 20 FEET WITHIN ROWS WITH ROWS 30 FEET APART.
4. INJECTION POINT SPACING AROUND THE PERIMETER OF BLDG 404 AND BLDG 400 IS APPROXIMATELY 10 FEET APART.

FIGURE 4
 APPROXIMATE NORTHERN PLUME INJECTION LOCATIONS
 SWMU 2C
 NAS OCEANA, VIRGINIA BEACH, VIRGINIA

NOT TO SCALE



LEGEND

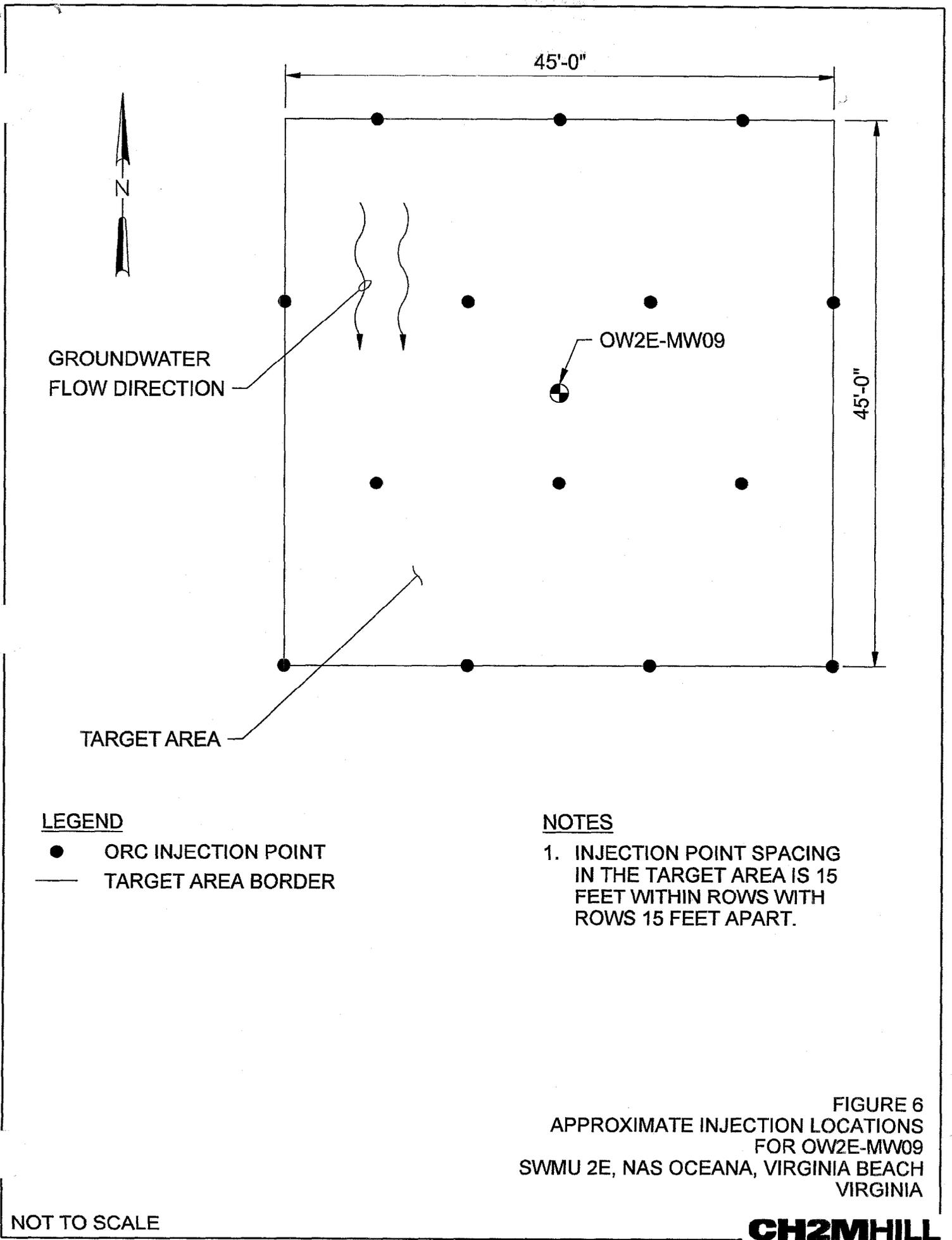
- ORC INJECTION POINT
- TARGET AREA BORDER

