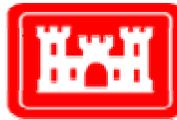


**FINAL**

# Remedial Investigation Report

## CW-6 Former Pesticide Storage Building

U. S. Army Installation Fort Monmouth  
Fort Monmouth, New Jersey



Directorate of Public Works



January 14, 2005

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Contract No. DACA51-00-D-0004  
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**United States Army**  
Fort Monmouth, New Jersey

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**Remedial Investigation Report  
CW-6 Former Pesticide Storage Building**

**Fort Monmouth, New Jersey**

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**January 14, 2005**

**REMEDIAL INVESTIGATION REPORT  
FOR THE CW-6 FORMER PESTICIDE STORAGE BUILDING  
FORT MONMOUTH, NEW JERSEY**



**PREPARED FOR:**

**UNITED STATES ARMY FORT MONMOUTH  
DIRECTORATE OF PUBLIC WORKS  
BUILDING 167  
FORT MONMOUTH, NJ 07703**

**PREPARED BY:**



**January 14, 2005**

**VERSAR PROJECT NO. 4936.116**

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## EXECUTIVE SUMMARY

VERSAR, Inc. (VERSAR) has been contracted by the United States (U.S.) Army Installation, Fort Monmouth (Fort Monmouth), Directorate of Public Works (DPW), Fort Monmouth, New Jersey to prepare a Remedial Investigation Report (RIR) for the CW-6 Pesticide Storage site based on work located in the Charles Wood Area. This report addresses the remedial investigation activities conducted at this site between April 1997 and February 2001.

The CW-6 Pesticide Storage site consists of a small complex of buildings in the south-central section of the Charles Wood Area. The complex consists of Building T-2044 and Building T-2070. The approximate area of the site is 25,000 square feet (0.6 acres). The CW-6 Pesticide Storage site historically was used to store and mix pesticides and herbicides. The aforementioned buildings are currently used to store golf course maintenance and landscaping equipment such as tractors and mowers. The CW-6 Pesticide Storage site currently does not store or mix pesticides or herbicides on site; an outside contractor has been hired to apply pesticides or herbicides.

The Weston report, *Site Investigation, Fort Monmouth, New Jersey, Main Post and Charles Wood Areas, Site Investigation Report* (December 1995), presents the results of field investigation activities that were conducted at 13 sites at the Main Post Area and eight sites at the Charles Wood Area. The results of the investigation of the CW-6 Pesticide Storage site are included in the Weston SI report. The field investigation activities included subsurface soil sampling, groundwater monitoring well installation and groundwater sampling. The Weston SI report was used as the basis for the supplemental remedial investigations of the CW-6 Pesticide Storage site described in the following sections of this report.

A total of four monitoring wells comprise the quarterly groundwater monitoring program conducted by the DPW at the CW-6 Pesticide Storage site. Three monitoring wells were installed in the west and northeast section of the site; one monitoring well was installed in the southeast section of the site.

The soil samples collected by Weston were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs) and Target Analyte List (TAL) metals. According to Weston Site Investigation (SI), VOCs were not detected in site soils. SVOCs were detected below New Jersey Department of Environmental Protection (NJDEP) soil cleanup criteria. One pesticide was detected above the NJDEP cleanup criteria. PCBs were not detected in site soils. One metal, chromium, was detected in concentrations exceeding the NJDEP soil cleanup criteria.

The groundwater samples collected by Weston in 1995 were analyzed for VOCs, SVOCs, pesticides and PCBs. Weston reported that one VOC, benzene, was detected above the NJDEP GWQC. SVOCs were detected below the NJDEP GWQC.

Weston concluded that the groundwater sample results for the CW-6 Pesticide Storage site indicate that benzene was detected slightly above the NJDEP GWQC. The Weston SI report stated that the DPW recommended the implementation of a long-term monitoring program at the CW-6 Pesticide Storage site. This remedial investigation was undertaken to assess the groundwater quality at the CW-6 Pesticide Storage site and verify that no COCs exist within the CW-6 Pesticide Storage site groundwater.

Fort Monmouth DPW conducted Remedial Investigation (RI) activities at the CW-6 Pesticide Storage site, including a quarterly groundwater sampling program. The purpose of this remedial investigation was to define the areal extent of potential pollutants and evaluate impacts to groundwater in the vicinity of the CW-6 Pesticide Storage site.

A total of 124 groundwater samples were collected from four groundwater monitoring wells to evaluate potential chemical impacts to groundwater from the CW-6 Pesticide Storage site. The samples were collected and analyzed for VOCs, SVOCs, pesticides, PCBs and TAL metals. Two additional rounds of sampling (low-flow #1 and low-flow #2) were conducted for TAL metals.

Based on the results of the groundwater quality evaluation, no VOCs or SVOCs were detected above the NJDEP GWQC. There was one pesticide detected in groundwater samples above the NJDEP GWQC; however, it is considered to be an isolated and marginal exceedance, and therefore is not considered to be a COC.

There were 11 metals detected in groundwater samples at concentrations exceeding the NJDEP GWQC. One metal, lead, was further considered as a COC; however, due to the low concentrations and the slow migration rate of the COC in groundwater at the CW-6 Pesticide Storage site, there is little potential for significant COC impact by migration. The Wenonah Mount Laurel aquifer, which is approximately 125 feet bgs, is too deep to be affected by the COC near the ground surface. In addition, the sensitive receptor survey (performed at various sites within Fort Monmouth - See M-12 Remedial Investigation Report by Versar 2003) indicates that there are no domestic or irrigation wells that are close enough to the CW-6 Pesticide Storage site to be adversely impacted by COC migration.

Overall, the lead distribution in groundwater does not suggest an association with any source and is more indicative of natural background conditions or a regional source, therefore, lead is not considered a COC. NFA is requested concerning groundwater at the CW-6 Pesticide Storage site.

## 1.0 INTRODUCTION

VERSAR has been contracted by the U.S. Army Installation, Fort Monmouth DPW, Fort Monmouth, New Jersey to prepare an RIR for the CW-6 Pesticide Storage site based on work located in the Charles Wood Area. This report addresses the remedial investigation activities conducted at this site between April 1997 and February 2001.

### 1.1 Objectives

The objective of this Remedial Investigation (RI) is to determine aquifer chemical and physical characteristics and to determine whether further remedial investigation or remedial action is required within the CW-6 Pesticide Storage site groundwater. The remedial investigation was conducted in accordance with New Jersey Administrative Code (NJAC) 7:26E - *Technical Requirements for Site Remediation* (July 1999).

The remedial investigation encompassed the following:

- Characterization of groundwater quality over time through quarterly groundwater sampling events conducted between April 1997 and February 2001.
- Investigation and evaluation of the designated aquifer uses, the associated aquifer classification, and the appropriate groundwater quality criteria for groundwater resources beneath the CW-6 Pesticide Storage site. The NJDEP Ground Water Quality Standards (GWQS) specify the quality criteria and designated uses for groundwater and also contain technical and general policies to ensure that the designated uses can be adequately protected.
- Comparison of the results of the groundwater quality and monitoring program with the NJDEP Ground Water Quality Criteria (GWQC).
- Formulation of a No Further Action (NFA) proposal for consideration by the NJDEP based on the results of field and laboratory investigations and evaluation of the hydrogeologic conditions at the CW-6 Pesticide Storage site.

### 1.2 Report Organization

This report is organized to minimize repetition. The findings of the Weston report entitled, *Site Investigation, Fort Monmouth, New Jersey, Main Post and Charles Wood Areas, Site Investigation Reports* (December 1995), were used as the basis for this remedial investigation program. **Section 2.0** provides background information and a general description of the CW-6 Pesticide Storage site located at the Charles Wood Area of Fort Monmouth, which a large portion was provided by Weston (1995). **Section 3.0** describes and summarizes the RI field activities conducted at the CW-6 Pesticide Storage site including the groundwater sampling. **Section 4.0** presents the physical characterization of the CW-6 Pesticide Storage site including the lithology and groundwater conditions. The site chemical characterization is presented in **Section 5.0**, which includes groundwater sample results and the determination of COCs. Conclusions and a recommendation for NFA for groundwater at the CW-6 Pesticide Storage site are included in **Section 6.0**. References used to prepare this RIR are listed in **Section 7.0**.

## 2.0 SITE BACKGROUND AND ENVIRONMENTAL SETTING

The following sections describe the site background and environmental setting of the area surrounding Fort Monmouth and the CW-6 Pesticide Storage site. Included is a description of the site location, background, current conditions and environmental setting.

### 2.1 Site Location and Description

Fort Monmouth is located in the central-eastern portion of New Jersey in Monmouth County, approximately 45 miles south of New York City and 70 miles northeast of Philadelphia (**Figure 2-1**). In addition to the Main Post, the installation includes two subposts, the Charles Wood Area and the Evans Area. The Main Post encompasses approximately 630 acres and is generally bounded by State Highway 35, Parkers Creek, Lafetra Creek, the New Jersey Transit Railroad and a residential area to the south. The post was established in 1918 during World War I (WWI) as an Army Signal Corps training center. The Main Post currently provides administrative, training and housing support functions, as well as providing many of the community facilities for Fort Monmouth. The Charles Wood Area is located one mile west of the Main Post and is comprised of approximately 511 acres. Charles Wood is used primarily for research and development, testing and personnel housing units. The primary mission of Fort Monmouth is to provide command, administrative, and logistical support for Headquarters, U.S. Army Communications and Electronics Command (CECOM). CECOM is a major subordinate command of the U.S. Army Materiel Command (AMC) and is the host tenant at Fort Monmouth.

The CW-6 Pesticide Storage site consists of a small complex of buildings in the south-central section of the Charles Wood Area (**Figure 2-2**). The complex consists of Building T-2044 and Building T-2070. The approximate area of the site is 25,000 square feet (0.6 acres). The CW-6 Pesticide Storage site historically was used to store and mix pesticides and herbicides. The aforementioned buildings are currently used to store golf course maintenance and landscaping equipment such as tractors and mowers. The CW-6 Pesticide Storage site currently does not store or mix pesticides or herbicides on site; an outside contractor has been hired to apply pesticides or herbicides.

### 2.2 Site Background

The U.S. Army Corps of Engineers (USACE), Baltimore District, initially contracted Weston to perform a field investigation at Fort Monmouth, New Jersey. This investigation was conducted at two separate areas of Fort Monmouth, the Main Post and the Charles Wood areas. Suspected hazardous waste sites were initially identified at Fort Monmouth in a report prepared by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA, 1980). The USATHAMA report identified 37 sites with known or suspected waste materials on the Main Post and the two subposts (Charles Wood and Evans Area). A background investigation was conducted by Weston of the 37 sites and eight additional sites that were identified by Fort Monmouth and the NJDEP. Weston's findings were described in a report titled, *Investigation of Suspected Hazardous Waste Sites at Fort Monmouth, New Jersey* (1993). In this background report, additional

investigations (including sampling and other field work) were recommended at 22 of the sites on the Main Post and Charles Wood areas, including the CW-6 Pesticide Storage site. NJDEP approved the recommendations on April 20, 1995. Additional investigations were also recommended at the Evans Area, and such investigations are being completed under the Base Realignment and Closure (BRAC) program.

The Weston report, *Site Investigation, Fort Monmouth, New Jersey, Main Post and Charles Wood Areas, Site Investigation Report* (December 1995), presents the results of field investigation activities that were conducted at 13 sites at the Main Post Area and eight sites at the Charles Wood Area. The results of the investigation of the CW-6 Pesticide Storage site are included in the Weston SI report. Initial field investigation activities were conducted between November 1994 and March 1995. The field investigation activities included subsurface soil sampling, groundwater monitoring well installation and groundwater sampling. The Weston SI report was used as the basis for the supplemental remedial investigations of the CW-6 Pesticide Storage site described in the following sections of this report.

A total of four monitoring wells (CW6-MW1, CW6-MW2, CW6-MW3 and CW2-MW34) comprise the quarterly groundwater monitoring program conducted by the DPW at the CW-6 Pesticide Storage site. Three monitoring wells (CW6-MW1, CW6-MW2 and CW6-MW3) were installed in the west and northeast section of the site. One monitoring well (CW2-MW34) was installed in the southeast section of the site. Three monitoring (CW6-MW1, CW6-MW2 and CW6-MW3) wells were installed by Tyree in June, July and December 1994, respectively. The wells were constructed with 4-inch diameter 20 Slot PVC to a depth of 15 feet below ground surface (bgs). One monitoring well (CW2-MW34) was installed by J.C. Anderson in January 1995. CW2-MW34 was constructed using 4-inch diameter 10 Slot PVC to a depth of 14.5 feet bgs. The monitoring well construction details are presented in **Table 2-1**. Well boring logs and monitoring well records are provided in **Appendix B**. The locations of the four monitoring wells at the CW-6 Pesticide Storage site are presented in **Figure 2-3**.

The soil samples collected by Weston in November 1994, January and May 1995 were analyzed for VOCs, SVOCs, pesticides, PCBs and TAL Metals. According to Weston SI, VOCs were not detected in site soils. SVOCs were detected below NJDEP soil cleanup criteria. One pesticide, dieldrin, was detected above the NJDEP cleanup criteria in SB-34. However, dieldrin was not detected in the site groundwater. PCBs were not detected in site soils. Of the eighteen metals detected, one metal (cadmium) was detected in concentrations exceeding the NJDEP soil cleanup criteria. However, cadmium was determined not to be a COC through the comparison of the arithmetic mean of the analytical results (**Appendix A**).

The groundwater samples collected by Weston in 1995 were analyzed for VOCs, SVOCs, pesticides and PCBs. Weston reported that one VOC, benzene, was detected above the NJDEP GWQC. SVOCs were detected below the NJDEP GWQC. One pesticide was detected slightly above the quantitation limits; however, there is no NJDEP GWQC established for alpha-chlordane.

Weston concluded that the groundwater sample results for the CW-6 Pesticide Storage site indicate that benzene was detected slightly above the NJDEP GWQC. The Weston SI report stated that the DPW recommended the implementation of a long-term monitoring program at the CW-6 Pesticide Storage site. This remedial investigation was undertaken to assess the groundwater quality at the CW-6 Pesticide Storage site and verify that no COCs exist within the CW-6 Pesticide Storage site groundwater.

### **2.3 Current Conditions**

VERSAR conducted a site walk on June 20, 2001 to assess current conditions at the CW-6 Pesticide Storage site. The site consisted of two buildings (T-2044 and T-2070) within the golf course, which is located in the south-central portion of Charles Wood Area. Site photographs are shown in **Appendix C**.

### **2.4 Environmental Setting**

The following is a description of the geological/hydrogeological setting of the area surrounding the CW-6 Pesticide Storage site. Included is a description of the regional geology and hydrogeology of the area surrounding Fort Monmouth, as well as descriptions of the local geology and hydrogeology of the Charles Wood Area.

#### **2.4.1 Regional Geology**

Monmouth County lies within the New Jersey Section of the Atlantic Coastal Plain physiographic province. The CW-6 site is located in what may be referred to as the Outer Coastal Plain subprovince, or the Outer Lowlands. The geologic map of New Jersey is provided as **Figure 2-4**.

In general, New Jersey Coastal Plain formations consist of a seaward-dipping wedge of unconsolidated deposits of clay, silt, sand and gravel. These formations typically strike northeast-southwest with a dip ranging from 10 to 60 feet per mile and were deposited on Precambrian and lower Paleozoic rocks (Zapeczka, 1989). These sediments, predominantly derived from deltaic, shallow marine and continental shelf environments, date from Cretaceous through the Quaternary Periods. The mineralogy ranges from quartz to glauconite.

The formations record several major transgressive/regressive cycles and contain units, which are generally thicker to the southeast and reflect a deeper water environment. More than 20 regional geologic units are present within the sediments of the Coastal Plain. Regressive, upward coarsening deposits are usually aquifers (e.g., Englishtown and Kirkwood Formations and the Cohansey Sand), while the transgressive deposits act as confining units (e.g., the Merchantville, Marshalltown and Navesink Formations). The individual thickness for these units varies greatly (e.g., from several feet to several hundred feet). The Coastal Plain deposits thicken to the southeast from the Fall Line (e.g., a boundary zone between older, resistant rocks and younger, softer plain sediments) to greater than 6,500 feet in Cape May County (Brown and Zapeczka, 1990).

Based on the regional geologic map (Jablonski, 1968), the Cretaceous age Red Bank and Tinton Sands outcrop at the Main Post area. The Red Bank Sand conformably overlies the Navesink Formation and dips to the southeast at 35 feet per mile. The upper member (Shrewsbury) of the Red Bank Sand is a yellowish-gray to reddish brown clayey, medium-to-coarse-grained sand that contains abundant rock fragments, minor mica and glauconite (Jablonski). The lower member (Sandy Hook) is a dark gray to black, medium-to-fine grained sand with abundant clay, mica and glauconite.

The Tinton Sand conformably overlies the Red Bank Sand and ranges from a clayey medium to very coarse-grained feldspathic-quartz and glauconite-sand to a glauconitic-coarse sand. The color varies from dark yellowish orange or light brown to moderate brown and from light olive to grayish olive. Glauconite may constitute 60 to 80 percent of the sand fraction in the upper part of the unit. The upper part of the Tinton is often highly oxidized and iron oxide encrusted (Minard, 1969). Groundwater occurs beneath the site at a depth of approximately 2 to 12 feet bgs.

The Kirkwood Formation (part of the Kirkwood-Cohansey system) crops out southeast of the Main Post and dips to the southeast at a slope of 20 feet per mile (Jablonski, 1968). The Kirkwood Formation consists of alternating layers of sand and clay. The upper unit is a light gray to yellowish-brown, fine-grained quartz sand with quartz nodules and small pebbles. The lower unit is brown silt in Monmouth County (Jablonski, 1968).

As presented in the *Site Investigation Report - Main Post and Charles Wood Areas, Fort Monmouth, New Jersey*, prepared by Weston (1995), several natural and anthropogenic factors contribute to the wide range in concentrations of metals in soils, which further impact the concentration of metals in groundwater. Soils derived from the glauconitic sands contain abundant aluminum, calcium, potassium, iron, magnesium and manganese (among others), which are likely to be present at elevated concentrations in the groundwater, particularly when sediments are entrained in the collected groundwater samples.

As presented in the Weston SI, the boring logs from monitoring well installations at the CW-6 Pesticide Storage site indicate that the lithology consists of topsoil (0.3 feet) underlain by brown medium to fine grained sand with olive brown sand laminae. Borehole logs also represent a lithology consisting of coarse sand with silt and greenish gray clay at this site. Groundwater saturation was observed at approximately 4 feet bgs at each well location during drilling activities at the CW-6 Pesticide Storage site. Water-level elevation data collected during the Weston SI indicate that the local groundwater flow is towards the east.

#### **2.4.2 Hydrogeology**

Fort Monmouth lies in the Atlantic and Eastern Gulf Coastal Plain groundwater region (Meisler et al., 1988). This groundwater region is underlain by undeformed, unconsolidated to semi-consolidated sedimentary deposits. The chemistry of the water

near the surface is variable with low dissolved solids and high iron concentrations. The water chemistry in areas underlain by glauconitic sediments (such as Red Bank, Tinton and Hornerstown Sands) is dominated by calcium, magnesium, manganese, aluminum and iron. The sediments in the area of Fort Monmouth were deposited in fluvial-deltaic to near shore environments.

The water table aquifer in the Main Post Area is identified as part of the “Navesink-Hornerstown Confining Units,” or minor aquifers. The minor aquifers include the Navesink formation, Red Bank Sand, Tinton Sand, Hornerstown Sand, Vincentown Formation, Manasquan Formation, Shark River Formation, Piney Point Formation and the basal clay of the Kirkwood Formation. These geologic formations comprise a “Composite Confining Bed” for the Wenonah Mount Laurel Aquifer (Zapczka, 1984).