NOTES

1. INJECTION POINT SPACING IN THE TARGET AREA IS 15 FEET WITHIN ROWS WITH ROWS 25 FEET APART.

FIGURE 5
 APPROXIMATE INJECTION LOCATIONS
 FOR TARGET AREAS AROUND MW-18, MW-19, AND MW-24
 NAS OCEANA, VIRGINIA BEACH
 VIRGINIA

NOT TO SCALE



GROUNDWATER
FLOW DIRECTION

TARGET AREA

45'-0"

45'-0"

OW2E-MW09

LEGEND

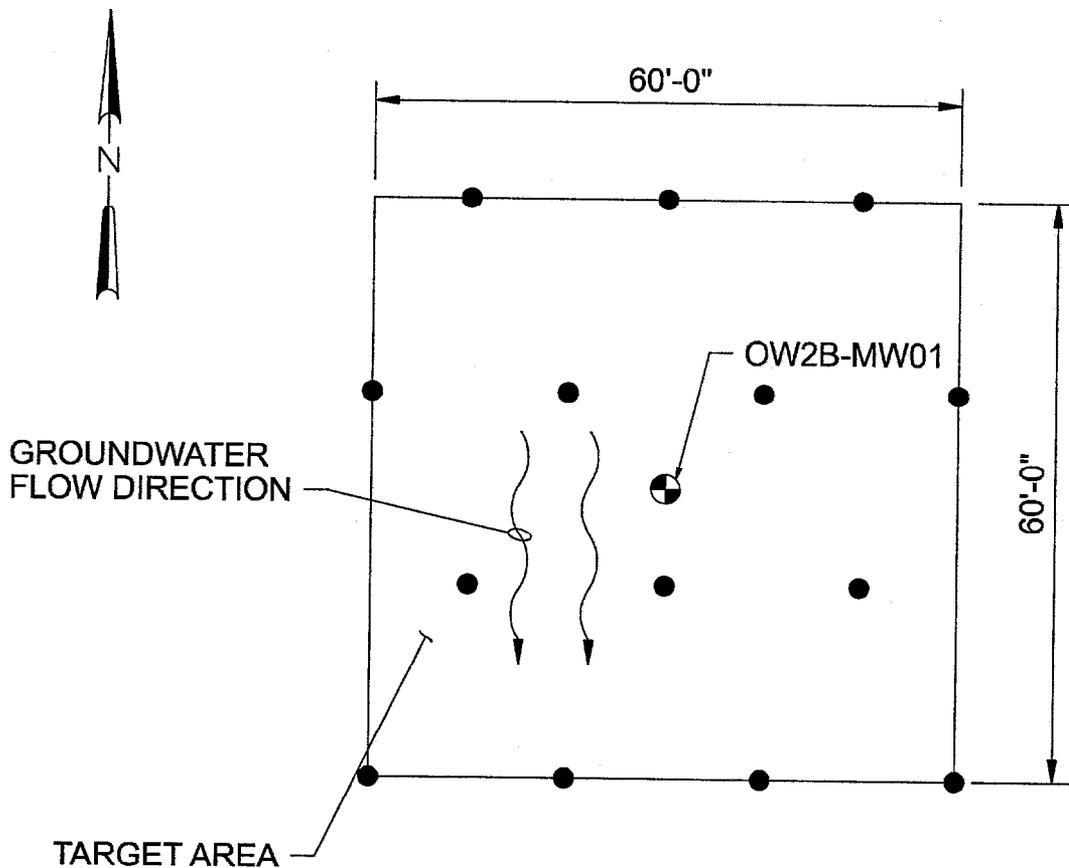
- ORC INJECTION POINT
- TARGET AREA BORDER