Wells installed in the Red Bank and Tinton Sands produce 2 to 25 gallons per minute (gpm) (Jablonski, 1968). Groundwater is typically encountered at the Main Post and in the surrounding areas at shallow depths below ground surface (2 to 9 feet bgs). Water in the surficial aquifer generally flows east toward the Atlantic Ocean.

Based on a review of the NJDEP GWQS (NJAC 7:9-6), January 7, 1993, Versar has determined that the site is underlain by a Class III-A aquifer. A formal presentation of this finding was made to the NJDEP on April 17, 2001 and November 21, 2003. The primary designated use for Class III-A groundwater is the release or transmittal of groundwater to adjacent classification areas and surface water, as relevant. Secondary designated uses in Class III-A include any reasonable use. Further discussion of the Class III-A aquifer classification is presented in **Section 2.4.3**.

Shallow groundwater may be locally influenced within the Main Post Area by the following factors:

- Tidal influence (based on proximity to the Atlantic Ocean, rivers, and tributaries)
- Topography
- Nature of the fill material within the Main Post Area
- Presence of clay and silt lenses in the natural overburden deposits
- Local groundwater recharge areas (e.g., streams, lakes)
- Roadways, utility conduits and stormwater culverts

Due to the fluvial nature of the overburden deposits (e.g., sand and clay lenses), shallow groundwater flow direction is best determined on a case-by-case basis. The groundwater flow in the vicinity of the CW-6 Pesticide Storage site is towards the southeast.

### **2.4.3 Aquifer Classification**

On review of the NJDEP GWQS (N.J.A.C. 7:9-6), January 7, 1993, the CW-6 Pesticide Storage site is found to be underlain by a Class III-A aquifer (**Figure 2-5**). The primary designated use for Class III-A ground water is the release or transmittal of groundwater to

adjacent classification areas and surface water, as relevant. Secondary designated uses in Class III-A include any reasonable uses. For an area to be classified as a Class III-A aquifer, the ground water must meet the following characteristics:

- Class III-A ground water includes portions of the saturated zones (that meet the criteria below) of the Woodbury Formation, Merchantville Formation, Marshalltown Formation, Navesink Formation, Hornerstown Formation, aquitard formations of the Potomac-Raritan-Magothy aquifer system and the Kirkwood aquifer system, portions of the glacial moraine and glacial lake deposits, and other geologic units having the characteristics of an aquitard. Class III-A areas have the following characteristics (N.J.A.C. 7:9-6.5):
  - The average thickness of a Class III-A area must be at least 50 feet;
  - Typical hydraulic conductivity of a Class II-A aquifer is approximately 0.1 feet per day or less; and
  - The aerial extent defined as Class III-A must be at least 100 acres.

The shallow aquifer at Fort Monmouth meets each of the four criteria listed above. These criteria are discussed below

- As presented in **Figure 2-6**, Fort Monmouth is located within the outcrop area of the “Navesink-Hornerstown Confining Unit.” The Navesink and Hornerstown Formations are part of the Composite Confining Unit (Martin, 1998), which also includes the Red Bank Sand, Tinton Sand, Vincentown Formation, Manasquan Formation, Shark River Formation, Piney Point Formation, and the basal clay of the Kirkwood Formation (see **Section 2.4.2**).
  - **Figure 2-7** also illustrates the thickness of the Hornerstown-Navesink Confining Unit, which in the vicinity of Fort Monmouth, is approximately 125 feet.
  - Published hydraulic conductivities (Martin, 1998) for the Navesink-Hornerstown Confining Unit, yielding a geometric mean of 0.12 feet per day.
  - The area of Fort Monmouth is greater than 100 acres.

Due to the fluvial nature of the overburden deposits (e.g., sand and clay lenses), shallow groundwater flow direction is best determined on a case-by-case basis. The groundwater flow in the vicinity of the CW-6 Pesticide Storage site is assumed to be towards the southeast.

#### 2.4.4 Soils

According to the U.S. Department of Agriculture (USDA), Soil Conservation Service, Monmouth County Soil Survey, the majority of the Main Post and Charles Wood areas are covered by urban land (**Figure 2-8**). The soil survey describes urban land as areas where concrete, asphalt, buildings, shopping centers, airports or other impervious surfaces cover 80 percent or more of the surface. In addition, the survey indicated that the natural subsurface soils have largely been replaced with artificial or foreign fill

materials (developed land with disturbed soils). The following soil series and classification units are mapped in the Main Post and Charles Wood areas:

- DoB Downer sandy loam (with 2 to 5 percent slopes);
- FrB Freehold sandy loam (with 2 to 5 percent slopes);
- FUB Freehold sandy loam/urban land complex (with 0 to 10 percent slopes);
- HV Humaquepts, frequently flooded;
- KvA Kresson loam (with 0 to 5 percent slopes);
- PT Pits, Sand and Gravel;
- Sn Shrewsbury sandy loam – poorly drained soils on upland flats;
- UA Udorthents, smoothed; and
- UD Udorthents – urban land complex (with 0 to 3 percent slopes).

The Downer series soils are well-drained soils that are found on uplands and terraces. The soils are formed in acid, silty coastal plain sediments. The Freehold soils are also well drained and are formed in acid, loamy, coastal plain sediments that, by volume, are 1 to 10 percent glauconite and are found on uplands. The Humaquepts soils are somewhat poorly- to very poorly- drained soils that are formed in stratified, sandy, or loamy sediments of fluvial origins. The Humaquepts soils are located on the floodplain and are subject to flooding several times each year. The Kresson loam is a nearly level to gently sloping soil and is somewhat poorly drained. The soil is found on low divides and in depressions. The Udorthents soils have been altered by excavation or filling activities. In filled areas, these soils consist of loamy material that is more than 20 inches thick. The filled areas include floodplain, tidal marshes and areas with moderately, well drained to very poorly drained soils. Some Udorthent soils contain concrete, asphalt, metal and glass. The soils in the vicinity of the CW-6 Pesticide Storage site are classified as Sn - Shrewsbury sandy loam – poorly drained soils on upland flats.

#### **2.4.5 Topography and Surface Drainage**

Over the last 80 years, the natural topography of Fort Monmouth has been altered by excavation and filling activities conducted by the military. The CW-6 Pesticide Storage site is located on the floodplain of Wampum Brook. The USGS topographic map (**Figure 2-1**) shows that the land surface of the site is relatively flat at an elevation of approximately 60 feet above mean sea level (amsl).

Surface water bodies in the vicinity of the Charles Wood Area include two unnamed tributaries of Wampum Brook. Wampum Brook is joined by several unnamed tributaries east of Charles Wood, prior to becoming Wampum Lake. Wampum Lake discharges into Mill Creek, which flows toward the Main Post Area.

The U.S Fish and Wildlife Service (FWS) National Wetland Inventory Long Branch quadrangle maps indicate the presence of several wetlands at the Main Post and Charles Wood areas. However, in the vicinity of the CW-6 Pesticide Storage site, the golf course lake is classified as palustrine open water/unknown bottom, and several areas along the

unnamed tributaries of Wampum Brook are classified as palustrine forested wetland, broad-leaved deciduous.

### 3.0 SITE ACTIVITIES

Fort Monmouth DPW conducted RI activities at the CW-6 Pesticide Storage site, including a quarterly groundwater sampling program. The purpose of this remedial investigation was to define the areal extent of potential pollutants and evaluate impacts to groundwater in the vicinity of the CW-6 Pesticide Storage site. Groundwater RI activities were conducted from April 1997 and continued through February 2001. These activities were managed by the Fort Monmouth DPW and performed by TECOM-Vinnell Services (TVS) and reported by VERSAR. The details of remedial investigation activities that occurred at the CW-6 Pesticide Storage site are described in the following sections.

#### 3.1 Groundwater Sampling Activities

As a part of the remedial investigation, a quarterly groundwater sampling program was conducted by the DPW from April 1997 through February 2001, at the CW-6 Pesticide Storage site. Sampling activities were performed in accordance with the *Fort Monmouth Standard Sampling Operating Procedure* (1997).

Groundwater samples were collected during 16 rounds of quarterly sampling events and were analyzed for VOCs, SVOCs, pesticides, PCBs and TAL metals. Two additional low-flow sampling rounds were analyzed for TAL metals which are addressed below. A total of 124 groundwater samples were collected as a part of the groundwater sampling program, including 18 duplicate samples, 18 field blanks and 16 trip blanks for quality assurance/quality control (QA/QC), were collected from a total of four 4-inch diameter monitoring wells (CW6-MW1, CW6-MW2, CW6-MW3 and CW6-MW34).

Copies of the chain-of-custody for the laboratory analyses can be found in **Appendix D**. A summary of the groundwater sampling activities, including rounds, well IDs, sample IDs, sample locations, collection/analysis date, analytical parameters and analysis method, is provided in **Table 3-1**. The results of these analyses are discussed in **Section 5.1**.

As presented in the Weston SI report (1995), several natural and anthropogenic factors contribute to the wide range in concentrations of metals in soils, which further impact the concentration of metals in groundwater. Soils derived from the glauconitic sands contain abundant aluminum, calcium, potassium, iron, magnesium and manganese (among others), which are likely to be present at elevated concentrations in the groundwater, particularly when sediments are entrained in the collected groundwater samples. A low-flow sampling methodology was proposed for use by the DPW and accepted by the NJDEP to assess the impact of entrained sediments on the dissolved phase metals concentrations at the CW-6 Pesticide Storage site. Using a low-flow sampling methodology to reduce the presence of entrained sediment has generally yielded substantial reductions in the dissolved phase concentrations of metals, such as arsenic, antimony, beryllium, cadmium, chromium, cobalt, lead, mercury, selenium, silver, thallium and vanadium at Fort Monmouth sites. Significant decreases in the concentrations of metals characteristic of glauconitic sand also were observed. These

included aluminum, barium, calcium, copper, iron, magnesium, manganese, nickel, potassium, sodium and zinc.

In consideration of the potential benefits of the low-flow sampling procedure, two additional rounds of low-flow sampling (Low-flow #1 and Low-flow #2) were conducted on August 28<sup>th</sup> through September 1<sup>st</sup>, 2000 and October 5, 2000 using a low-flow groundwater sampling technique. A total of 12 samples out of the total 124 groundwater samples were collected and analyzed only for TAL metals, to determine whether elevated metal concentrations observed in the groundwater samples are due to sediments rather than groundwater. The samples were analyzed by the Fort Monmouth Environmental Testing Laboratory (FMETL) for TAL metals utilizing United States Environmental Protection Agency (USEPA) Methods 3120B and 3112B. The results of these analyses are discussed in **Section 5.0**.

Sampling equipment was thoroughly decontaminated before and after each use, in accordance with the *Fort Monmouth Standard Operating Procedures* (1997). The sample containers were labeled, sealed, packed in ice and transported to the FMETL under proper chain-of-custody procedures.

### **3.2 Groundwater Depth Measurements**

During each of the groundwater monitoring rounds, measurements of the depth-to-water in each of the monitoring wells were recorded with an accuracy of 0.01 feet. These depth-to-water measurements, recorded from April 1997 through February 2001, are presented in **Table 3-2**. The groundwater elevation at each well was calculated by subtracting the measured depth-to-water from the elevation of the top of the well casing with the depth-to-water at the well. The groundwater elevations are discussed in **Section 4.2**.

## 4.0 SITE PHYSICAL CHARACTERISTICS

The following sections represent the findings of the site geologic and hydrogeologic characterization program for the CW-6 Pesticide Storage site. These sections include a detailed discussion of the physical properties of the unconsolidated soil, bedrock and groundwater underlying the study area. Groundwater elevation and water quality data collected by the DPW from April 1997 to February 2001 are presented in this section.

### 4.1 Lithology

The lithology encountered at the CW-6 Pesticide Storage site consists of fine to coarse sand, silt and clay. A geologic cross section (A-A') was prepared for four monitoring wells. The cross section location map is included as **Figure 4-1**. The data used to create the cross section is presented in **Table 4-1**.

The cross-section A-A' is presented in **Figure 4-2**. Cross section A-A' depicts the profiles for monitoring wells CW6-MW1, CW6-MW2, CW6-MW3 and CW6-MW34. Groundwater was encountered at a depth of 4 feet bgs during drilling activities.

As stated in **Section 2.4.2**, the wide range of concentrations of metals in soils further impact the concentration of metals in groundwater. Soils derived from glauconitic sands contain abundant aluminum, calcium, potassium, iron, magnesium and manganese (among others), which are likely to be present at elevated concentrations in the groundwater, particularly when sediments are entrant during the collection of groundwater samples.

### 4.2 Groundwater Flow Direction

Groundwater contour plots (**Figure 4-3a** through **4-3q**) were generated based on groundwater depth measurements from the monitoring wells collected between April 1997 and February 2001. The groundwater underlying the site appears to be flowing towards the southeast. Changes in groundwater elevation were noted between the 16 rounds of water level measurements (**Table 3-2**).

## 5.0 SITE CHEMICAL CHARACTERIZATION

This section includes a discussion of the chemical analytical characterization of the site based on the various samples collected and analyzed from the site, including 16 rounds of groundwater monitoring well samples and two rounds of low-flow groundwater sampling. The DPW personnel were responsible for the collection of samples during this site investigation. Sample analyses were performed by the FMETL, a New Jersey certified laboratory (Certification No. 13461).

### 5.1 Groundwater Sample Results

A total of 124 groundwater samples were collected from four groundwater monitoring wells to evaluate potential chemical impacts to groundwater from the CW-6 Pesticide Storage site. The laboratory analytical results are summarized in **Table 5-1**. This section presents the results of laboratory analyses performed for the 16 rounds of groundwater sampling that were collected from April 1997 through February 2001 from the four monitoring wells at the CW-6 Pesticide Storage site. The three monitoring wells CW6-MW1, CW6-MW2 and CW6-MW3 were installed in June, July and December 1994. CW6-MW34 was installed in January 1995. The samples were collected and analyzed for VOCs, SVOCs, pesticides, PCBs and TAL metals. Two additional rounds of sampling (low-flow #1 and low-flow #2) that were conducted on August 28<sup>th</sup> through September 1<sup>st</sup>, 2000 (Low Flow #1) and October 5, 2000 (Low Flow #2) using a low-flow groundwater sampling technique for TAL metals. As stated above, a low flow sampling methodology was proposed for use by the DPW and accepted by the NJDEP to assess the impact of suspended sediments on the dissolved phase metals concentrations at the site.

As discussed in **Section 2.4.3**, Fort Monmouth is underlain by a Class III-A aquifer. The groundwater quality criteria for Class III-A is considered to be the criteria for the most stringent classification for vertically or horizontally adjacent ground waters that are not Class III-A (N.J.A.C. 7:9-6.7e). The NJDEP criteria used for comparison of groundwater analytical results were the higher of the Practical Quantitation Limits (PQLs) and the NJDEP GWQC for Class II-A aquifers (N.J.A.C. 7:9-6, Table 1). Analytes detected in groundwater samples at concentrations above the NJDEP criteria are bold and highlighted in **Table 5-1**. The laboratory data sheets are provided in **Appendix D**.

This section discusses the detection of the compounds and analytes of the four analytical categories, VOCs, SVOCs, Pesticides and PCBs and TAL metals. One VOC was detected in groundwater samples below the NJDEP GWQC. Five SVOCs were detected in groundwater samples below the NJDEP GWQC. A total of seven pesticides were detected in site groundwater. One pesticide was detected above NJDEP GWQC, and the remaining six pesticides were detected below the NJDEP GWQC. A total of 23 TAL metals were detected in site groundwater. Eleven TAL metals were detected above the NJDEP GWQC, and the remaining 12 TAL metals were detected below the NJDEP GWQC.

### 5.1.1 Volatile Organic Compounds

No VOCs were detected above their respective GWQC at the site.

### 5.1.2 Semi-Volatile Organic Compounds

No SVOCs were detected above their respective GWQC at the site.

### 5.1.3 Pesticides and PCBs

During 16 groundwater sampling rounds and two low-flow sampling rounds, one pesticide was detected above its NJDEP GWQC in at least one sample at the CW-6 Pesticide Storage site.

*Heptachlor epoxide* was detected at concentrations exceeding the GWQC of 0.2 ug/L during one separate round of sampling collected at one separate monitoring well location (CW6-MW1) at a concentration of 0.271 ug/L (sampling round #11).

### 5.1.4 TAL Metals

During 16 groundwater sampling rounds and two low-flow sampling rounds, a total of 11 TAL metals were detected above their respective NJDEP GWQC in at least one sample at the CW-6 Pesticide Storage site.

*Aluminum* was detected at concentrations exceeding the GWQC of 200 ug/L during 18 separate rounds of sampling collected at four separate monitoring well locations. Concentrations ranged from 204 ug/L in CW6-MW34 (sampling round #5) to 183,000 ug/L in CW6-MW2 (Low-flow #2).

*Arsenic* was detected at concentrations exceeding the GWQC of 8.0 ug/L during nine separate rounds of sampling collected at two separate monitoring well locations. Concentrations ranged from 8.87 ug/L in CW6-MW1 (sampling round #10) to 88 ug/L in CW6-MW1 (sampling round #6).

*Barium* was detected at concentrations exceeding the GWQC of 2,000 ug/L during one separate round of sampling collected at one separate monitoring well location (CW6-MW1) at a concentration of 2.3 ug/L (sampling round #6).

*Beryllium* was detected at concentrations exceeding the GWQC of 20 ug/L during one separate round of sampling collected at one separate monitoring well location (CW6-MW1) at a concentration of 20.5 ug/L (sampling round #6).

*Chromium* was detected at concentrations exceeding the GWQC of 100 ug/L during two separate rounds of sampling collected at one separate monitoring well location (CW6-MW1) at concentrations ranging from 139 ug/L (Low-flow #1) to 482 ug/L (sampling round #16).

**Iron** was detected at concentrations exceeding the GWQC of 300 ug/L during 18 separate rounds of sampling collected at four separate monitoring well locations. Concentrations ranged from 451 ug/L in CW6-MW3 (sampling round #10) to 159,000 ug/L in CW6-MW2 (Low-flow #2).

**Lead** was detected at concentrations exceeding the GWQC of 10 ug/L during 13 separate rounds of sampling collected at three separate monitoring well locations. Concentrations ranged from 13.9 ug/L in CW6-MW34 (Low-flow #2) to 522 ug/L in CW6-MW1 (sampling round #6).

**Manganese** was detected at concentrations exceeding the GWQC of 50 ug/L during 18 separate rounds of sampling collected at four separate monitoring well locations. Concentrations ranged from 54 ug/L in CW6-MW34 (sampling round #1) to 1,120 ug/L in CW6-MW1 (sampling round #6).

**Nickel** was detected at concentrations exceeding the GWQC of 100 ug/L during two separate rounds of sampling collected at two separate monitoring well locations. Concentrations ranged from 114 ug/L in CW6-MW1 (sampling round #6) to 53,500 ug/L in CW6-MW3 (sampling round #12).

**Silver** was detected at concentrations exceeding the GWQC of 20 ug/L during four separate rounds of sampling collected at two separate monitoring well locations. Concentrations ranged from 21 ug/L in CW6-MW1 (sampling round #1) to 259 ug/L in CW6-MW1 (sampling round #14).

**Sodium** was detected at concentrations exceeding the GWQC of 50,000 ug/L during ten separate rounds of sampling collected at two separate monitoring well locations. Concentrations ranged from 54,500 ug/L in CW6-MW2 (sampling round #9) to 332,000 ug/L in CW6-MW1 (Low-flow #1).