NOTES

1. INJECTION POINT SPACING IN THE TARGET AREA IS 15 FEET WITHIN ROWS WITH ROWS 15 FEET APART.

FIGURE 6
APPROXIMATE INJECTION LOCATIONS
FOR OW2E-MW09
SWMU 2E, NAS OCEANA, VIRGINIA BEACH
VIRGINIA

NOT TO SCALE



LEGEND

- EMULSIFIED OIL AND LACTATE INJECTION POINT
- TARGET AREA BORDER

NOTES

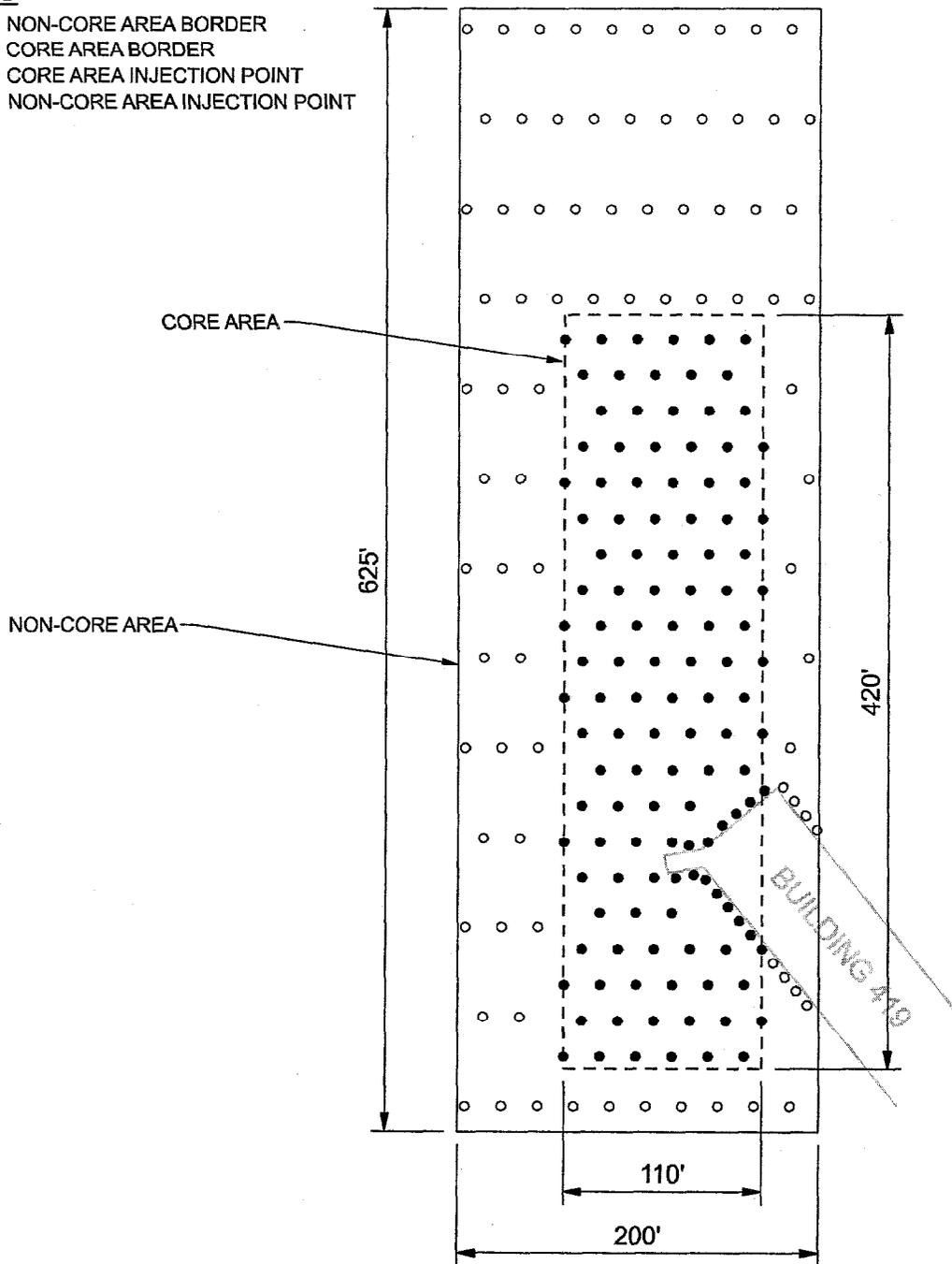
1. INJECTION POINT SPACING IN THE TARGET AREA IS 20 FEET WITHIN ROWS WITH ROWS 20 FEET APART.