## 5.2 Contaminants of Concern

No VOCs or SVOCs were detected above the NJDEP criteria. There was one pesticide detected in groundwater samples above the laboratory method detection limit and above the NJDEP criteria. There were 11 TAL metals detected above their respective NJDEP GWQC. **Table 5-1** presents a summary of each individual analyte's exceedences of the NJDEP GWQC.

As presented in the Weston SI Report (1995), several natural and man-made factors contribute to the wide range in concentrations of metals in soils, which further impact the concentration of metals in groundwater. Soils derived from the glauconitic sands contain abundant aluminum, calcium, potassium, iron, magnesium, and manganese (among others), which are likely to be present at elevated concentrations in the groundwater, particularly when sediments are entrained in the collected groundwater samples. A low flow sampling methodology was proposed for use by the DPW and accepted by the NJDEP to assess the impact of suspended sediments on the dissolved phase metals concentrations at the site. Using a low flow sampling methodology to reduce the

presence of suspended sediment yielded substantial reductions in the dissolved phase concentrations of metals, particularly for the constituents regarded as “non-native” (e.g., arsenic, antimony, beryllium, cadmium, chromium, cobalt, lead, mercury, selenium, silver, thallium, vanadium). Significant decreases in the concentrations of naturally occurring metals also were observed, including aluminum, barium, calcium, copper, iron, magnesium, manganese, nickel, potassium, sodium, and zinc. However, the native metal constituents (e.g., those indigenous to the soil types present at Fort Monmouth) were consistently present in the groundwater, even when the low-flow sampling methodology was employed.

The 11 TAL metals detected in site groundwater at concentrations exceeding the NJDEP GWQC (aluminum, arsenic, barium, beryllium, chromium, iron, lead, manganese, nickel, silver and sodium) are distinguished into background metals and non-native metals. The indigenous metals are compared to the Fort Monmouth Summary of site-specific Maximum Background Concentrations (MBCs), identified in the Weston SI (1995), which are presented in **Table 5-2**. The non-native metals are discussed in relation to the NJDEP GWQC only.

Of the 11 TAL metals detected that exceeded the NJDEP GWQC, six TAL metals (aluminum, barium, iron, manganese, nickel and sodium) are common background constituents in Monmouth County and the Charles Wood Area soils. The water chemistry in areas underlain by glauconitic sediments (such as Red Bank, Tinton and Hornerstown Sands) is dominated by calcium, magnesium, manganese, aluminum and iron. Elevated concentrations of these metals are routinely observed in groundwater samples collected at Fort Monmouth. The groundwater analytical results for (aluminum, barium, iron, manganese, nickel and sodium) were compared with the low-flow sampling results to their respective MBCs. These six background metals are not considered to be COCs in site groundwater.

There were five non-native metals that exceeded the NJDEP GWQC (arsenic, beryllium, chromium, lead and silver). The groundwater analytical results were compared with the low-flow sampling results to the NJDEP GWQC. The two separate rounds of low-flow sampling were performed during the quarterly groundwater sampling program, using the low-flow groundwater sampling technique as discussed in **Section 3.2.1**. This technique was used to determine if the detected metal concentrations observed in the groundwater samples are a function of contaminated sediments suspended in the groundwater during the course of well purging and sampling activities, or an accurate representation of aquifer/groundwater conditions. This low-flow sampling approach resulted in reduced concentrations or non-detections of two uncharacteristic metals (beryllium and silver) during the two rounds of low-flow groundwater sampling conducted at the site. Therefore, the two non-native metals (beryllium and silver) that exceeded the NJDEP GWQC are not considered to be COCs in CW-6 Pesticide Storage site groundwater.

Chromium was detected above the NJDEP GWQC in one monitoring well location in two separate rounds of groundwater sampling. The two exceedences are isolated to one monitoring well location, and therefore chromium is not considered to be a COC.

Arsenic was detected above the NJDEP GWQC in one monitoring well location in eight separate rounds of groundwater sampling. The exceedences in the two low-flow sampling rounds are isolated to one monitoring well, therefore arsenic is not considered to be a COC.

The use of the low-flow sampling approach did not eliminate the detection of the one uncharacteristic metal (lead), which persisted at concentrations exceeding the NJDEP GWQC during the two low-flow sampling rounds mentioned above. Lead was detected above the NJDEP GWQC in all four monitoring well locations in 14 separate rounds of groundwater sampling. However, due to the low concentrations of lead in groundwater at the CW-6 Pesticide Storage site and the extremely slow migration rates for lead in the site groundwater, there is little potential for a significant lead impact by migration. The Wenonah Mount Laurel aquifer, which is approximately 125 feet bgs, is too deep to be affected by lead near the ground surface. In addition, the sensitive receptor survey (performed at various sites within Fort Monmouth - **See M-12 Remedial Investigation Report by Versar, 2003**) indicates that there are no domestic or irrigation wells that are close enough to the CW-6 Pesticide Storage site to be adversely impacted by COC migration.

### 5.3 Quality Assurance/Quality Control

To verify the reliability of the analytical results, VERSAR reviewed the holding times for each sample and the results of the analysis of 19 method blanks for VOCs, 17 method blanks for SVOCs, 19 method blanks for pesticides and PCBs, 18 method blanks for TAL metals, 17 trip blanks, 20 field blanks and 19 field duplicate samples. Samples were analyzed by the FMETL within the prescribed holding time requirements for each analytical method.

#### Method Blanks

Laboratory method blanks accompanied each batch of samples for the CW-6 Pesticide Storage site. These method blanks consist of laboratory grade water that is processed identically to the samples and analyzed with the sample batch. A total of 19 method blanks for VOCs, 17 method blanks for SVOCs, 19 method blanks for pesticides and PCBs and 18 method blanks for TAL metals were analyzed with the CW-6 Pesticide Storage site samples.

Seven SVOCs were detected in two method blank samples. These SVOCs were benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene and di-n-butylphthalate. None of these SVOCs were detected at a concentration exceeding their respective NJDEP criteria. Their presence in only two samples is not indicative of a widespread laboratory contamination problem.

Several metals were detected in at least one method blank sample, including aluminum, antimony, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, vanadium, and zinc. Most of

the metals were detected in only a few samples at very low concentrations. However, lead was detected in one method blank at a concentration greater than its NJDEP criteria. Lead also found in the CW-6 Pesticide Storage site groundwater samples at levels exceeding its NJDEP criteria. Therefore, any subsequent evaluation of the metals analytical results must account for the possibility of laboratory contamination resulting in false positives for the environmental samples. However, metals are not COCs for the CW-6 Pesticide Storage site, so the impact to the project results is minimal.

#### Trip Blanks

Seventeen trip blanks were included as part of the CW-6 Pesticide Storage site sampling program to document that volatile organics were not introduced into the samples during the handling process. The trip blanks were prepared by the FMETL and consisted of sample bottles filled with laboratory deionized water. The trip blanks remained with the sample bottles in coolers and were returned to the laboratory for analysis with the groundwater samples.

Three VOCs were detected in at least one trip blank. Acetone was detected in two trip blanks at concentrations below its NJDEP criteria. Chloroform was detected in four of the 17 trip blanks, with no detections exceeding the NJDEP criteria. Methylene chloride was detected in one of the trip blanks, and the detected concentration exceeded its NJDEP criteria. However, methylene chloride is a common laboratory contaminant. The detections of chloroform and acetone indicate that the sample handling procedures, including the sample glassware, may have introduced contamination into the sampling and analysis process.

#### Field Blanks

One field blank sample was obtained during the sampling activities each day to document the equipment decontamination procedures. A total of 20 field samples (e.g., field blanks) were collected during the CW-6 Pesticide Storage site sampling events. The field blanks were collected by rinsing deionized water, supplied by the laboratory, over the sampling equipment used for daily activities. The water was collected in clean laboratory-supplied sample jars and submitted for analysis along with the CW-6 Pesticide Storage site groundwater samples.

The results of the field blank analyses showed that one VOC was detected in at least one field blank. Chloroform was detected in four of the 20 field blanks, all at concentrations below the NJDEP criteria. As noted for the trip blanks, the detections of chloroform indicate that the sample handling procedures, including the sample glassware, may have introduced contamination into the sampling and analysis process. In addition, the same VOC found in the field blanks was also found in the trip blanks, suggesting that the sampling and decontamination procedures did not introduce additional contamination.

Two SVOC, bis(2-ethylhexyl) phthalate and di-n-butylphthalate, were each detected in at least one of the field blank samples. Both analytes were detected at low concentrations that are below their respective NJDEP criteria. In addition, both of these compounds were also identified in the method blanks; therefore, their presence in the field blank

samples does not suggest that the sampling and decontamination procedures introduced additional contamination.

As noted for the method blanks, several metals were detected in at least one field blank sample, including aluminum, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, silver, sodium, thallium, vanadium and zinc. All of the metals were detected in only a few samples at very low concentrations. Because these metals were also detected in the method blank samples, the sampling and decontamination procedures do not appear to have been the source of sample contamination. However, any subsequent evaluation of the metals analytical results must account for the possibility of laboratory contamination resulting in false positives for the environmental samples.

#### Duplicate Samples

Nineteen field duplicate samples were also collected during the CW-6 Pesticide Storage site sampling events to verify the consistency of the entire sampling and analytical procedure. The results for all of the duplicate samples were close to those obtained for the original samples. The relative percent differences (RPDs), which are the differences between the two samples being compared divided by their average, indicate the relative levels of precision maintained by the laboratory throughout its analytical procedures. The RPDs for the duplicate samples VOCs was 11.5%. The RPDs for the duplicate samples pesticides and PCBs was 0.0%. These RPDs are well below the established limit of 30% for laboratory duplicate samples and indicate that a high level of precision was maintained throughout the sampling and analytical procedures.

The RPDs for the duplicate samples metals analyses ranged from 0.0% to 197.7%, however, the average RPDs for all of the metals results is 29.4%. This indicates that, overall, good precision was maintained, but that the metals results were much more varied than those for the VOCs or pesticides/PCBs. The apparent metals contamination noted in the method and field blanks may have impacted the precision of the metals analysis.

The QC sample results indicate good precision for all of the analyses. However, the presence of metals in the method blanks and field blanks indicate that contamination may have been introduced by the sampling and analysis procedures. Therefore, any subsequent evaluation of the metals analytical results must account for the possibility of laboratory contamination resulting in false positives for the environmental samples.

## **6.0 CONCLUSIONS**

Geologic publications show that the CW-6 Pesticide Storage site is located within an aquitard (the Navesink-Hornerstown Confining Unit). The low hydraulic conductivity of the aquitard and the thickness of the aquitard at the site conform to the requirements of a Class III-A aquifer, as specified in the NJDEP GWQS (NJAC 7:9-6, January 7, 1993).

The analytical results for the groundwater samples collected at the CW-6 Pesticide Storage site between April 1997 and February 2001 indicate that no COCs exist within the CW-6 Pesticide Storage site groundwater. The Class II-A criteria were used for comparison with site-specific data obtained from the various groundwater sampling rounds because the GWQS (NJAC 7:9-6.7e) state that the groundwater quality criteria to be used for Class III-A aquifers are the most stringent criteria associated with vertically or horizontally adjacent groundwaters that are not Class III-A.

One pesticide (heptachlor epoxide) was detected above the NJDEP GWQC and is considered to be an isolated and marginal exceedance, and therefore is not considered to be a COC. There were 11 metals (aluminum, arsenic, barium, beryllium, chromium, iron, lead, manganese, nickel, silver and sodium) detected in groundwater samples at concentrations exceeding the NJDEP GWQC.

One metal, lead, was further considered as a COC; however, due to the low concentrations and the slow migration rate of the COC in groundwater at the CW-6 Pesticide Storage site, there is little potential for significant COC impact by migration. The Wenonah Mount Laurel aquifer, which is approximately 125 feet bgs, is too deep to be affected by the COC near the ground surface. In addition, the sensitive receptor survey (performed at various sites within Fort Monmouth - See M-12 Remedial Investigation Report by Versar 2003) indicates that there are no domestic or irrigation wells that are close enough to the CW-6 Pesticide Storage site to be adversely impacted by COC migration.

Overall, the lead distribution in groundwater does not suggest an association with any source and is more indicative of natural background conditions or a regional source, therefore, lead is not considered a COC. NFA is requested concerning groundwater at the CW-6 Pesticide Storage site.



## 7.0 REFERENCES

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**TABLES**

**Table 2-1**  
**Well Construction Summary**  
**CW-6 Pesticide Storage Site**  
**Fort Monmouth, New Jersey**

Well ID	NJDEP Permit Number	Northing	Easting	Elevation of Inner Casing Survey Mark	Elevation of Ground Surface	Hole Diameter	Total Depth of Well	Depth to Top of Screen	Screen Length	Screen Diameter	Screen Material	Date of Construction
Units	--	ft	ft	ft (amsl) <sup>(1)</sup>	ft (amsl) <sup>(1)</sup>	in	ft (bgs) <sup>(2)</sup>	ft (bgs) <sup>(2)</sup>	ft	in	--	--
CW6-MW1	29-30970	533320.756	610460.9	35.06	32.85	8	15.0	2.0	13.0	4.0	20 Slot PVC	6/30/1994
CW6-MW2	29-30971	533259.848	610420.127	35.05	32.19	8	15.0	2.0	13.0	4.0	20 Slot PVC	7/1/1994
CW6-MW3	29-30972	533362.198	610451.403	36.34	33.79	8	15.0	2.0	13.0	4.0	20 Slot PVC	12/16/1994
CW6-MW34	29-32597	533200.247	610576.992	33.76	31.97	12	14.5	4.5	9.54	4.0	10 Slot PVC	1/3/1995

Notes:

<sup>(1)</sup>amsl = above mean sea level

<sup>(2)</sup>bgs = below ground surface

Where a difference in reported data exists between a monitoring well permit and the corresponding boring log, data from the permit was used.

**Table 3-1  
Groundwater Sampling Summary  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Round #	Sample ID	Monitoring Well ID	Date Collected	Date Analysis Started	Matrix	Sample Type	Analytical Parameters	Analysis Method
1	2494.05	MW-1	4/30/1997	05/02/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	2494.03	MW-2	4/30/1997	05/02/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	2494.04	MW-3	4/30/1997	05/03/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	2494.06	MW-34	4/30/1997	05/03/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	2494.01	Trip Blank	4/30/1997	05/02/97	Aqueous	GW	VOCs	Method 624
	2494.02	Field Blank	4/30/1997	05/02/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	2494.07	Duplicate	4/30/1997	05/03/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
2	2947.03	MW-1	9/2/1997	09/08/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	2943.04	MW-2	8/29/1997	09/02/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	2943.03	MW-3	8/29/1997	09/02/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	2947.04	MW-34	9/2/1997	09/08/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	2943.01	Trip Blank	8/29/1997	09/08/97	Aqueous	GW	VOCs	Method 624
	2947.02	Field Blank	8/29/1997	09/08/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	2943.05	Duplicate	08/29/97	09/02/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
3	3186.06	MW-1	12/1/1997	12/05/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3186.04	MW-2	12/1/1997	12/09/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3186.03	MW-3	12/1/1997	12/05/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3186.05	MW-34	12/1/1997	12/05/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3186.01	Trip Blank	12/1/1997	12/05/97	Aqueous	GW	VOCs	Method 624
	3186.02	Field Blank	12/1/1997	12/10/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3186.07	Duplicate	12/1/1997	12/10/97	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
4	3388.03	MW-1	3/5/1998	03/09/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3388.03	MW-2	3/5/1998	03/10/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3388.05	MW-3	3/5/1998	03/10/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3388.06	MW-34	3/5/1998	03/10/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3388.01	Trip Blank	3/5/1998	03/09/98	Aqueous	GW	VOCs	Method 624
	3388.02	Field Blank	3/5/1998	03/09/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3388.07	Duplicate	3/5/1998	03/10/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
5	3650.03	MW-1	06/15/98	06/22/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3650.04	MW-2	06/15/98	06/22/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3650.05	MW-3	06/15/98	06/22/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3650.06	MW-34	06/15/98	06/22/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3650.01	Trip Blank	06/15/98	06/22/98	Aqueous	GW	VOCs	Method 624
	3650.02	Field Blank	06/15/98	06/16/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3650.07	Duplicate	06/15/98	06/16/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
6	3901.04	MW-1	9/22/1998	10/02/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3901.05	MW-2	9/22/1998	10/02/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3901.06	MW-3	9/22/1998	10/02/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3901.07	MW-34	9/22/1998	10/02/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3901.01	Trip Blank	9/22/1998	10/01/98	Aqueous	GW	VOCs	Method 624
	3901.02	Field Blank	9/22/1998	10/01/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	3901.03	Duplicate	9/22/1998	10/01/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B

**Table 3-1  
Groundwater Sampling Summary  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Round #	Sample ID	Monitoring Well ID	Date Collected	Date Analysis Started	Matrix	Sample Type	Analytical Parameters	Analysis Method
7	4111.03	MW-1	12/4/1998	12/09/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4111.04	MW-2	12/4/1998	12/09/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4111.05	MW-3	12/4/1998	12/09/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4111.06	MW-34	12/4/1998	12/10/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4111.01	Trip Blank	12/4/1998	12/09/98	Aqueous	GW	VOCs	Method 624
	4111.02	Field Blank	12/4/1998	12/07/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4111.07	Duplicate	12/4/1998	12/18/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
8	4280.03	MW-1	2/17/1999	02/23/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4280.04	MW-2	2/17/1999	02/23/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4280.05	MW-3	2/17/1999	02/23/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4280.06	MW-34	2/17/1999	02/23/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4280.01	Trip Blank	2/17/1999	02/24/98	Aqueous	GW	VOCs	Method 624
	4280.02	Field Blank	2/17/1999	02/24/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4280.07	Duplicate	2/17/1998	02/24/98	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
9	4562.03	MW-1	6/18/1999	06/22/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4562.04	MW-2	6/18/1999	06/22/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4562.05	MW-3	6/18/1999	06/22/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4562.06	MW-34	6/18/1999	06/22/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4562.01	Trip Blank	6/18/1999	06/22/99	Aqueous	GW	VOCs	Method 624
	4562.02	Field Blank	6/18/1999	06/22/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4562.07	Duplicate	6/18/1999	06/22/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
10	4705.03	MW-1	8/10/1999	08/11/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4705.04	MW-2	8/10/1999	08/11/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4705.05	MW-3	8/10/1999	08/11/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4705.06	MW-34	8/10/1999	08/11/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4705.01	Trip Blank	8/10/1999	08/11/99	Aqueous	GW	VOCs	Method 624
	4705.02	Field Blank	8/10/1999	08/11/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4705.07	Duplicate	8/10/1999	08/11/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
11	4942.04	MW-1	11/15/1999	11/22/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4942.05	MW-2	11/15/1999	11/22/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4942.06	MW-3	11/15/1999	11/22/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4942.07	MW-34	11/15/1999	11/22/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4942.01	Trip Blank	11/15/1999	11/24/99	Aqueous	GW	VOCs	Method 624
	4942.02	Field Blank	11/15/1999	11/24/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	4942.07	Duplicate	11/15/1999	11/24/99	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
12	5291.01	MW-1	3/27/2000	04/01/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5291.02	MW-2	3/27/2000	04/01/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5291.03	MW-3	3/27/2000	04/01/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5291.04	MW-34	3/27/2000	04/01/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5291.07	Trip Blank	3/27/2000	04/01/00	Aqueous	GW	VOCs	Method 624
	5291.05	Field Blank	3/27/2000	04/01/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5291.06	Duplicate	3/27/2000	04/01/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B

**Table 3-1  
Groundwater Sampling Summary  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Round #	Sample ID	Monitoring Well ID	Date Collected	Date Analysis Started	Matrix	Sample Type	Analytical Parameters	Analysis Method
13	5480.04	MW-1	6/15/2000	06/17/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5480.05	MW-2	6/15/2000	06/17/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5480.06	MW-3	6/15/2000	06/17/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5480.07	MW-34	6/15/2000	06/17/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5480.01	Trip Blank	6/15/2000	06/17/00	Aqueous	GW	VOCs	Method 624
	5480.02	Field Blank	6/15/2000	06/17/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5480.03	Duplicate	6/15/2000	06/17/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
14	5680.04	MW-1	8/31/2000	09/11/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5680.05	MW-2	8/31/2000	09/11/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5680.06	MW-3	8/31/2000	09/11/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5680.07	MW-34	8/31/2000	09/11/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5680.01	Trip Blank	8/31/2000	09/11/00	Aqueous	GW	VOCs	Method 624
	5680.02	Field Blank	8/31/2000	09/11/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5680.03	Duplicate	8/31/2000	09/11/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
15	5848.04	MW-1	11/9/2000	11/14/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5848.05	MW-2	11/9/2000	11/14/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5848.06	MW-3	11/9/2000	11/14/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5848.07	MW-34	11/9/2000	11/14/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5848.01	Trip Blank	11/9/2000	11/13/00	Aqueous	GW	VOCs	Method 624
	5848.02	Field Blank	11/9/2000	11/13/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	5848.03	Duplicate	11/9/2000	11/13/00	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
Low Flow 1	5665.04	MW-1	8/28/2000	09/07/00	Aqueous	GW	TAL Metals	Method 3120B
	5684.03	MW-2	9/1/2000	09/08/00	Aqueous	GW	TAL Metals	Method 3120B
	5665.05	MW-3	8/28/2000	09/07/00	Aqueous	GW	TAL Metals	Method 3120B
	5665.03	MW-34	8/28/2000	09/07/00	Aqueous	GW	TAL Metals	Method 3120B
	NA	Trip Blank	NA	NA	NA	NA	NA	NA
	5665.01	Field Blank	9/1/2000	09/08/00	Aqueous	GW	TAL Metals	Method 3120B
	5665.02	Duplicate	8/28/2000	09/07/00	Aqueous	GW	TAL Metals	Method 3120B
Low Flow 2	5771.04	MW-1	10/5/2000	10/10/00	Aqueous	GW	TAL Metals	Method 3120B
	5771.06	MW-2	10/5/2000	10/10/00	Aqueous	GW	TAL Metals	Method 3120B
	5771.05	MW-3	10/5/2000	10/10/00	Aqueous	GW	TAL Metals	Method 3120B
	5771.03	MW-34	10/5/2000	10/10/00	Aqueous	GW	TAL Metals	Method 3120B
	NA	Trip Blank	NA	NA	NA	NA	NA	NA
	5771.01	Field Blank	10/5/2000	10/10/00	Aqueous	GW	TAL Metals	Method 3120B
	5771.02	Duplicate	10/5/2000	10/10/00	Aqueous	GW	TAL Metals	Method 3120B
16	553	MW-1	2/2/2001	02/07/01	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	554	MW-2	2/2/2001	02/07/01	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	555	MW-3	2/2/2001	02/07/01	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	558	MW-34	2/2/2001	02/07/01	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	550	Trip Blank	2/2/2001	02/07/01	Aqueous	GW	VOCs	Method 624
	551	Field Blank	2/2/2001	02/07/01	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B
	552	Duplicate	2/2/2001	02/07/01	Aqueous	GW	VOCs, SVOCs, Pesticides, PCBs, TAL Metals	Method 624, 625, 608, 3120B, 3112B

**Notes:**

GW : Groundwater

VOCs: Volatile Organic Compounds

SVOCs: Semi Volatile Organic Compounds

PCBs: Poly Chlorinated Biphenols

\*Low Flow Sampling Method was used to collect sample

**Table 3-2  
Groundwater Elevation Summary  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Well ID	Elev. of Inner Casing Survey Mark	#1			#2			#3			#4		
		Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
CW6MW1	35.06	04/30/97	3.60	31.46	09/02/97	4.80	30.26	12/01/97	4.20	30.86	03/05/98	3.38	31.58
CW6MW2	35.05	04/30/97	3.03	32.02	08/29/97	5.80	29.25	12/01/97	4.10	30.95	03/05/98	2.81	32.24
CW6MW3	36.34	04/30/97	3.90	32.44	08/29/97	6.50	29.84	12/01/97	4.80	31.54	03/05/98	3.32	33.02
CW6MW34	33.76	04/30/97	3.75	30.01	09/02/97	4.90	28.86	12/01/97	4.25	29.51	03/05/98	3.78	29.98

Notes:

- 1) Elevation in feet above mean sea level.
- 2) Depth to water: depth in feet from the inner casing survey mark.
- 3) NM: Not Measured

**Table 3-2  
Groundwater Elevation Summary  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Well ID	Elev. of Inner Casing Survey Mark	#5			#6			#7			#8		
		Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
CW6MW1	35.06	06/15/98	3.47	31.59	09/22/98	6.21	28.85	12/04/98	8.25	26.81	02/17/99	4.24	30.82
CW6MW2	35.05	06/15/98	3.06	31.99	09/22/98	6.22	28.83	12/04/98	6.51	28.54	02/17/99	4.11	30.94
CW6MW3	36.34	06/15/98	3.98	32.36	09/22/98	7.15	29.19	12/04/98	7.37	28.97	02/17/99	4.73	31.61
CW6MW34	33.76	06/15/98	5.54	28.22	09/22/98	6.31	27.45	12/04/98	NM	NM	02/17/99	4.23	29.53

Notes:

- 1) Elevation in feet above mean sea level.
- 2) Depth to water: depth in feet from the inner casing survey mark.
- 3) NM: Not Measured

**Table 3-2  
Groundwater Elevation Summary  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Well ID	Elev. of Inner Casing Survey Mark	#9			#10			#11			#12		
		Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
CW6MW1	35.06	06/18/99	5.93	29.13	08/10/99	7.36	27.70	11/15/99	5.06	30.00	03/27/00	4.28	30.78
CW6MW2	35.05	06/18/99	5.93	29.12	08/10/99	7.04	28.01	11/15/99	5.00	30.05	03/27/00	3.88	31.17
CW6MW3	36.34	06/18/99	6.72	29.62	08/10/99	7.75	28.59	11/15/99	5.93	30.41	03/27/00	4.73	31.61
CW6MW34	33.76	06/18/99	6.28	27.48	08/10/99	7.12	26.64	11/15/99	4.91	28.85	03/27/00	4.11	29.65

Notes:

- 1) Elevation in feet above mean sea level.
- 2) Depth to water: depth in feet from the inner casing survey mark.
- 3) NM: Not Measured

**Table 3-2  
Groundwater Elevation Summary  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Well ID	Elev. of Inner Casing Survey Mark	#13			#14			Low-flow #1			#15		
		Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
CW6MW1	35.06	05/08/00	7.15	27.91	06/15/00	4.84	30.22	08/28/00	5.00	30.06	08/31/00	5.00	30.06
CW6MW2	35.05	05/08/00	6.96	28.09	06/15/00	4.68	30.37	09/01/00	5.05	30.00	08/31/00	4.86	30.19
CW6MW3	36.34	05/08/00	7.29	29.05	06/15/00	6.47	29.87	08/28/00	5.55	30.79	08/31/00	5.57	30.77
CW6MW34	33.76	05/08/00	8.13	25.63	06/15/00	4.80	28.96	08/28/00	5.15	28.61	08/31/00	6.20	27.56

Notes:

- 1) Elevation in feet above mean sea level.
- 2) Depth to water: depth in feet from the inner casing survey mark.
- 3) NM: Not Measured

**Table 3-2**  
**Groundwater Elevation Summary**  
**CW-6 Pesticide Storage Site**  
**Fort Monmouth, New Jersey**

Well ID	Elev. of Inner Casing Survey Mark	Low-flow #2			#16			#17		
		Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
CW6MW1	35.06	10/05/00	4.15	30.91	11/09/00	5.34	29.72	02/02/01	3.87	31.19
CW6MW2	35.05	10/05/00	4.00	31.05	11/09/00	5.44	29.61	02/02/01	3.09	31.96
CW6MW3	36.34	10/05/00	4.50	31.84	11/09/00	6.05	30.29	02/02/01	3.91	32.43
CW6MW34	33.76	10/05/00	4.20	29.56	11/09/00	5.33	28.43	02/02/01	3.77	29.99

Notes:

- 1) Elevation in feet above mean sea level.
- 2) Depth to water: depth in feet from the inner casing survey mark.
- 3) NM: Not Measured

**Table 4-1  
Data for Cross-Section  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Well ID	Units	CW6-MW3	CW6-MW1	CW6-MW2	CW6-MW34
Elevation of Top of Casing	ft (amsl)	36.34	35.06	35.05	33.76
Elevation of Ground Surface	ft (amsl)	33.79	32.85	32.19	31.97
Elevation of Top of Screen	ft (amsl)	31.79	30.85	30.19	27.47*
Elevation of Groundwater (Feb 01)	ft (amsl)	3.91	3.87	3.09	3.77
Elevation of Top of Unit 2	ft (amsl)	32.79	32.35	31.69	31.97
Elevation of Top of Unit 3	ft (amsl)	19.79	19.85	19.19	NA
Elevation of Top of Unit 4	ft (amsl)	NA	NA	NA	27.97
Elevation of Bottom of Well	ft (amsl)	18.79	17.85	17.19	17.47
Distance from Point A on Cross-Section	ft	0	41	84	195

Explanation of Units

Surface Materials:

Unit 1 (not in table) = Brown topsoil

Unit 2 = Fill: Brown, green, and gray poorly sorted sand and gravel, trace wood fragments and iron oxide stains.

Tinton Sand:

Unit 3 = greenish gray quartz sand and silt, trace mica and .layers of sub-rounded quartz gravel

Notes:

All measurements in feet.

amsl: above mean sea level.

NA: Not Applicable.

\*Refer to Minard, 1969.

**Table 5-1  
Groundwater Sampling Results  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Field Sample Location Lab Sample ID Sample Date	NJDEP	Site Specific MBC <sup>(1)</sup>	NJDEP# 29-30970																	
			CW6-MW1 2494.05 4/30/97	CW6-MW1 2947.03 9/2/97	CW6-MW1 3186.06 12/1/97	CW6-MW1 3388.03 3/5/98	CW6-MW1 3650.03 6/15/98	CW6-MW1 3901.04 9/22/98	CW6-MW1 4111.03 12/4/98	CW6-MW1 4280.03 2/17/99	CW6-MW1 4562.03 6/18/99	CW6-MW1 4705.03 8/10/99	CW6-MW1 4942.04 11/15/99	CW6-MW1 5291.01 3/27/00	CW6-MW1 5480.04 6/15/00	CW6-MW1 5665.04 8/28/00	CW6-MW1 5680.04 8/31/00	CW6-MW1 5771.04 10/5/00	CW6-MW1 5848.04 11/9/00	CW6-MW1 553 2/2/01
Round Number			1	2	3	4	5	6	7	8	9	10	11	12	13	LF1	14	LF2	15	16
<b>Volatiles (ug/L)</b>																				
Acetone	700	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	7.78	3.75
Chloroform	6	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	ND	ND
<b>Semi-Volatiles (ug/L)</b>																				
bis(2-ethylhexyl)phthalate	30	N/A	ND	ND	ND	1.16	ND	ND	ND	NS	ND	NS	ND	ND						
Di-n-octylphthalate	100	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	ND	ND
Di-n-butylphthalate	900	N/A	ND	ND	1.88	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	ND	ND
Butylbenzylphthalate	100	N/A	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	ND	ND
<b>Pesticide/PCB (ug/L)</b>																				
Heptachlor Epoxide	0.20	N/A	0.029	0.035	0.024	0.026	0.02	ND	ND	0.028	ND	ND	0.271	0.027	ND	ND	ND	0.039	ND	ND
Endosulfan I	0.40	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	0.10	N/A	0.026	0.027	0.023	0.014	ND	ND	0.024	0.013	ND	ND	ND	0.014	ND	ND	ND	0.027	ND	ND
4,4'-DDT	0.10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.009	ND	ND
4,4'-DDE	0.10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Alpha-chlordane	0.50	N/A	0.057	0.096	0.057	0.031	0.054	ND	0.05	0.062	ND	0.021	0.284	0.038	ND	ND	ND	0.066	ND	ND
Gamma-chlordane	0.50	N/A	0.038	0.054	0.025	0.025	0.031	ND	0.021	0.03	ND	0.031	0.307	0.046	ND	ND	ND	0.053	ND	ND
<b>Metals (ug/L)</b>																				
Aluminum	200	121000	291.7	361.8	303	373.8	541	77700	237	91.2	638	661	590	116	162	197	440	183	383	652
Antimony	20	N/A	0.6	1.7	ND	ND	ND	ND	2.46	ND	ND	2.94	ND	ND	ND	2.72	ND	ND	ND	ND
Arsenic	8	N/A	2	4	ND	ND	5.1	88	10.8	ND	4.74	8.87	2.33	ND	ND	4.06	ND	2.73	3.12	4.26
Barium	2000	699	8.2	ND	8.9	9.8	8.1	2020	22.9	9.83	10.4	15.9	9.86	11	40.9	64.9	48.5	44.8	29.6	16.2
Beryllium	20	N/A	0.1	ND	ND	ND	ND	20.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	4	N/A	ND	ND	ND	2	2.1	1.9	ND	1.56	1.34	1.93	ND	ND	ND	ND	ND	ND	ND	3.87
Calcium	NLE	45400	30600	21020	28140	25000	29920	92400	56100	42400	33400	30900	29200	25100	79400	126000	87500	79200	60200	31100
Chromium	100	N/A	5.4	53	2.9	ND	ND	65.3	7.36	5.83	5.64	8.07	5.34	2.85	9.82	ND	ND	7.15	5.32	6.99
Cobalt	NLE	N/A	2	ND	ND	1.2	1.2	49.3	1.67	ND	1.12	0.915	ND	ND	1.37	1.72	1.26	1.41	0.974	2.02
Copper	1000	65.6	61	30	29	48.5	102	124	24.9	23.9	43.4	20.4	33.1	6.93	10.7	ND	ND	48.4	59.7	40.3
Iron	300	431000	1880	790	468	1953	2414	112000	2190	1140	1930	4760	1190	2270	1650	1930	1140	1910	2600	3290
Lead	10	N/A	2	2.3	25	4.1	2.7	522	3.17	ND	ND	4.59	ND	ND	ND	1.76	1.49	ND	ND	ND
Magnesium	NLE	62700	7690	5050	6370	5816	6636	43900	12300	10400	7740	7070	7270	5680	17300	23900	17600	15700	12100	6720
Manganese	50	331	258	126	94.4	238.2	255	1120	516	278	270	229	90	178	516	713	457	499	409	449
Mercury	2	N/A	ND	ND	0.3	0.5	0.6	0.2	0.44	ND	ND	ND	0.1	ND	ND	ND	0.1	ND	0.4	0.3
Nickel	100	187	ND	ND	4.6	12.5	13.3	114	5.71	5.64	2.07	4.72	4.12	3.6	6.35	ND	2.81	7.05	3.2	3.45
Potassium	NLE	137000	840	1400	ND	1099	1838	25000	2410	1060	1980	1730	1820	1550	5110	10900	8020	7490	6080	2850
Selenium	50	N/A	2	ND	ND	ND	ND	ND	4.07	4.38	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	20	N/A	21	6	ND	ND	ND	ND	ND	ND	37.9	ND	ND	ND	ND	259	ND	ND	ND	ND
Sodium	50000	21500	24110	23730	17320	18070	20990	107000	20200	28600	21900	17800	19300	10600	125000	332000	227000	226000	185000	93400
Thallium	10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	NLE	N/A	7.7	ND	ND	2.3	6.8	67	6.14	1.89	6.97	9.9	4.07	3.56	2.78	1.12	ND	2.18	5.25	6.53
Zinc	5000	233	130	17	87	54.4	39.6	832	35.1	38.5	ND	25.6	28.2	15.6	34.8	38.7	25.9	17.6	20.8	15.6

**Notes**  
All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb)  
NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs) & Groundwater Quality Criteria (GWQC) (N.J.A.C. 7:9-6)  
Exceedences of NJDEP GWQS are shaded and bold  
ND: Analyte not detected in sample  
NA: Not Applicable  
NS: Not Sampled  
<sup>(1)</sup> MBC - Maximum Background Criteria for native metals.  
LF: Low Flow Sampling