FIGURE 7
 APPROXIMATE INJECTION LOCATIONS
 FOR OW2B-MW01
 SWMU 2B, NAS OCEANA, VIRGINIA BEACH
 VIRGINIA

NOT TO SCALE

LEGEND

- NON-CORE AREA BORDER
- - - CORE AREA BORDER
- CORE AREA INJECTION POINT
- NON-CORE AREA INJECTION POINT



NOTES

1. SEE FIGURE 1 FOR SPACIAL ORIENTATION RELATIVE TO SWMU 2C.
2. INJECTION POINT SPACING IN THE CORE AREA IS 20 FEET WITHIN ROWS WITH ROWS 20 FEET APART.
3. INJECTION POINT SPACING IN THE NON-CORE AREA IS 20 FEET WITHIN ROWS WITH ROWS 50 FEET APART.
4. INJECTION POINT SPACING AROUND THE PERIMETER OF BLDG 404 AND BLDG 400 IS APPROXIMATELY 10 FEET APART.

FIGURE 8
APPROXIMATE SOUTHERN PLUME INJECTION LOCATIONS
SWMU 2C
NAS OCEANA, VIRGINIA BEACH, VIRGINIA

NOT TO SCALE

CH2MHILL

APPENDIX A



| | | |
|---------------------------------------|-----------------------------------|--------------|
| PROJECT NUMBER 157051.SI.ID | BORING NUMBER OW2C-MW26 | SHEET 1 OF 1 |
| SOIL BORING LOG | | |

PROJECT : SWMU 2C Pre-injection Well Installation LOCATION : Naval Air Station Oceana
 ELEVATION : 20.05 ft amsl DRILLING CONTRACTOR : Parratt Wolf
 DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger
 WATER LEVELS 14.02 ft amsl START : 0700 7/21/04 END : 0930 7/21/04 LOGGER : Dennis Ballam

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) | | STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N) | CORE DESCRIPTION | COMMENTS |
|--------------------------|---------------|--------|--|---|----------------|
| | RECOVERY (IN) | #/TYPE | | | |
| | | | | | |
| 0-14" | 14" | | no blow counts recorded Geoprobe hammer used | Flightline concrete to 14" bgs | |
| 5-7' | 24" | 1 | | CLAY and SAND with trace silt (SC), gray (5Y5/1); moist; medium stiff; poorly graded | PID = 11.3 ppm |
| 10-12' | 24" | 2 | | SAND (SP); gray (5Y5/1); saturated; medium dense; well sorted; medium to fine grained | PID = 9.3 ppm |
| 15-17' | 24" | 3 | | Same as above | PID = 0 ppm |
| 20' | | | | End of boring 17' bgs Set well at 16' bgs | |
| 25' | | | | | |
| 30' | | | | | |
| 35' | | | | | |
| 40' | | | | | |



| | | |
|---------------------------------------|-----------------------------------|--------------|
| PROJECT NUMBER 157051.SI.ID | BORING NUMBER OW2C-MW27 | SHEET 1 OF 1 |
| SOIL BORING LOG | | |