**Table 5-1  
Groundwater Sampling Results  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Field Sample Location Lab Sample ID Sample Date	NJDEP	Site Specific MBC <sup>(1)</sup>	CW6-MW2		NJDEP#		29-30971		CW6-MW2		CW6-MW2		CW6-MW2		CW6-MW2		CW6-MW2		CW6-MW2		CW6-MW2	
			2494.03 4/30/97	2943.04 8/29/97	3186.06 12/1/97	3388.03 3/5/98	3650.04 6/15/98	3901.05 9/22/98	4111.04 12/4/98	4280.04 2/17/99	4562.04 6/18/99	4705.04 8/10/99	4942.05 11/15/99	5291.02 3/27/00	5480.05 6/15/00	5680.05 8/31/00	5684.03 9/1/00	5771.06 10/5/00	5848.05 11/9/00	554 2/2/01		
Round Number			1	2	3	4	5	6	7	8	9	10	11	12	13	14	LF 1	LF2	15	16		
<b>Volatiles (ug/L)</b>																						
Acetone	700	N/A	ND	ND	ND	ND	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	11.15	ND		
Chloroform	6	N/A	ND	ND	ND	ND	1.14	ND	ND	1.38	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND		
<b>Semi-Volatiles (ug/L)</b>																						
bis(2-ethylhexyl)phthalate	30	N/A	4.95	ND	ND	ND	ND	ND	ND	1.53	2	ND	ND	ND	ND	ND	NS	NS	ND	ND		
Di-n-octylphthalate	100	N/A	ND	ND	ND	ND	ND	ND	ND	1.89	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND		
Di-n-butylphthalate	900	N/A	81.36	ND	1.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND		
Butylbenzylphthalate	100	N/A	18.84	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND		
<b>Pesticide/PCB (ug/L)</b>																						
Heptachlor Epoxide	0.20	N/A	ND	NA	ND	ND	ND	0.023	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Endosulfan I	0.40	N/A	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
4,4'-DDD	0.10	N/A	ND	NA	ND	ND	ND	0.026	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
4,4'-DDT	0.10	N/A	ND	NA	ND	ND	ND	0.018	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
4,4'-DDE	0.10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Alpha-chlordane	0.50	N/A	ND	NA	ND	ND	ND	0.056	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Gamma-chlordane	0.50	N/A	ND	NA	ND	ND	ND	0.033	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
<b>Metals (ug/L)</b>																						
Aluminum	200	121000	258	2600	10060	28570	37960	630	5040	26000	24700	3610	15700	87700	25000	21500	45500	183000	44300	86700		
Antimony	20	N/A	5	ND	ND	ND	ND	ND	2.4	ND	ND	ND	ND	ND	2.94	ND	ND	ND	ND	ND		
Arsenic	8	N/A	22	6	7	17.9	48.1	13	ND	7.88	2.94	ND	2.28	ND	ND	2.29	58	77.5	11.5	34.2		
Barium	2000	699	729.3	290	114.4	231.4	467	21.9	63.4	176	107	59.3	75.9	143	126	129	701	935	281	473		
Beryllium	20	N/A	11.77	5.45	1.7	3	5.6	ND	ND	2.47	1.3	ND	1.07	1.96	1.52	1.93	11.2	11.8	3.52	6.09		
Cadmium	4	N/A	ND	4	ND	1.1	1.2	1.8	ND	1.76	1	0.664	0.931	0.943	ND	ND	ND	ND	ND	3.52		
Calcium	NLE	45400	14240	16970	9660	14320	25710	57800	6240	13400	6840	5910	6430	9390	8990	9160	40300	35300	14500	21900		
Chromium	100	N/A	2.6	43	6	5.7	25.1	6.5	8.29	21.8	10.3	8.78	9.45	11.7	17.7	0.615	20.5	482	82.4	139		
Cobalt	NLE	N/A	12.3	ND	9.9	11.8	16	0.7	5.52	9.01	4.12	5.17	6.12	5.34	4.39	6.36	39.7	18	9.23	11.7		
Copper	1000	65.6	39	14	18	26.3	32	42	4.15	12.6	ND	6.9	8.82	ND	8.66	ND	ND	55.9	ND	37		
Iron	300	431000	76540	7140	9943	21390	41540	5450	3500	17700	9570	2930	8610	28600	15400	12500	53100	159000	34900	73400		
Lead	10	N/A	70.4	14.8	41	67.3	178	6	8.28	27.8	8.42	ND	8.7	14.9	17.5	20	231	187	42	93.5		
Magnesium	NLE	62700	29580	10430	7630	11320	15120	11600	3660	9440	5430	3080	5920	14700	6300	7050	31800	33700	12000	18700		
Manganese	50	331	12	228	108.6	180.5	337	355	78.6	136	68.5	58.8	68.7	89	90.6	89.3	501	423	160	260		
Mercury	2	N/A	ND	ND	0.3	0.5	0.2	0.5	ND	0.11	ND	ND	ND	ND	ND	ND	0.2	0.2	ND	ND		
Nickel	100	187	30	50	42.3	31.2	36.4	6.1	11.7	22.9	4.73	10.7	13.2	5.41	7.55	9.27	92.2	49.5	19	24.6		
Potassium	NLE	137000	5190	4490	3480	5721	11200	3070	2200	3450	2460	2290	2490	2260	2440	3070	7860	24200	7050	8920		
Selenium	50	N/A	7	ND	ND	ND	ND	ND	ND	4.31	ND	ND	ND	ND	ND	ND	ND	ND	3.4	ND		
Silver	20	N/A	89	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	24.2	ND	ND	ND	ND	ND		
Sodium	50000	21500	104500	48940	21020	30750	46240	22200	27700	57100	54500	32100	32700	32900	47800	45200	29600	123000	56400	77400		
Thallium	10	N/A	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Vanadium	NLE	N/A	34.7	ND	3	14.7	29.6	9	6.28	17	9.17	6.29	7.27	19.6	13.1	6.61	28.3	374	70	115		
Zinc	5000	233	301	274	278	325.2	437	24	96.3	160	44.2	74.1	104	78.6	85.2	120	730	402	148	234		

**Notes**  
 All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb)  
 NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs) & Groundwater Quality Criteria (GWQC) (N.J.A.C. 7:9-6)  
 Exceedences of NJDEP GWQS are shaded and bold  
 ND: Analyte not detected in sample  
 NA: Not Applicable  
 NS: Not Sampled  
<sup>(1)</sup> MBC - Maximum Background Criteria for native metals.  
 LF: Low Flow Sampling

**Table 5-1  
Groundwater Sampling Results  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Field Sample Location Lab Sample ID Sample Date	NJDEP	Site Specific MBC <sup>(1)</sup>	CW6-MW3 NJDEP# 29-30972																	
			CW6-MW3	CW6-MW3	CW6-MW3	CW6-MW3	CW6-MW3	CW6-MW3	CW6-MW3	CW6-MW3	CW6-MW3	CW6-MW3	CW6-MW3	CW6-MW3	CW6-MW3	CW6-MW3	CW6-MW3	LF1	LF2	15
Round Number			1	2	3	4	5	6	7	8	9	10	11	12	13	14	LF1	LF2	15	16
<b>Volatiles (ug/L)</b>																				
Acetone	700	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND
Chloroform	6	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND
<b>Semi-Volatiles (ug/L)</b>																				
bis(2-ethylhexyl)phthalate	30	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND
Di-n-octylphthalate	100	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND
Di-n-butylphthalate	900	N/A	ND	ND	1.48	ND	NS	NS	ND	ND										
Butylbenzylphthalate	100	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND
<b>Pesticide/PCB (ug/L)</b>																				
Heptachlor Epoxide	0.20	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	0.40	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	0.10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	0.10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	0.10	N/A	ND	ND	ND	ND	ND	ND	ND	0.009	0.006	ND	ND	ND	ND	ND	ND	ND	ND	ND
Alpha-chlordane	0.50	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-chlordane	0.50	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
<b>Metals (ug/L)</b>																				
Aluminum	200	121000	124.1	292	293	506	335	934	425	1050	950	345	408	673	165	308	285	235	429	2250
Antimony	20	N/A	0.5	ND	9.54	ND	ND	ND	ND	ND	ND									
Arsenic	8	N/A	1	ND	5.04	ND	ND	ND	ND	ND	ND									
Barium	2000	699	20.2	ND	27.1	27.3	19.1	38	43.3	30.4	30	33.8	33.5	27.4	26.3	39	53.4	52	52.1	12.2
Beryllium	20	N/A	0.16	0.06	ND	ND	ND	ND												
Cadmium	4	N/A	ND	ND	1	2	0.7	ND	ND	2.31	0.575	ND	ND	3.51	ND	0.652	0.689	0.664	1.06	2.28
Calcium	NLE	45400	8960	7280	11740	11660	9745	8970	1020	11300	12100	13900	12600	15100	20100	9710	13000	11800	11000	11400
Chromium	100	N/A	0.8	21	2.4	ND	ND	7.5	3.82	3.4	3.19	2.39	1.35	ND	3.19	ND	ND	0.816	ND	10.4
Cobalt	NLE	N/A	2.6	ND	2.2	2.1	1.2	1.7	781	1.79	1.52	1.07	1.59	105	1.06	1.9	2.4	2.15	2.07	ND
Copper	1000	65.6	12	ND	10	11.4	ND	7	ND	6.13	ND	8.09	4.73	5.77	6.2	ND	ND	ND	ND	ND
Iron	300	431000	595	2490	538	848.4	1165	3600	781	1110	542	451	604	2360	1010	267	171	132	481	4530
Lead	10	N/A	0.8	9	10	ND	2.8	ND	ND	ND	ND	ND	ND	6.7	3.47	1.69	ND	ND	ND	1.71
Magnesium	NLE	62700	1990	1890	2370	2178	1548	2430	3120	2150	1990	2550	2130	29000	1910	2150	2750	2600	2520	1640
Manganese	50	331	17	15	34.1	43	29.1	24	28.5	37.1	17.5	19.5	16.4	406	17.7	19.9	40.9	28.8	29.8	7.77
Mercury	2	N/A	ND	ND	0.2	ND	ND	ND	ND	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	100	187	ND	10	4.9	6.9	4.3	5.4	5.95	5.64	6.58	3.02	2.84	53500	3.75	ND	ND	3.61	ND	ND
Potassium	NLE	137000	360	380	ND	639.6	632	1240	936	411	702	901	728	534	571	739	900	753	639	3340
Selenium	50	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	20	N/A	19	ND	ND	ND	ND													
Sodium	50000	21500	11370	7090	11830	10780	10860	7320	8720	14300	11600	15100	12400	10800	13800	15700	21400	14600	11200	4900
Thallium	10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	NLE	N/A	ND	ND	ND	ND	ND	7	1.92	1.52	ND	1.24	ND	6.83	1.14	ND	ND	ND	1.66	10.1
Zinc	5000	233	40	36	135	87.7	56.2	14	46.2	48.4	10.6	18.3	35.4	10.3	103	85.3	110	64	60.9	12.3

**Notes**  
 All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb)  
 NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs) & Groundwater Quality Criteria (GWQC) (N.J.A.C. 7-9-6)  
 Exceedences of NJDEP GWQS are shaded and bold  
 ND: Analyte not detected in sample  
 NA: Not Applicable  
 NS: Not Sampled  
<sup>(1)</sup> MBC - Maximum Background Criteria for native metals.  
 LF: Low Flow Sampling

**Table 5-1  
Groundwater Sampling Results  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Field Sample Location Lab Sample ID Sample Date	NJDEP	Site Specific MBC <sup>(1)</sup>	CW6-MW34		NJDEP# 29-32599																
			CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34	CW6-MW34
Round Number			1	2	3	4	5	6	7	8	9	10	11	12	13	LF1	14	LF2	15	16	
<b>Volatiles (ug/L)</b>																					
Acetone	700	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	16.09	NS	ND	ND	
Chloroform	6	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	NS	ND	ND	
<b>Semi-Volatiles (ug/L)</b>																					
bis(2-ethylhexyl)phthalate	30	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	ND	ND	
Di-n-octylphthalate	100	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	ND	ND	
Di-n-butylphthalate	900	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	ND	ND	
Butylbenzylphthalate	100	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	ND	ND	
<b>Pesticide/PCB (ug/L)</b>																					
Heptachlor Epoxide	0.20	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Endosulfan I	0.40	N/A	ND	ND	ND	ND	0.011	ND													
4,4'-DDD	0.10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
4,4'-DDT	0.10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
4,4'-DDE	0.10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Alpha-chlordane	0.50	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Gamma-chlordane	0.50	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
<b>Metals (ug/L)</b>																					
Aluminum	200	121000	48	119.9	348	385.6	204	360	434	345	419	522	215	285	365	372	391	342	510	245	
Antimony	20	N/A	ND	ND	ND	ND	ND	ND	3.09	ND											
Arsenic	8	N/A	2	1	ND	ND	ND	6	ND	ND	2.71	2.89	ND								
Barium	2000	699	17.5	ND	40.2	36	18.2	16.2	42.4	33.4	33.7	39.1	37.5	42	37	36.3	44.3	49.1	67.3	37.6	
Beryllium	20	N/A	0.17	0.24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Cadmium	4	N/A	ND	4	ND	ND	0.6	ND	2.19	1.18	ND	ND	0.571	ND	ND	ND	ND	ND	0.886	1.95	
Calcium	NLE	45400	17840	5370	10240	9775	11250	5500	5450	9660	6940	5230	8310	10400	9930	16400	12200	13900	13900	16800	
Chromium	100	N/A	5.7	48	2.7	ND	ND	5.1	4	4.04	2.27	3.49	2.35	ND	4	ND	ND	4.15	ND	2.15	
Cobalt	NLE	N/A	2.6	ND	1.6	1.6	0.9	0.9	1.61	0.691	1.42	1.18	1.19	1.14	1.32	1.71	1.38	1.84	1.9	1.71	
Copper	1000	65.6	15	11	12	9.5	5.2	4	10.7	4.89	ND	3.8	4.41	ND	ND	ND	ND	81.6	ND	62.8	
Iron	300	431000	2110	1380	652	2212	2624	9030	2280	2640	5350	4940	1390	2920	5560	1480	1960	1790	4920	3770	
Lead	10	N/A	0.5	ND	10	ND	13.9	ND	8.74												
Magnesium	NLE	62700	3930	1370	2700	2599	2245	1280	2350	2040	1560	1410	2060	2200	2170	3580	2590	3480	3330	3560	
Manganese	50	331	54	26	25.8	34.7	37.9	32.8	27.1	21.2	32.1	34	23.4	34.1	48.2	43.9	37.5	43	60	55.3	
Mercury	2	N/A	ND	ND	0.3	ND	ND	ND	0.11	0.14	ND	0.3	ND								
Nickel	100	187	ND	ND	4.9	4.9	6.8	4.2	7.26	5.39	ND	3.41	3.17	37	3.87	ND	ND	ND	1.14	2.63	
Potassium	NLE	137000	4420	3680	2680	3600	6526	5060	1930	2860	3630	2970	2270	3140	3750	5730	4580	4240	3260	3070	
Selenium	50	N/A	ND	ND	ND	ND	ND	ND	ND	3.56	ND										
Silver	20	N/A	18	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Sodium	50000	21500	15510	16570	15480	15940	15380	16300	14400	18800	19400	20600	19400	12100	19000	20900	21300	19900	21800	19100	
Thallium	10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Vanadium	NLE	N/A	ND	200	ND	ND	1.4	4	2.39	ND	1.81	2.26	ND	1.87	1.43	ND	ND	ND	1.26	ND	
Zinc	5000	233	67	104	200	154.8	75	63	125	120	133	110	84.2	135	151	106	144	236	178	184	

**Notes**  
 All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb)  
 NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs) & Groundwater Quality Criteria (GWQC) (N.J.A.C. 7:9-6)  
 Exceedences of NJDEP GWQS are shaded and bold  
 ND: Analyte not detected in sample  
 NA: Not Applicable  
 NS: Not Sampled  
<sup>(1)</sup> MBC - Maximum Background Criteria for native metals.  
 LF: Low Flow Sampling

**Table 5-2  
Determination of Contaminants of Concern  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

Analyte	NJDEP Cleanup Criteria <sup>(1)</sup>	Site Specific Groundwater MBC <sup>(2)</sup>	Maximum Result	No. of NJDEP Criteria Exceedences	No. of Site Maximum Background Exceedences	Comments
<b>Volatiles</b>						
Acetone	700	N/A	16.09	0	N/A	No exceedance of NJDEP GWQC
Chloroform	6	N/A	1.38	0	N/A	No exceedance of NJDEP GWQC
<b>Semi-Volatiles</b>						
bis(2-ethylhexyl)phthalate	30	N/A	4.95	0	N/A	No exceedance of NJDEP GWQC
Di-n-octylphthalate	100	N/A	1.89	0	N/A	No exceedance of NJDEP GWQC
Di-n-butylphthalate	900	N/A	81.36	0	N/A	No exceedance of NJDEP GWQC
Butylbenzylphthalate	100	N/A	18.84	0	N/A	No exceedance of NJDEP GWQC
<b>Pesticide/PCB</b>						
Heptachlor Epoxide	0.20	N/A	0.271	1	N/A	<b>Not a Contaminant of Concern. Isolated and marginal at location MW-1 on 11/15/99.</b>
Endosulfan I	0.40	N/A	0.011	0	N/A	No exceedance of NJDEP GWQC
4,4'-DDD	0.10	N/A	0.027	0	N/A	No exceedance of NJDEP GWQC
4,4'-DDT	0.10	N/A	0.018	0	N/A	No exceedance of NJDEP GWQC
4,4'DDE	0.10	N/A	0.009	0	N/A	No exceedance of NJDEP GWQC
Alpha-chlordane	0.50	N/A	0.284	0	N/A	No exceedance of NJDEP GWQC
Gamma-chlordane	0.50	N/A	0.307	0	N/A	No exceedance of NJDEP GWQC
<b>Metals</b>						
Aluminum	200	121000	183000	63	1	<b>Not a Contaminant of Concern. Background metal.</b>
Antimony	20	N/A	9.54	0	N/A	No exceedance of NJDEP GWQC
Arsenic	8	N/A	88	11	N/A	<b>Not a Contaminant of Concern. Isolated and marginal at location MW-2.</b>
Barium	2000	699	2020	1	4	<b>Not a Contaminant of Concern. Background metal.</b>
Beryllium	20	N/A	20.5	1	N/A	<b>Not a Contaminant of Concern. Marginal exceedance.</b>
Cadmium	4	N/A	4	2	N/A	<b>Not a Contaminant of Concern. Marginal exceedance.</b>
Calcium	NLE	45400	126000	0	8	No limits established.
Chromium	100	N/A	482	2	N/A	<b>Not a Contaminant of Concern. Isolated and marginal at location MW-2.</b>
Cobalt	NLE	N/A	781	N/A	N/A	No limits established.
Copper	1000	65.6	124	0	2	<b>Not a Contaminant of Concern. Background metal.</b>
Iron	300	431000	159000	70	0	<b>Not a Contaminant of Concern. Background metal.</b>
Lead	10	N/A	522	17	N/A	<b>COC: Exceeded NJDEP criteria during low flow sampling rounds I and II.</b>
Magnesium	NLE	62700	33700	N/A	0	No exceedance of NJDEP GWQC
Manganese	50	331	10430	39	13	<b>Not a Contaminant of Concern. Background metal.</b>
Mercury	2	N/A	0.6	0	N/A	No exceedance of NJDEP GWQC
Nickel	100	187	53500	2	1	<b>Not a Contaminant of Concern. Background metal.</b>
Potassium	NLE	137000	25000	N/A	0	No exceedance of NJDEP GWQC
Selenium	50	N/A	4.38	0	N/A	No exceedance of NJDEP GWQC
Sodium	50000	21500	332000	13	28	<b>Not a Contaminant of Concern. Background metal.</b>
Silver	20	N/A	259	5	0	<b>Not a Contaminant of Concern. Low Flow Sampling presents no detections.</b>
Thallium	10	N/A	2	0	N/A	No exceedance of NJDEP GWQC
Vanadium	NLE	N/A	374	N/A	N/A	No limits established.
Zinc	5000	233	730	0	10	No exceedance of NJDEP GWQC

**Notes:**

All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb).

NJDEP GWQC: New Jersey Department of Environmental Protection Groundwater Quality Criteria.

N/A = Not Applicable

Exceeds NJDEP GWQC =

ND: Analyte not detected in sample

NLE: No limit established for this analyte

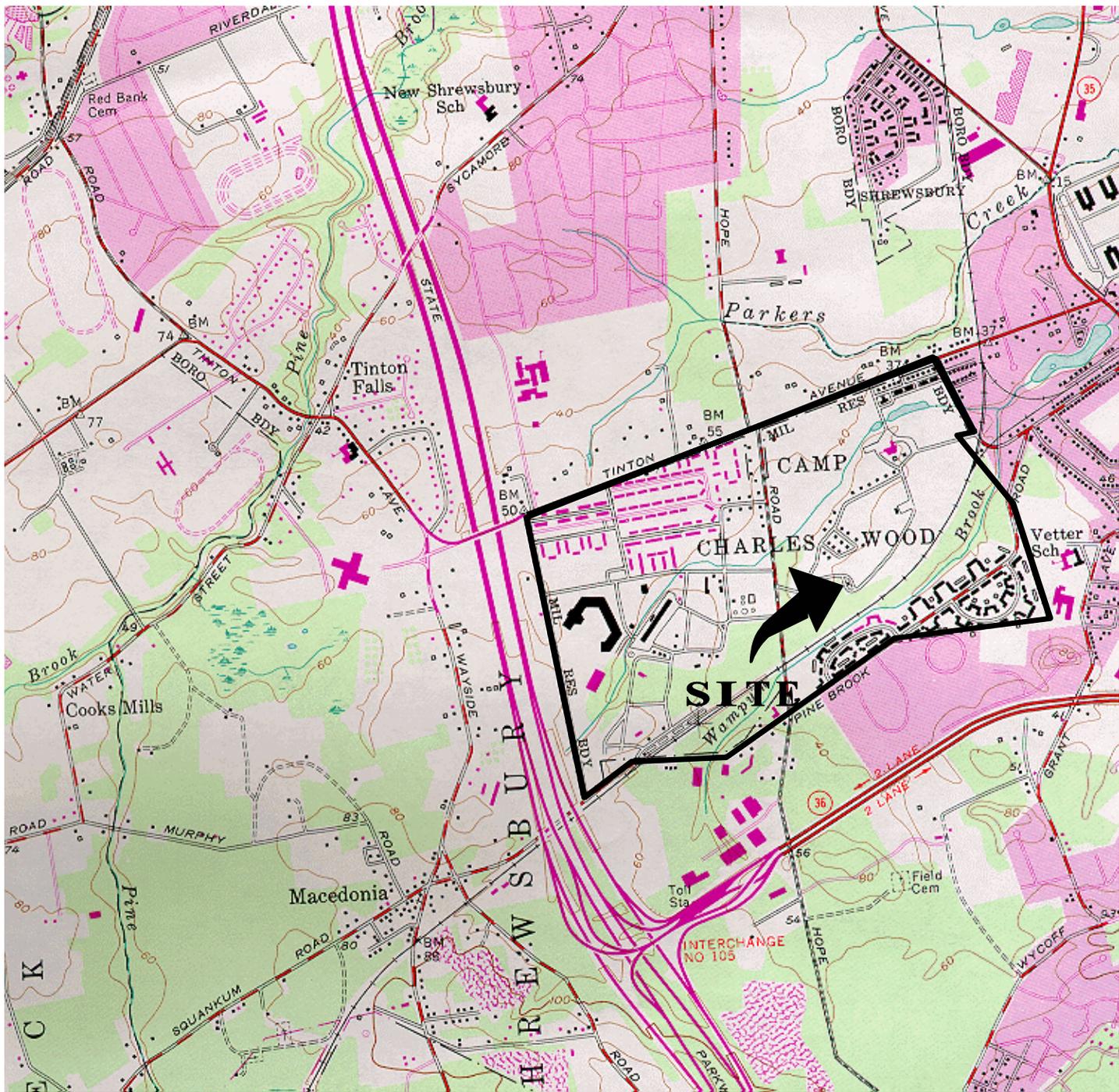
<sup>(1)</sup>Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per N.J.A.C. 7:9-6

<sup>(2)</sup>Fort Monmouth Summary of Site-specific Groundwater Maximum Background Concentrations (MBC);

MBCs are shown for background (native) metals only.