PROJECT : SWMU 2C Pre-injection Well Installation LOCATION : Naval Air Station Oceana
 ELEVATION : 19.9 ft amsl DRILLING CONTRACTOR : Parratt Wolff
 DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger
 WATER LEVELS 13.68 ft amsl START : 1700 7/20/04 END : 1830 7/20/04 LOGGER : Dennis Ballam

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) | | RECOVERY (IN) #/TYPE | STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N) | CORE 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, AND INSTRUMENTATION. |
|--------------------------|---------------|-----|-------------------------|---|---|--|
| | 0-2" | 2" | | | | |
| | 5-7' | 14" | | | | |
| 0-2' | 0-2" | 2" | | no blow counts recorded Geoprobe hammer used | asphalt at surface | |
| 5-7' | 5-7' | 14" | 1 | | clayey SAND (SC); olive gray (5Y4/2); moist; soft/loose; well sorted; medium to fine grained | PID = 0.0 ppm |
| 10-12' | 10-12' | 12" | 2 | | SAND (SP); gray (5Y5/1); saturated; medium dense; well sorted; medium to fine grained | PID = 0.0 ppm |
| 15-17' | 15-17' | 24" | 3 | | Same as above | PID = 0.0 ppm |
| 17-18' | | | | | End of boring 17' bgs Set well at 16' bgs | |



| | | |
|---------------------------------------|-----------------------------------|--------------|
| PROJECT NUMBER 157051.SI.ID | BORING NUMBER OW2C-MW28 | SHEET 1 OF 1 |
| SOIL BORING LOG | | |

PROJECT : SWMU 2C Pre-injection Well Installation LOCATION : Naval Air Station Oceana
 ELEVATION : 19.36 ft amsl DRILLING CONTRACTOR : Parratt Wolff
 DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger
 WATER LEVELS 14.12 ft amsl START : 0745 7/20/04 END : 0900 7/20/04 LOGGER : Dennis Ballam

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) | | STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N) | CORE DESCRIPTION | COMMENTS |
|--------------------------|---------------|--------|--|---|---------------|
| | RECOVERY (IN) | #/TYPE | | | |
| | | | | | |
| 0-2' | 2" | | no blow counts recorded Geoprobe hammer used | asphalt at surface | |
| 5-7' | 4" | 1 | | clayey SAND (SC); dark yellowish brown (10YR4/6); moist; dense; well sorted; 2" diameter piece of limestone wedged in nose of spoon resulted in poor recovery | PID = 0.0 ppm |
| 10-12' | 22" | 2 | | SAND (SP); gray (5Y6/1); saturated; medium dense; well sorted; medium to fine grained | PID = 0.0 ppm |
| 15-17' | 24" | 3 | | Same as above | PID = 0.0 ppm |
| 20-22' | 24" | 4 | | Same as above | PID = 0.0 ppm |
| 25' | | | | End of boring 22' bgs Set well at 18' bgs | |
| 30' | | | | | |
| 35' | | | | | |
| 40' | | | | | |



| | | |
|---------------------------------------|-----------------------------------|--------------|
| PROJECT NUMBER 157051.SI.ID | BORING NUMBER OW2C-MW30 | SHEET 1 OF 1 |
| SOIL BORING LOG | | |

PROJECT : SWMU 2C Pre-injection Well Installation LOCATION : Naval Air Station Oceana
 ELEVATION : 17.28 ft amsl DRILLING CONTRACTOR : Parratt Wolff
 DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger
 WATER LEVELS 12.78 ft amsl START : 1445 7/19/04 END : 1600 7/19/04 LOGGER : Dennis Ballam