<sup>(3)</sup>Interim Criteria used as NJDEP criteria

**FIGURES**



**FIGURE 2-1**

Site Location Map  
 CW-6 Pesticide Storage Site  
 Fort Monmouth, New Jersey



LONG BRANCH, N. J.

40073-C8-TF-024

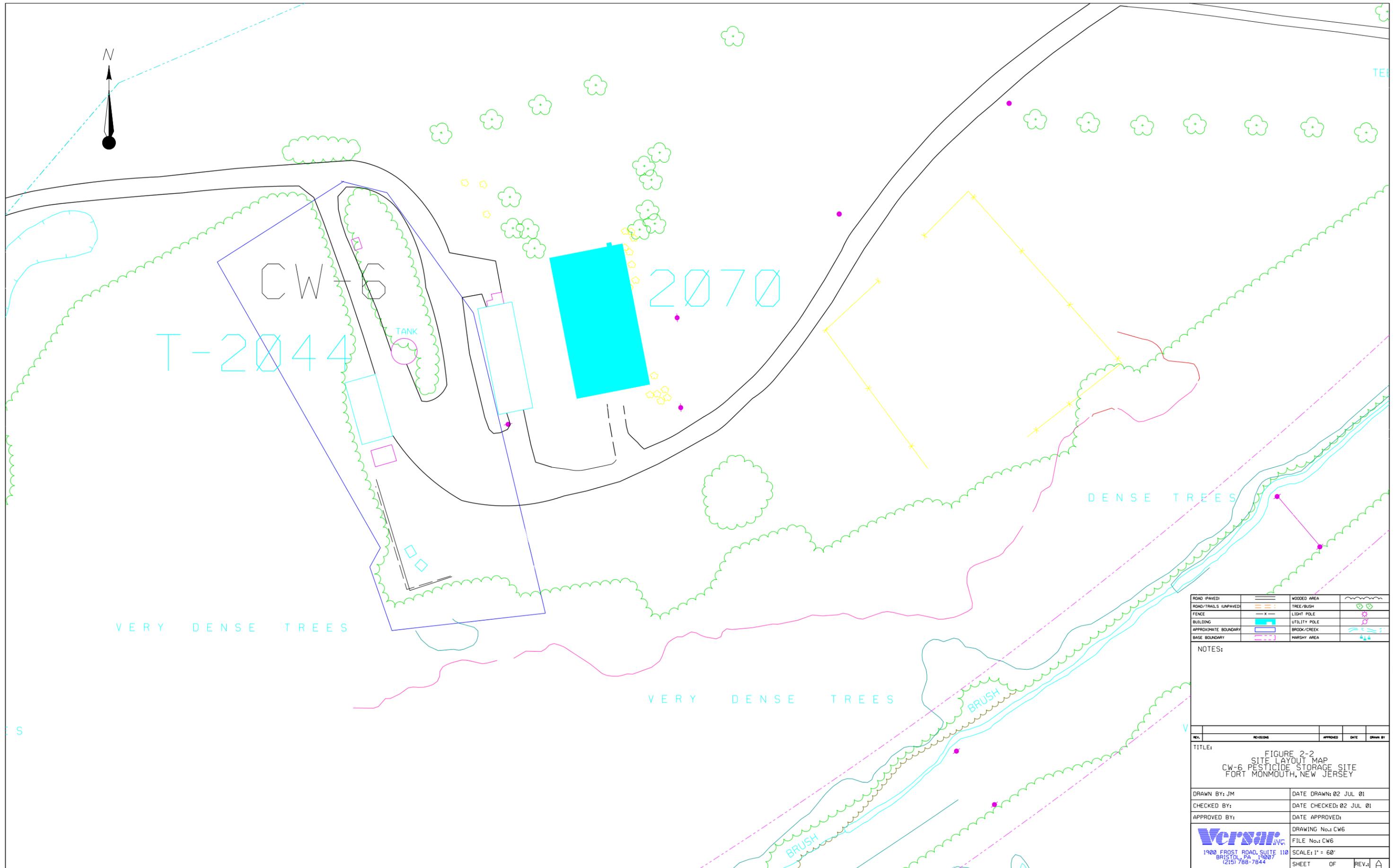
1954

PHOTOREVISED 1981

DMA 6164 I SE-SERIES V822

NEW  
 JERSEY

QUADRANGLE LOCATION



ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

NOTES:

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:  
 FIGURE 2-2  
 SITE LAYOUT MAP  
 CW-6 PESTICIDE STORAGE SITE  
 FORT MONMOUTH, NEW JERSEY

DRAWN BY: JM      DATE DRAWN: 02 JUL 01

CHECKED BY:      DATE CHECKED: 02 JUL 01

APPROVED BY:      DATE APPROVED:

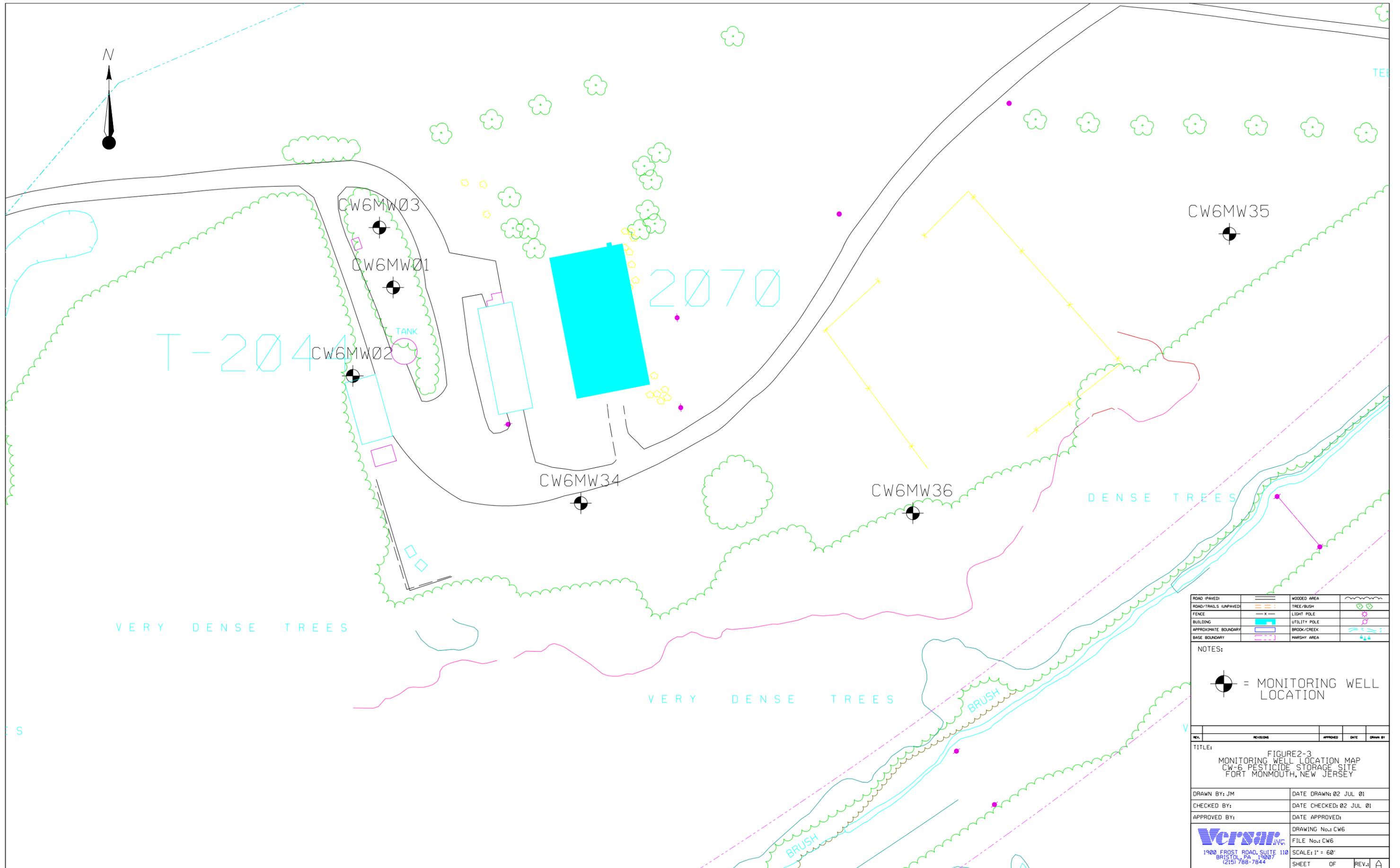
DRAWING No.: CW6

FILE No.: CW6

SCALE: 1" = 60'

SHEET OF REV.: A

**Versar** INC.  
 1900 FROST ROAD, SUITE 110  
 BRISTOL, PA 19007  
 (215) 788-7844



ROAD (PAVED)	ROAD/TRAILS (UNPAVED)	FENCE	BUILDING	APPROXIMATE BOUNDARY	BASE BOUNDARY	WOODED AREA	TREE/BUSH	LIGHT POLE	UTILITY POLE	BROOK/CREEK	MARSHY AREA
--------------	-----------------------	-------	----------	----------------------	---------------	-------------	-----------	------------	--------------	-------------	-------------

NOTES:

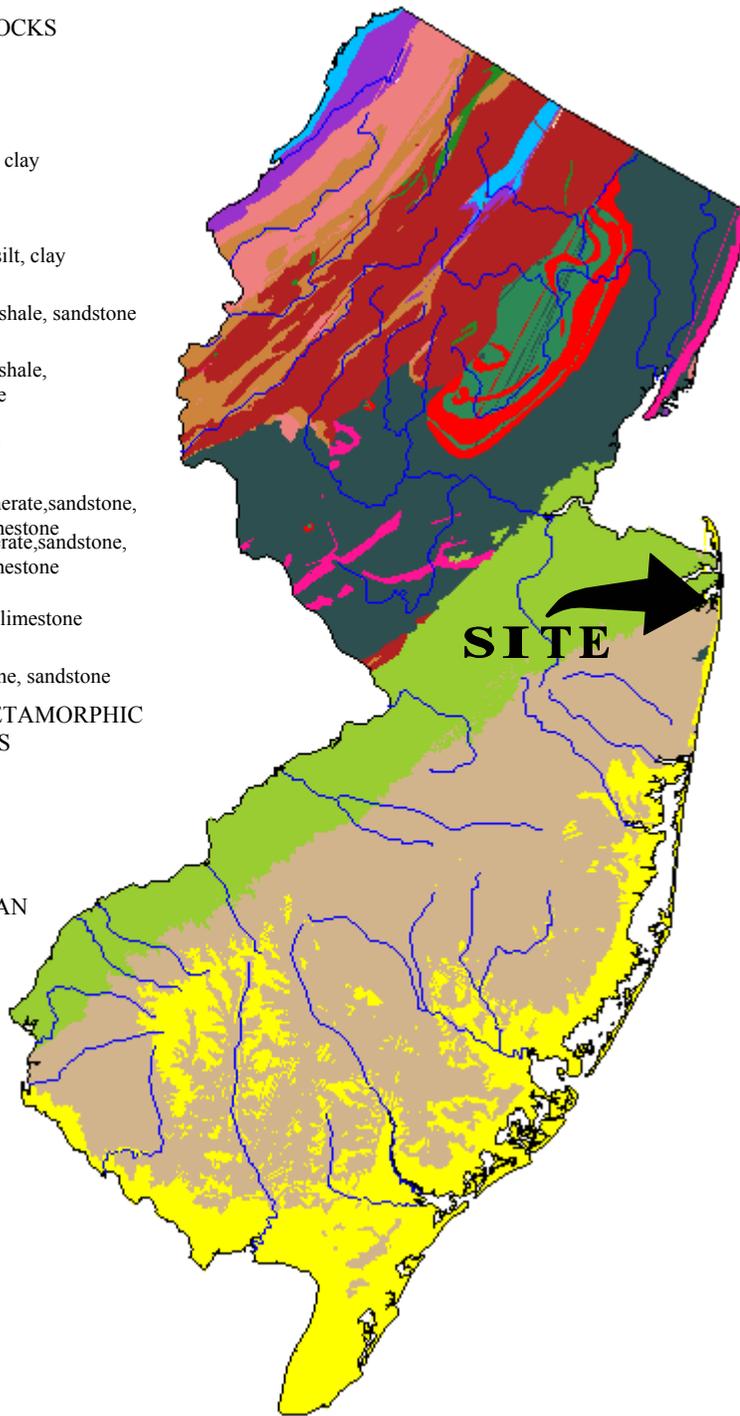
= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 2-3 MONITORING WELL LOCATION MAP CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 02 JUL 01		
CHECKED BY:		DATE CHECKED: 02 JUL 01		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6		
SCALE: 1" = 60'		SHEET OF REV.: A		

**Versar** INC.  
1900 FROST ROAD, SUITE 110  
BRISTOL, PA 19007  
(215) 788-7844

# Geologic Map of New Jersey

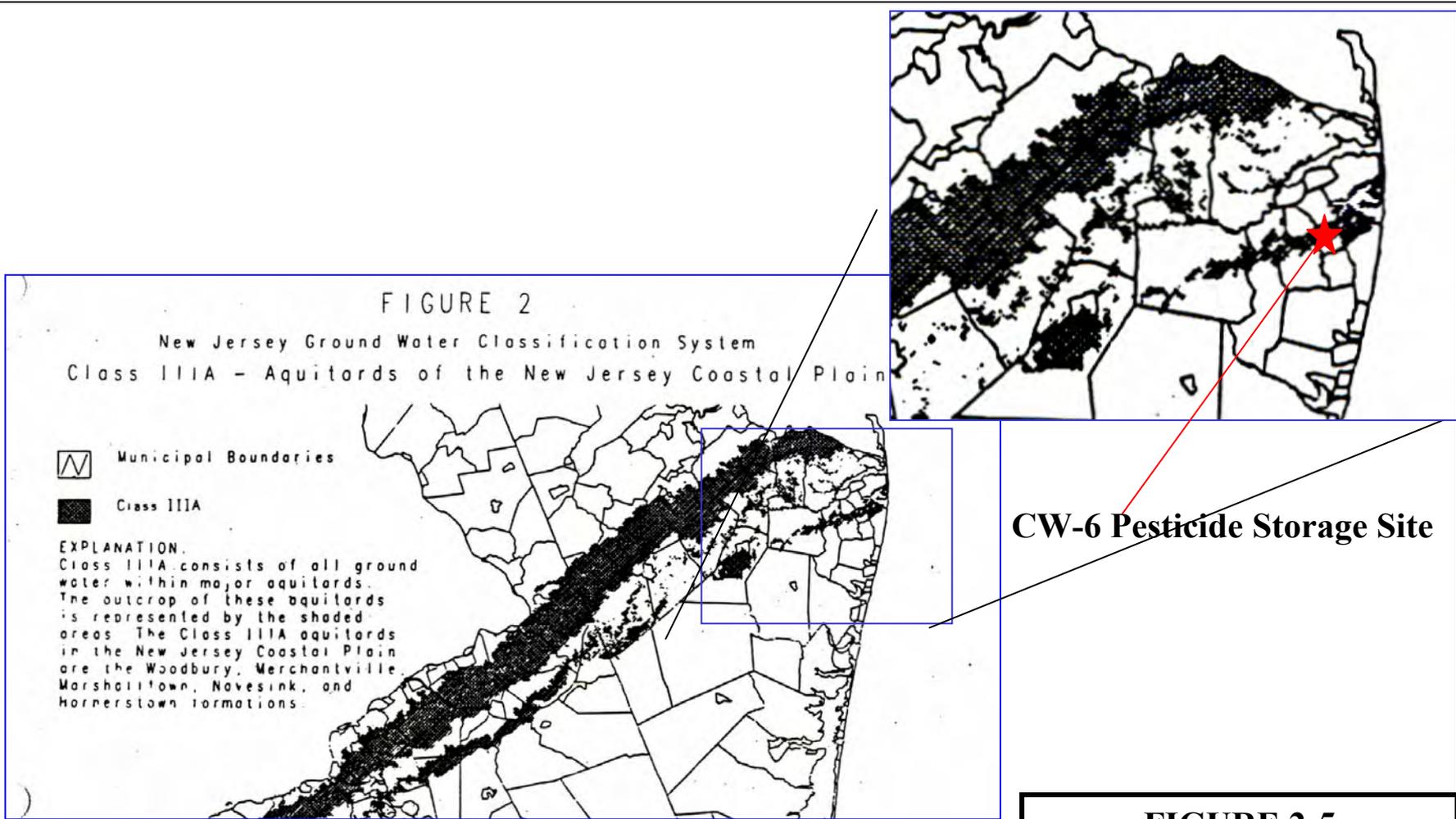
- SEDIMENTARY ROCKS**
- CENOZOIC**
- Holocene: sand
  - Tertiary: sand, silt, clay
- MESOZOIC**
- Cretaceous: sand, silt, clay
  - Jurassic: siltstone, shale, sandstone
  - Triassic: siltstone, shale, sandstone
- PALEOZOIC**
- Devonian: conglomerate, sandstone, shale, limestone
  - Silurian: conglomerate, sandstone, shale, limestone
  - Ordovician: shale, limestone
  - Cambrian: limestone, sandstone
- IGNEOUS AND METAMORPHIC ROCKS**
- MESOZOIC**
- Jurassic: basalt
  - Jurassic: diabase
- PRECAMBRIAN**
- marble
  - gneiss, granite



**FIGURE 2-4**  
 Geological Map of New Jersey  
 CW-6 Pesticide Storage Site  
 Fort Monmouth, New Jersey

Source: New Jersey Geologic Survey, 1994, *Geologic Map of New Jersey*.





Source: New Jersey Groundwater Quality Standards, NJAC 7:9-6

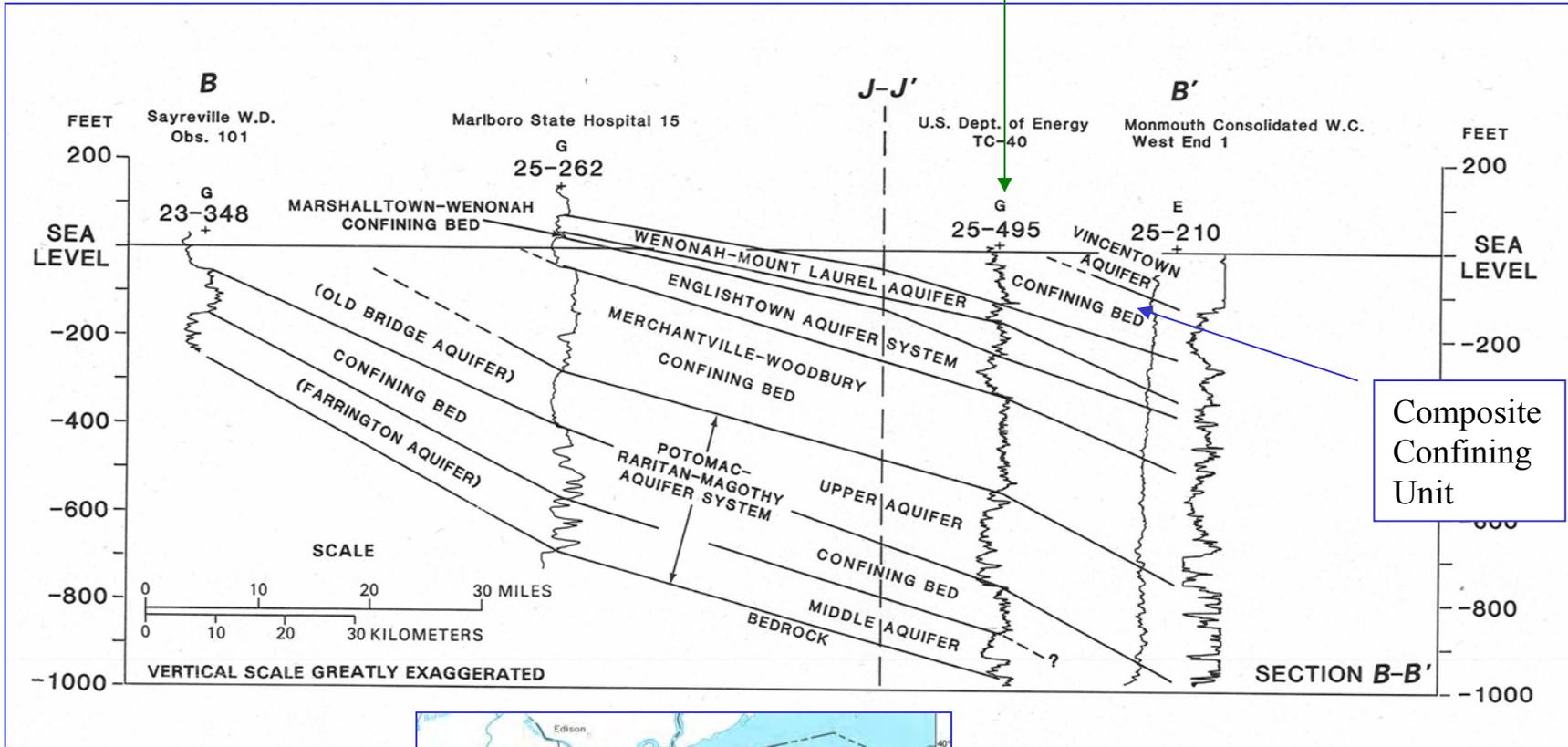
**FIGURE 2-5**

**New Jersey Groundwater Classification  
Class IIIA  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

201 Gibraltar Rd., Ste. 100  
Horsham, PA 19044  
(215) 957-0955

**Versar** INC.

Fort Monmouth



**FIGURE 2-6**

**Geologic Cross-Section  
CW-6 Pesticide Storage Site  
Fort Monmouth, New Jersey**

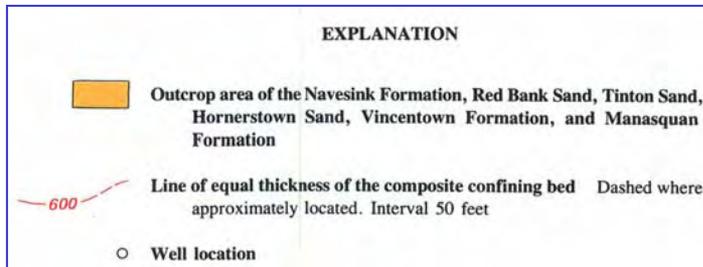
Source: Zapecza, O. 1989. *Hydrogeologic Framework of the New Jersey Coastal Plain*. USGS Professional Paper 1404-B. U.S. Government Printing Office, Washington, DC.

**Versar** INC.

201 Gibraltar Rd., Ste. 100  
Horsham, PA 19044  
(215) 957-0955



Fort Monmouth  
125 feet in thickness  
at Fort Monmouth

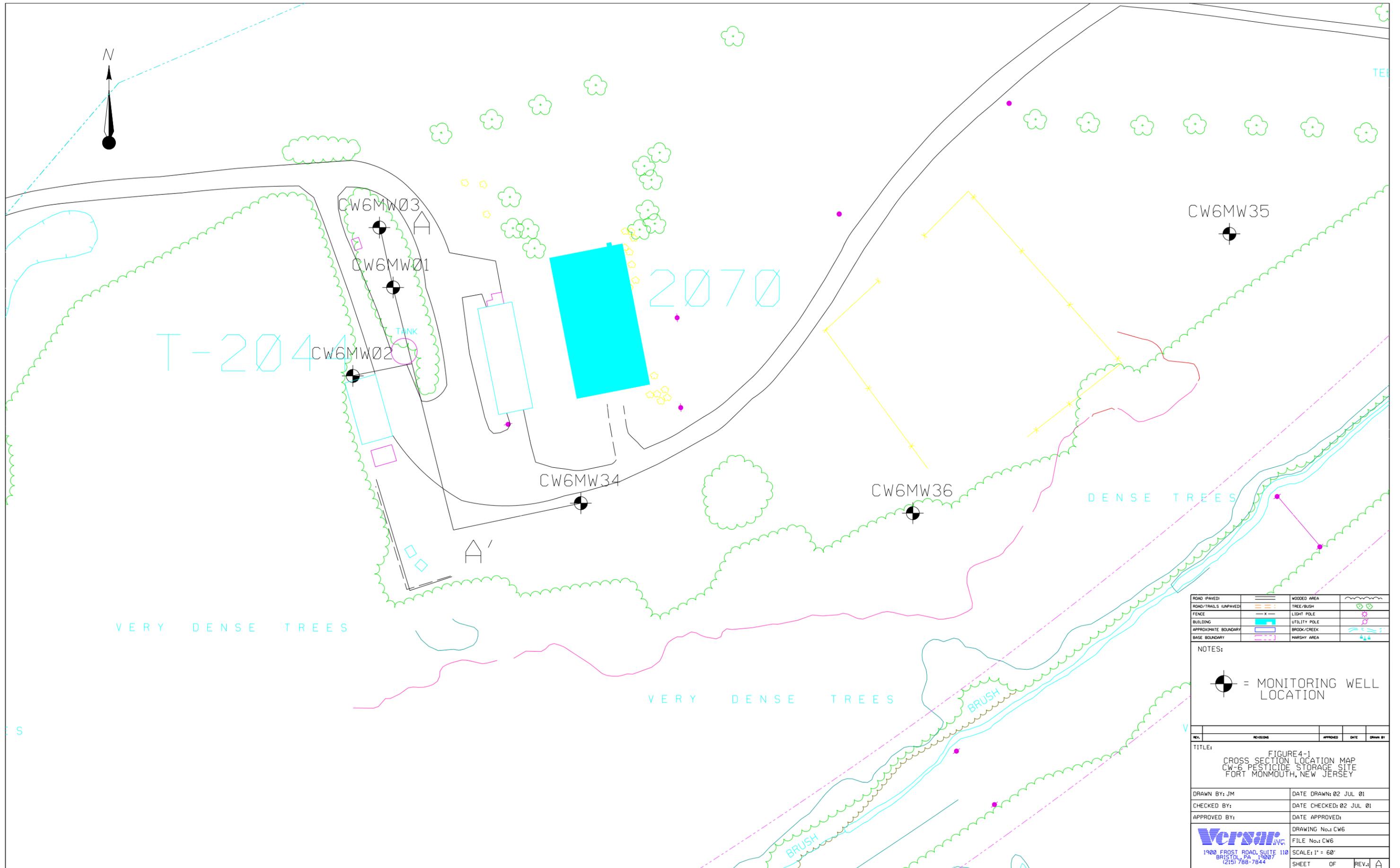


**FIGURE 2-7**

**Outcrop and Thickness of Composite Confining Unit CW-6 Pesticide Storage Site Fort Monmouth, New Jersey**

Source: Zapecza, O. 1989. *Hydrogeologic Framework of the New Jersey Coastal Plain*. USGS Professional Paper 1404-B. U.S. Government Printing Office, Washington, DC.





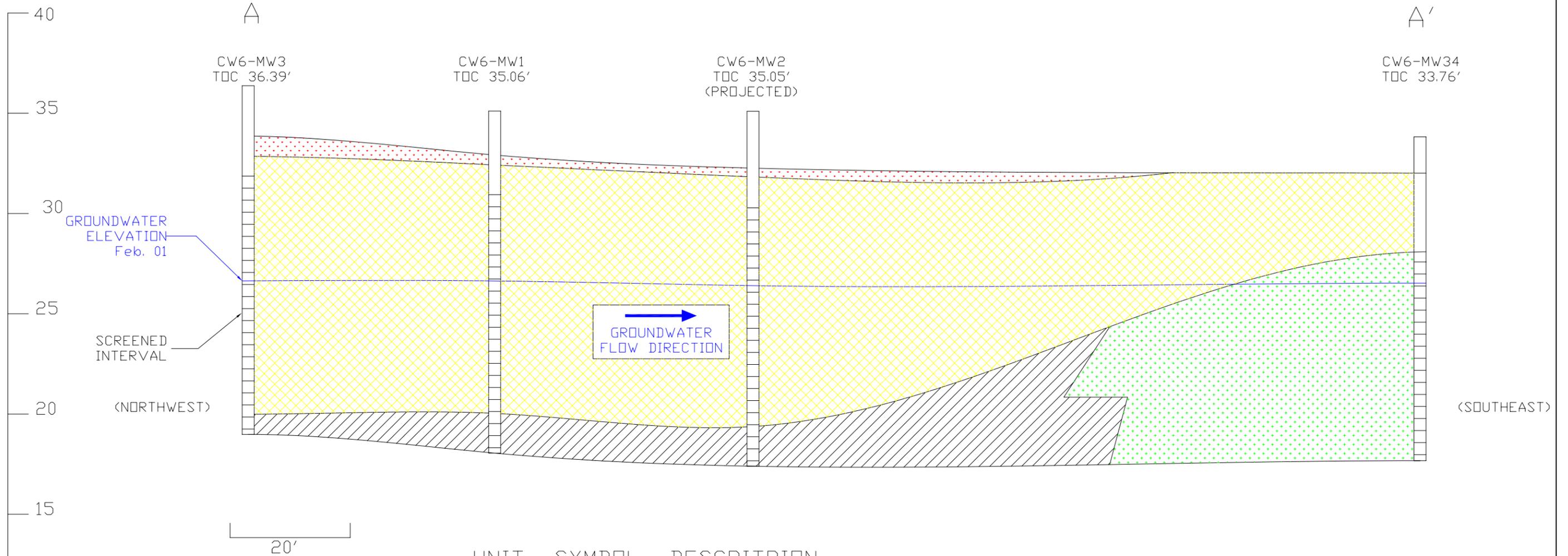
ROAD (PAVED)	---	WOODED AREA	~
ROAD/TRAILS (UNPAVED)	---	TREE/BUSH	☼
FENCE	---x---	LIGHT POLE	⊕
BUILDING	▭	UTILITY POLE	⊕
APPROXIMATE BOUNDARY	---	BROOK/CREEK	~
BASE BOUNDARY	---	MARSHY AREA	~

NOTES:

⊕ = MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE4-1 CROSS SECTION LOCATION MAP CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 02 JUL 01		
CHECKED BY:		DATE CHECKED: 02 JUL 01		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6		
1900 FROST ROAD, SUITE 110 BRISTOL, PA 19007 (215) 788-7844		SCALE: 1" = 60'		
SHEET		OF		REV.: A

ELEVATION  
(FT MSL)



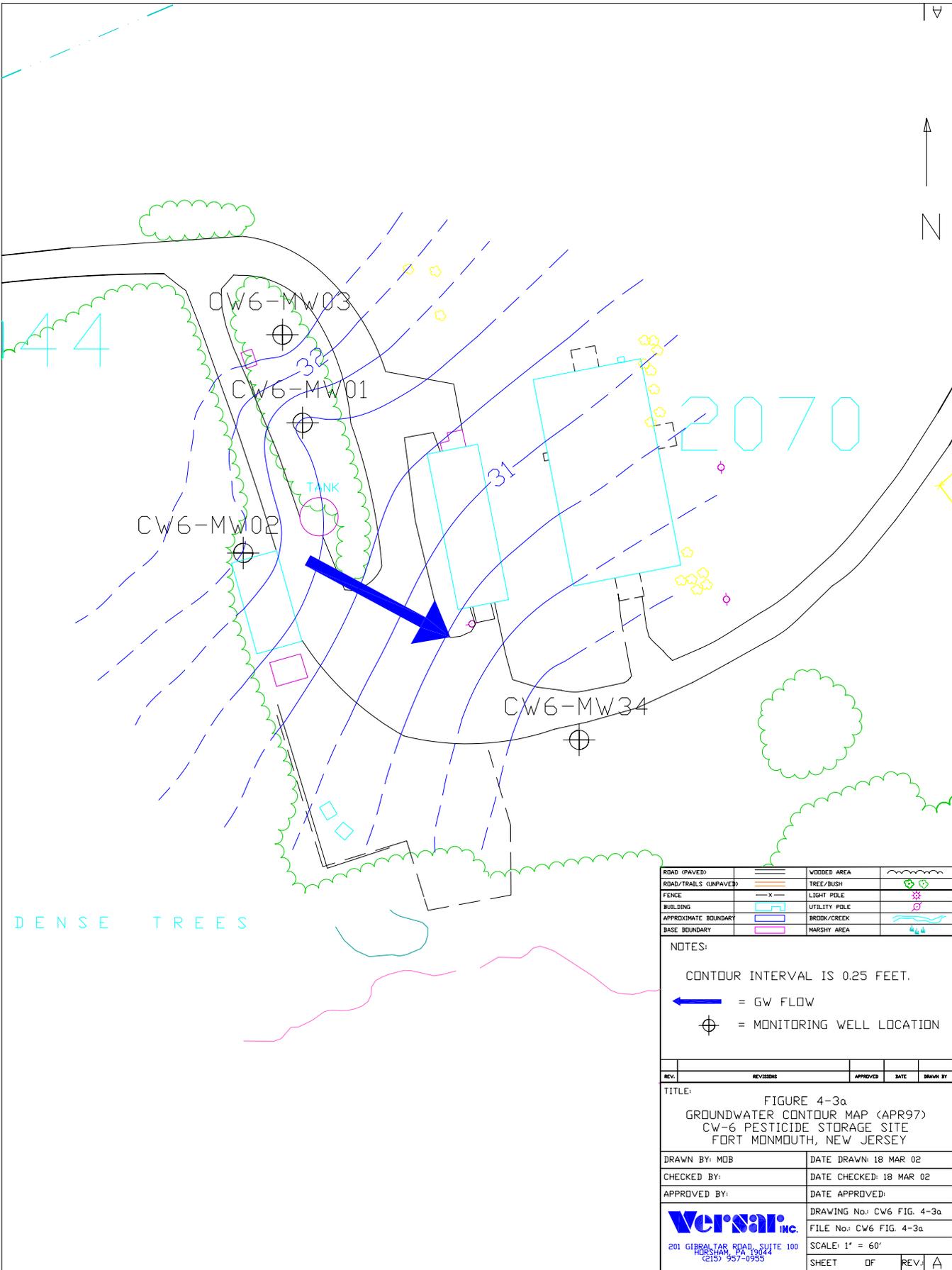
UNIT    SYMBOL    DESCRIPTION

(1)		TOPSOIL AND ROOTS
(2)		BROWN MEDIUM TO COARSE SAND - FILL
(3)		GREENISH-GRAY TO BLACK SILTY CLAY
(4)		BROWN, ORANGE, AND GREENISH POORLY GRADED SAND

NOTES

- 1) CROSS SECTION LINE (A TO A') IS SHOWN ON FIGURE 4-1.
- 2) VERTICAL SCALE: 1" = 6'.  
HORIZONTAL SCALE: 1" = 20'.  
VERTICAL EXAGGERATION = 3.33.
- 3) FT MSL: FEET ABOVE MEAN SEA LEVEL
- 4) TOC = ELEVATION OF INNER WELL CASING SURVEY MARK (FT MSL).
- 5) GROUNDWATER ELEVATION SHOWN IN FEET.
- 6) EACH OF THE WELLS HAS A DIAMETER OF 4 INCHES, WHICH IS ENLARGED ON THIS DRAWING FOR PRESENTATION.
- 7) BOUNDARIES ARE DASHED WHERE INFERRED.