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) | | | STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N) | CORE 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, AND INSTRUMENTATION. |
|--------------------------|---------------|--------|--|--|--|--|
| | RECOVERY (IN) | #/TYPE | | | | |
| | | | | | | |
| 0-2" | 2" | | | no blow counts recorded Geoprobe hammer used | asphalt at surface just below asphalt surface, soil cutting are sandy CLAY (SC); very dark gray (5Y3/1); moist | PID = 0.2 - 3.4 ppm |
| 5-7' | 22" | 1 | | | SAND (SP); gray (2.5Y5/1); wet; medium dense; well sorted; medium to fine grained | PID = 0.0 ppm |
| 10-12' | 22" | 2 | | | SAND (SP); dark gray (5Y4/1); saturated; medium dense; well sorted; medium to fine grained | PID = 0.0 ppm |
| 15-17' | 20" | 3 | | | SAND (SP); gray (5Y5/1); saturated; medium dense; well sorted; medium to fine grained | PID = 0.0 ppm |
| 20-22' | 24" | 4 | | | Same as above | PID = 0.0 ppm |
| 25' | | | | | End of boring 22' bgs Set well at 20' bgs | |
| 30' | | | | | | |
| 35' | | | | | | |
| 40' | | | | | | |



| | | |
|---------------------------------------|-----------------------------------|--------------|
| PROJECT NUMBER 157051.SI.ID | BORING NUMBER OW2C-MW32 | SHEET 1 OF 1 |
| SOIL BORING LOG | | |

PROJECT :SWMU 2C Pre-injection Well Installation LOCATION : Naval Air Station Oceana
 ELEVATION : 17.66 ft amsl DRILLING CONTRACTOR : Parratt Wolff
 DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger
 WATER LEVELS 13.14 ft amsl START : 1330 7/20/04 END : 1500 7/20/04 LOGGER : Dennis Ballam

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) | | STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N) | CORE DESCRIPTION | COMMENTS |
|--------------------------|---------------|--------|--|--|---------------|
| | RECOVERY (IN) | #/TYPE | | | |
| | | | | | |
| 0-2" | 2" | | no blow counts recorded Geoprobe hammer used | grass and organic topsoil at surface | |
| 5-7' | 8" | 1 | | CLAY, some silt (CH); brownish yellow (10YR6/8); moist to saturated at 6' bgs; medium stiff; some reddish mottling | PID = 0.0 ppm |
| 10-12' | 24" | 2 | | SAND (SP); gray (5Y5/1); saturated; loose; well sorted; fine to medium grained | PID = 0.0 ppm |
| 15-17' | 24" | 3 | | Same as above | PID = 0.0 ppm |
| 20-22' | 20" | 4 | | Same as above | PID = 0.0 ppm |
| 25 | | | | End of boring 22' bgs Set well at 20' bgs | |
| 30 | | | | | |
| 35 | | | | | |
| 40 | | | | | |



| | | |
|---------------------------------------|-----------------------------------|--------------|
| PROJECT NUMBER 157051.SI.ID | BORING NUMBER OW2C-MW33 | SHEET 1 OF 1 |
| SOIL BORING LOG | | |

PROJECT : SWMU 2C Pre-injection Well Installation LOCATION : Naval Air Station Oceana
 ELEVATION : 16.86 ft amsl DRILLING CONTRACTOR : Parratt Wolff
 DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger
 WATER LEVELS 9.18 ft amsl START : 1000 7/20/2004 END : 1200 7/20/04 LOGGER : Dennis Ballam

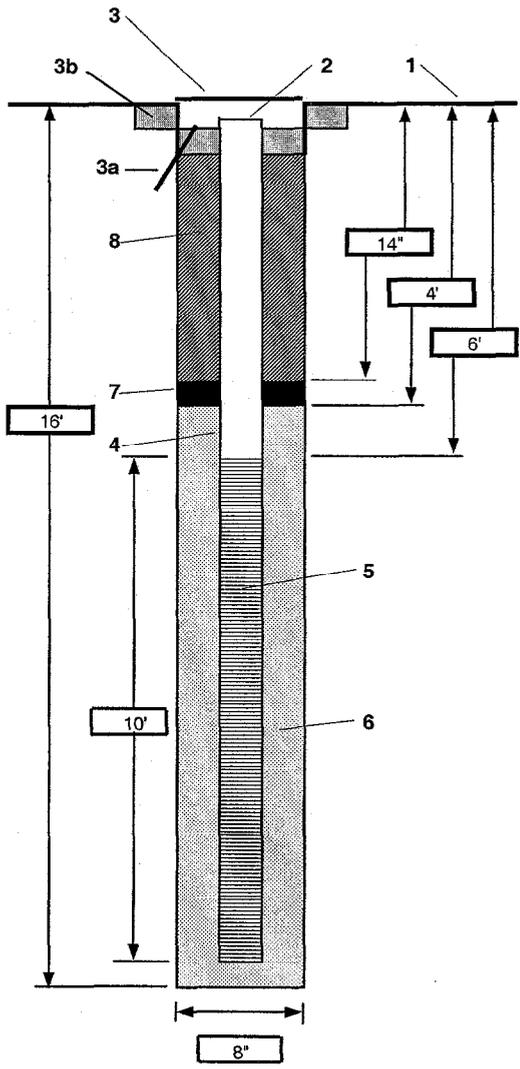
| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) | | STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N) | CORE DESCRIPTION | COMMENTS |
|--------------------------|---------------|--------|---|--|---------------|
| | RECOVERY (IN) | #/TYPE | | | |
| | | | | | |
| 0-2" | 2" | | no blow counts recorded Geoprobe hammer used | asphalt at surface | |
| 5-7' | 24" | 1 | | SAND (SP); gray (5Y6/1); saturated; loose; well sorted; fine to medium grained | PID = 0.0 ppm |
| 10-12' | 24" | 2 | | Same as above | PID = 4.6 |
| 15-17' | 24" | 3 | | Same as above | PID = 0.0 ppm |
| 20-22' | 20" | 4 | | silty SAND (SM); dark gray (5Y4/1); saturated; loose; poorly graded | PID = 0.0 ppm |
| 25' | | | | End of boring 22' bgs Set well at 20' bgs | |
| 30' | | | | | |
| 35' | | | | | |
| 40' | | | | | |

APPENDIX B



| | |
|--|--|
| PROJECT NUMBER 157051.SI.ID | WELL NUMBER OW2C-MW26 |
| SHEET 1 OF 1 | |
| WELL COMPLETION DIAGRAM | |

| | |
|--|----------------------------------|
| PROJECT : CTO-55 | LOCATION: SWMU 2C |
| DRILLING CONTRACTOR : Parratt Wolff | NORTHING: EASTING: |
| DRILLING METHOD AND EQUIPMENT USED : CME 75 and 4.25" ID hollow stem auger | |
| WATER LEVELS : 14.02 ft amsl | START : 07/21/04 0745 END : 0930 |
| LOGGER : Dennis Ballam | |

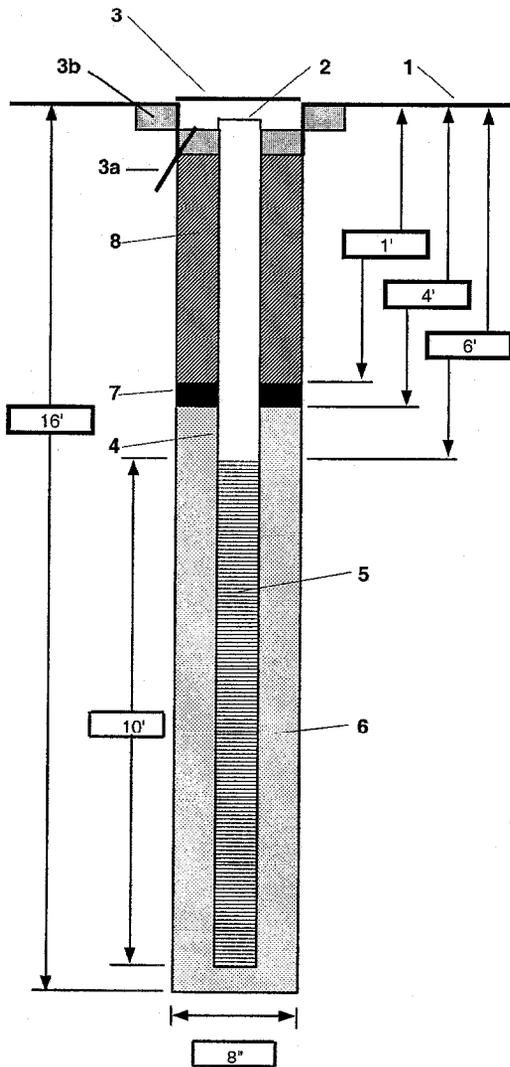


| | |
|-----------------------------------|-------------------------------|
| 1- Ground elevation at well | 20.25 ft amsl |
| 2- Top of casing elevation | 20.05 ft amsl |
| 3- Wellhead protection cover type | 8" steel flushmount cover |
| a) drain tube? | no, sand filter installed |
| b) concrete pad dimensions | 24" round |
| 4- Dia./type of well casing | 2" Schedule 40 PVC |
| 5- Type/slot size of screen | 0.010 Slot Schedule 40 PVC |
| 6- Type screen filter | DSI #1 Silica Sand |
| a) Quantity used | Not available |
| 7- Type of seal | 3/8" hydrated bentonite chips |
| a) Quantity used | Not available |
| 8- Grout | none |
| a) Grout mix used | |
| b) Method of placement | |
| c) Vol. of well casing grout | |
| Development method | Submersible Whale Pump |
| Development time | 40 minutes |
| Estimated purge volume | 45 gallons |
| Comments | |
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|---|---------------------------------|
| PROJECT NUMBER 157051.SI.ID | WELL NUMBER OW2C-MW27 |
| SHEET 1 OF 1 | |
| <h2 style="margin: 0;">WELL COMPLETION DIAGRAM</h2> | |

| | |
|--|----------------------------------|
| PROJECT : CTO-55 | LOCATION: SWMU 2C |
| DRILLING CONTRACTOR : Parratt Wolff | NORTHING: EASTING: |
| DRILLING METHOD AND EQUIPMENT USED : CME 75 and 4.25" ID hollow stem auger | |
| WATER LEVELS : 13.68 ft amsl | START : 07/20/04 1700 END : 1830 |
| LOGGER : Dennis Ballam | |



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|-----------------------------------|-------------------------------|
| 1- Ground elevation at well | 20.1ft amsl |
| 2- Top of casing elevation | 19.9 ft amsl |
| 3- Wellhead protection cover type | 8" steel flushmount cover |
| a) drain tube? | no, sand filter installed |
| b) concrete pad dimensions | 24" round |
| 4- Dia./type of well casing | 2" Schedule 40 PVC |
| 5- Type/slot size of screen | 0.010 Slot Schedule 40 PVC |
| 6- Type screen filter | DSI #1 Silica Sand |
| a) Quantity used | Not available |
| 7- Type of seal | 3/8" hydrated bentonite chips |
| a) Quantity used | Not available |
| 8- Grout | none |
| a) Grout mix used | |
| b) Method of placement | |
| c) Vol. of well casing grout | |
| Development method | Submersible Whale Pump |
| Development time | 40 minutes |
| Estimated purge volume | 45 gallons |
| Comments | |
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