REV.	REVISIONS	APPROVED	DRAWN BY
TITLE:			
FIGURE 4-2 GEOLOGIC CROSS SECTION A TO A' CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY			
DRAWN BY: TJK/TJW		DATE DRAWN: 16 OCT 01	
CHECKED BY:		DATE CHECKED:	
APPROVED BY:		DATE APPROVED:	
DRAWING No: FIGURE 4-2		FILE No: CW-6 Figure 4-2	
2558 PEARL BUCK ROAD, SUITE 1 BRISTOL, PA 19007 (215) 788-7844		SCALE: 1" = 20' (VERTICAL=3")	
SHEET 1 OF 1		REV:	A



ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

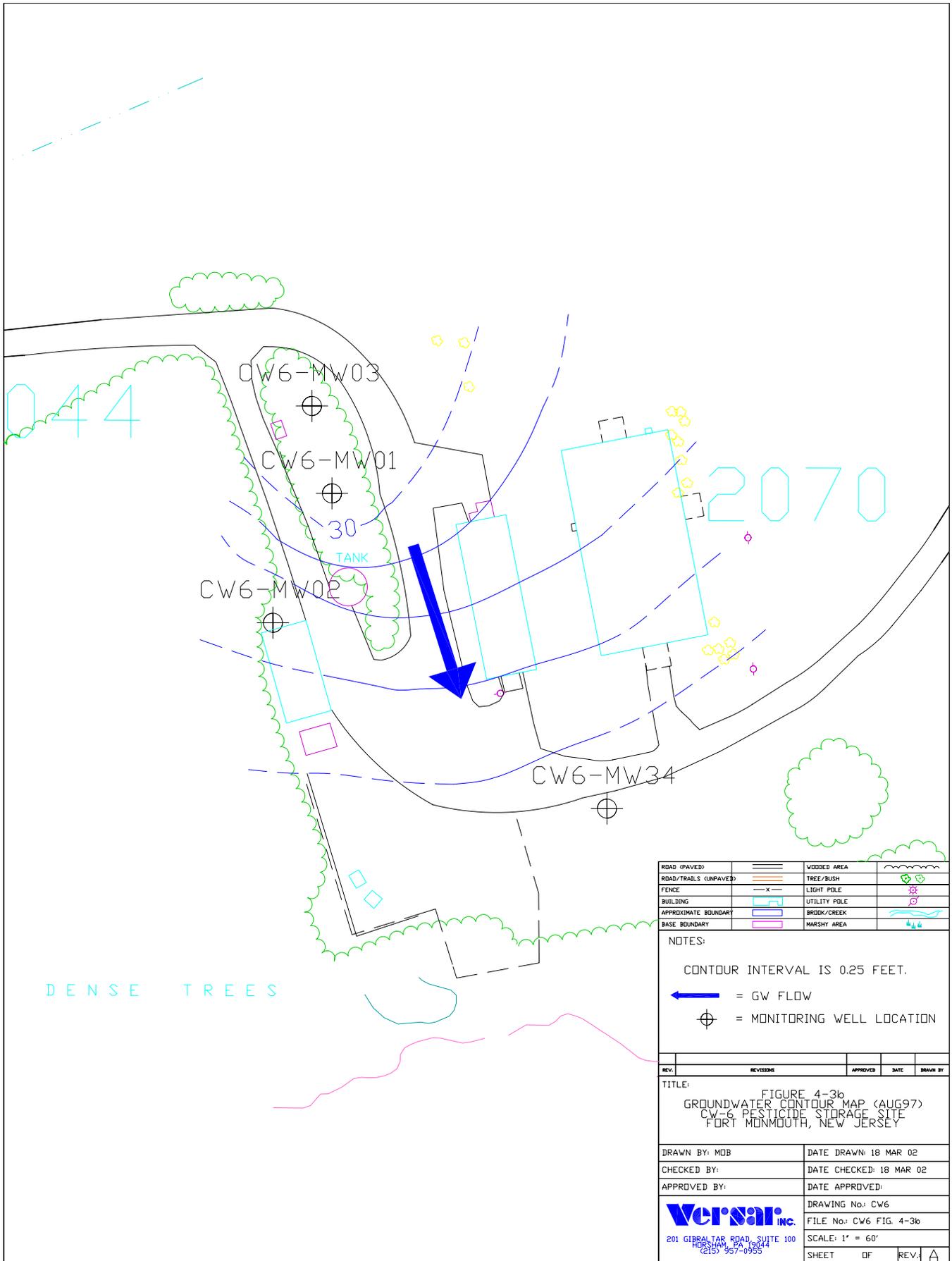
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3a GROUNDWATER CONTOUR MAP (APR97) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: MDB		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
 201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		DRAWING No.: CW6 FIG. 4-3a		
		FILE No.: CW6 FIG. 4-3a		
SCALE: 1" = 60'		SHEET	OF	REV.: A



ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

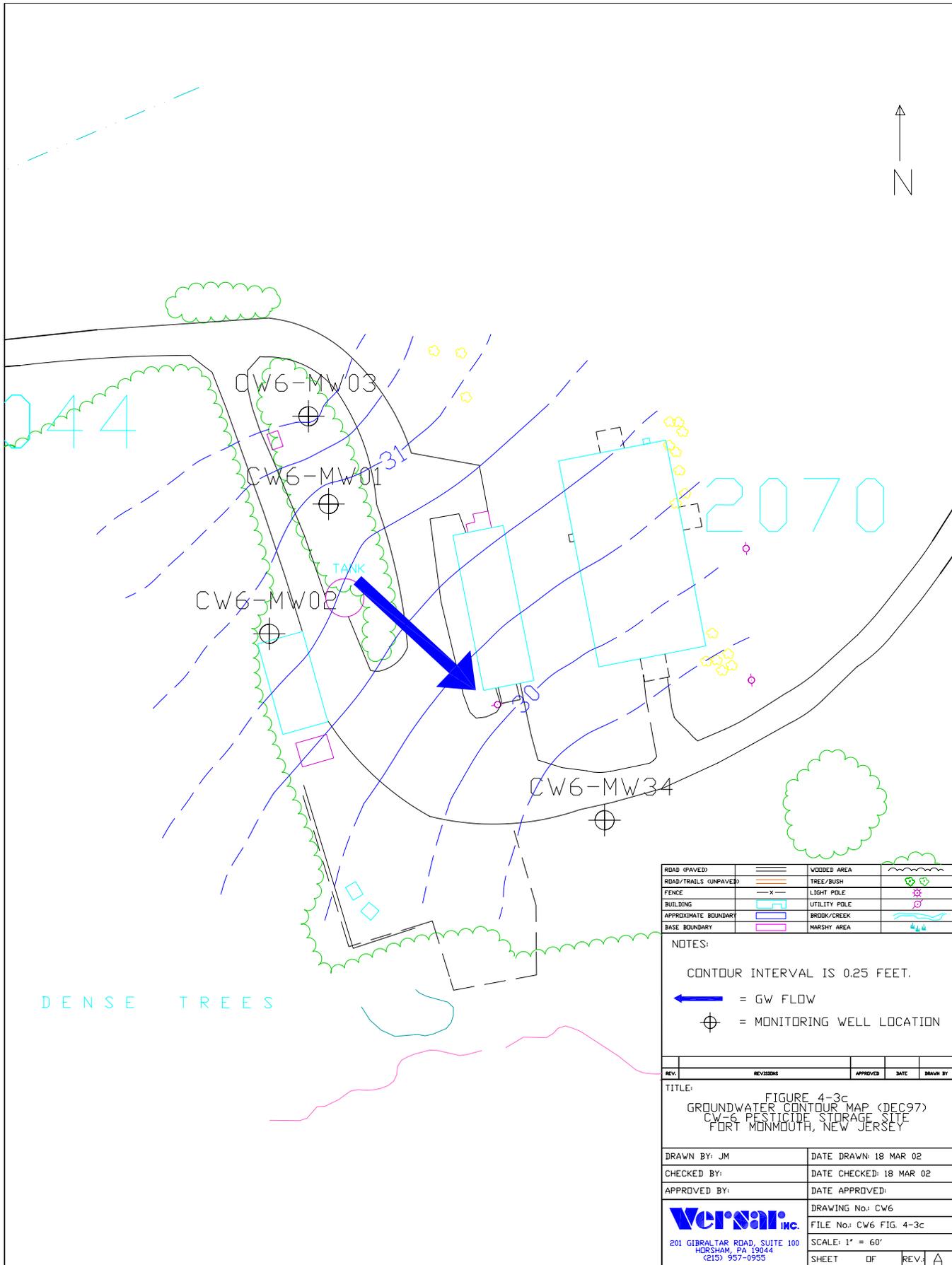
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV:	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3b GROUNDWATER CONTOUR MAP (AUG97) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: MDB		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
 201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		DRAWING No.: CW6		
		FILE No.: CW6 FIG. 4-3b		
		SCALE: 1" = 60'		
SHEET	OF	REV.	A	



DENSE TREES

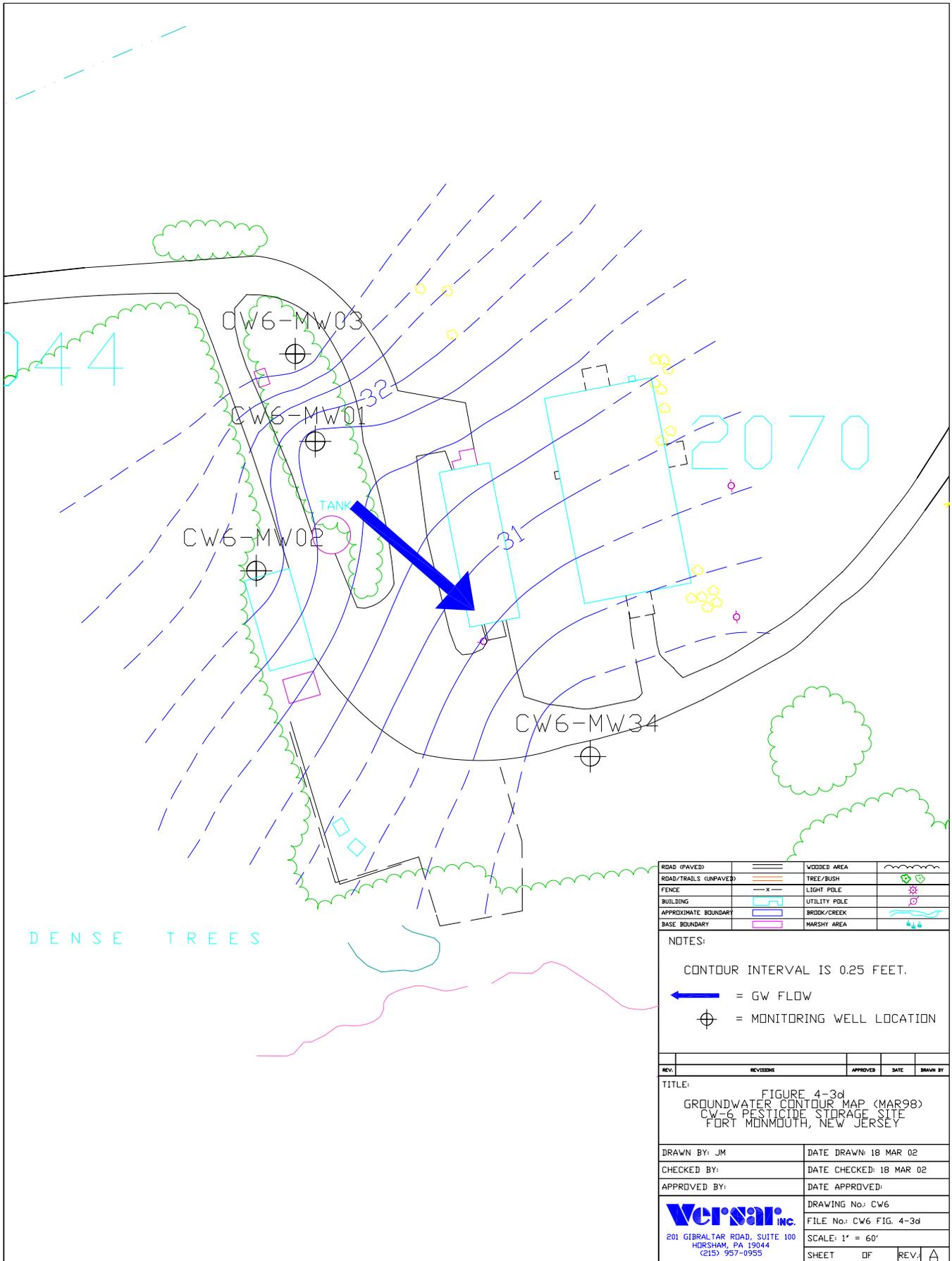
ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

- = GW FLOW
- = MONITORING WELL LOCATION

REV:	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3c GROUNDWATER CONTOUR MAP (DEC97) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
 201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		DRAWING No.: CW6		
		FILE No.: CW6 FIG. 4-3c		
SCALE: 1" = 60'		SHEET	OF	REV: A



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CW6-MW03

CW6-MW01

CW6-MW02

TANK

31

2070

CW6-MW34

DENSE TREES

ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

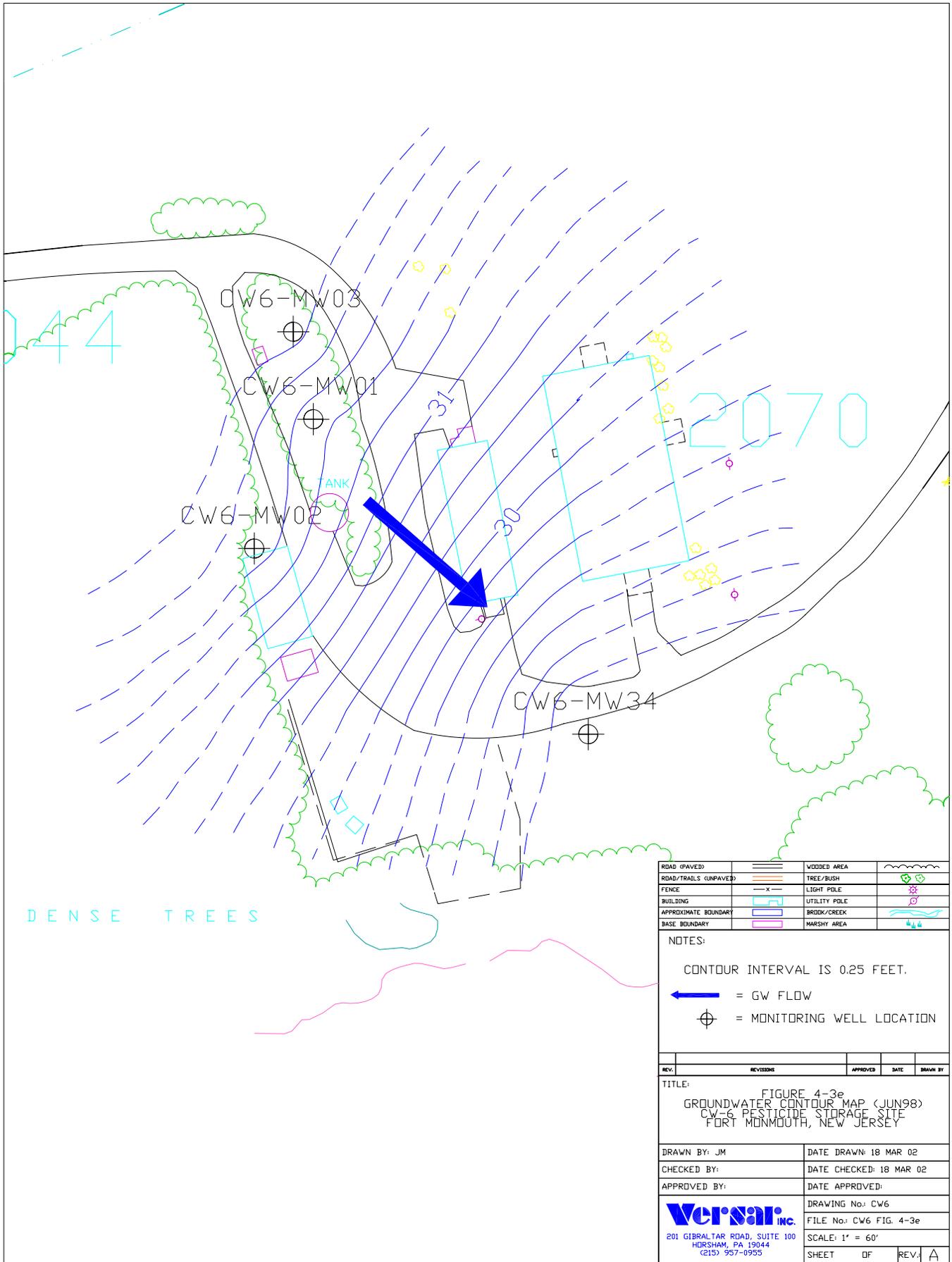
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3d GROUNDWATER CONTOUR MAP (MAR98) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6 FIG. 4-3d		
201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		SCALE: 1" = 60'		
SHEET	OF	REV.	A	



ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

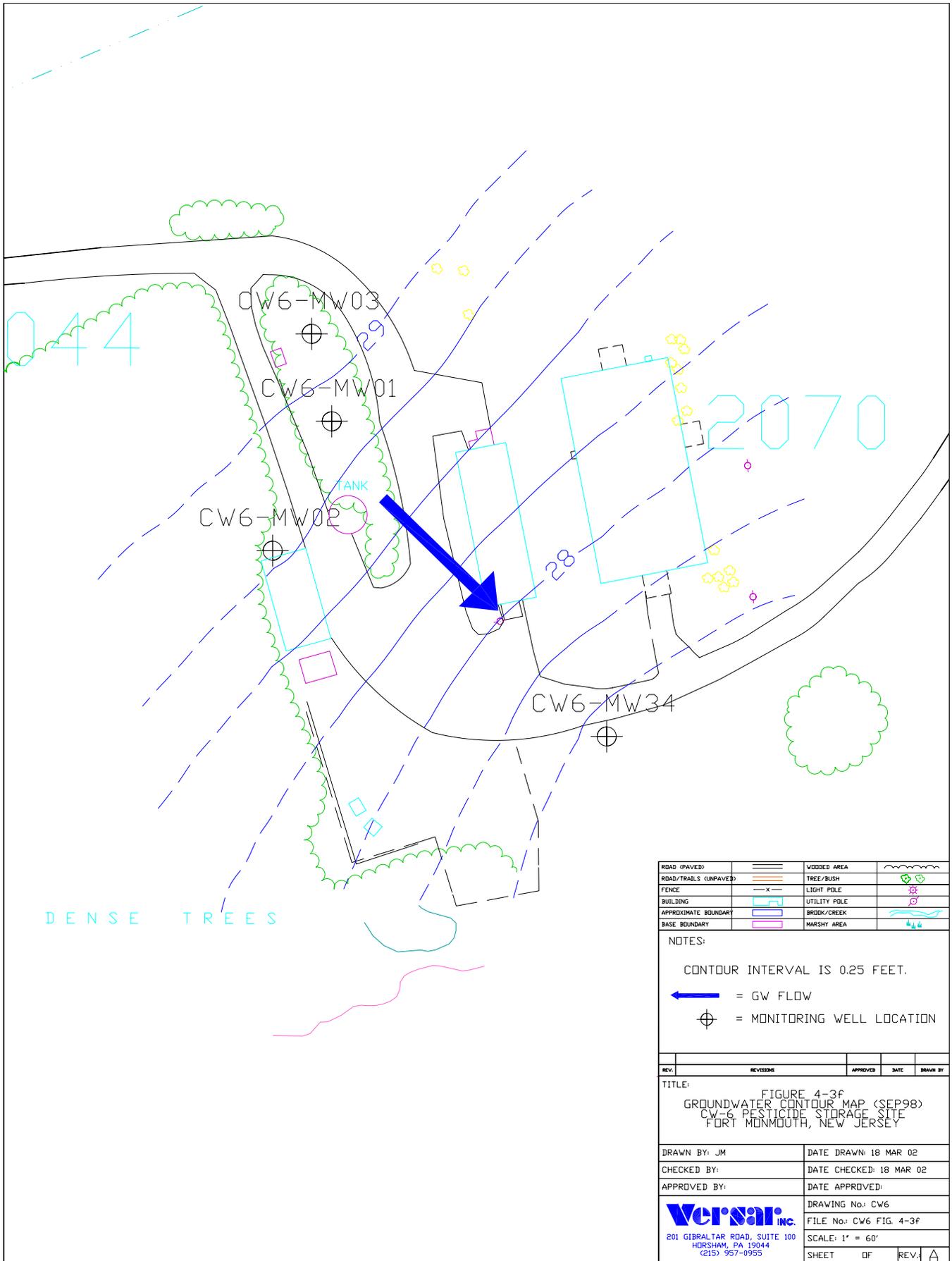
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3e GROUNDWATER CONTOUR MAP (JUN98) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6 FIG. 4-3e		
201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		SCALE: 1" = 60'		
SHEET	OF	REV.	A	



ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
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TITLE:  
 FIGURE 4-3F  
 GROUNDWATER CONTOUR MAP (SEP98)  
 CW-6 PESTICIDE STORAGE SITE  
 FORT MONMOUTH, NEW JERSEY

DRAWN BY: JM      DATE DRAWN: 18 MAR 02

CHECKED BY:      DATE CHECKED: 18 MAR 02

APPROVED BY:      DATE APPROVED:

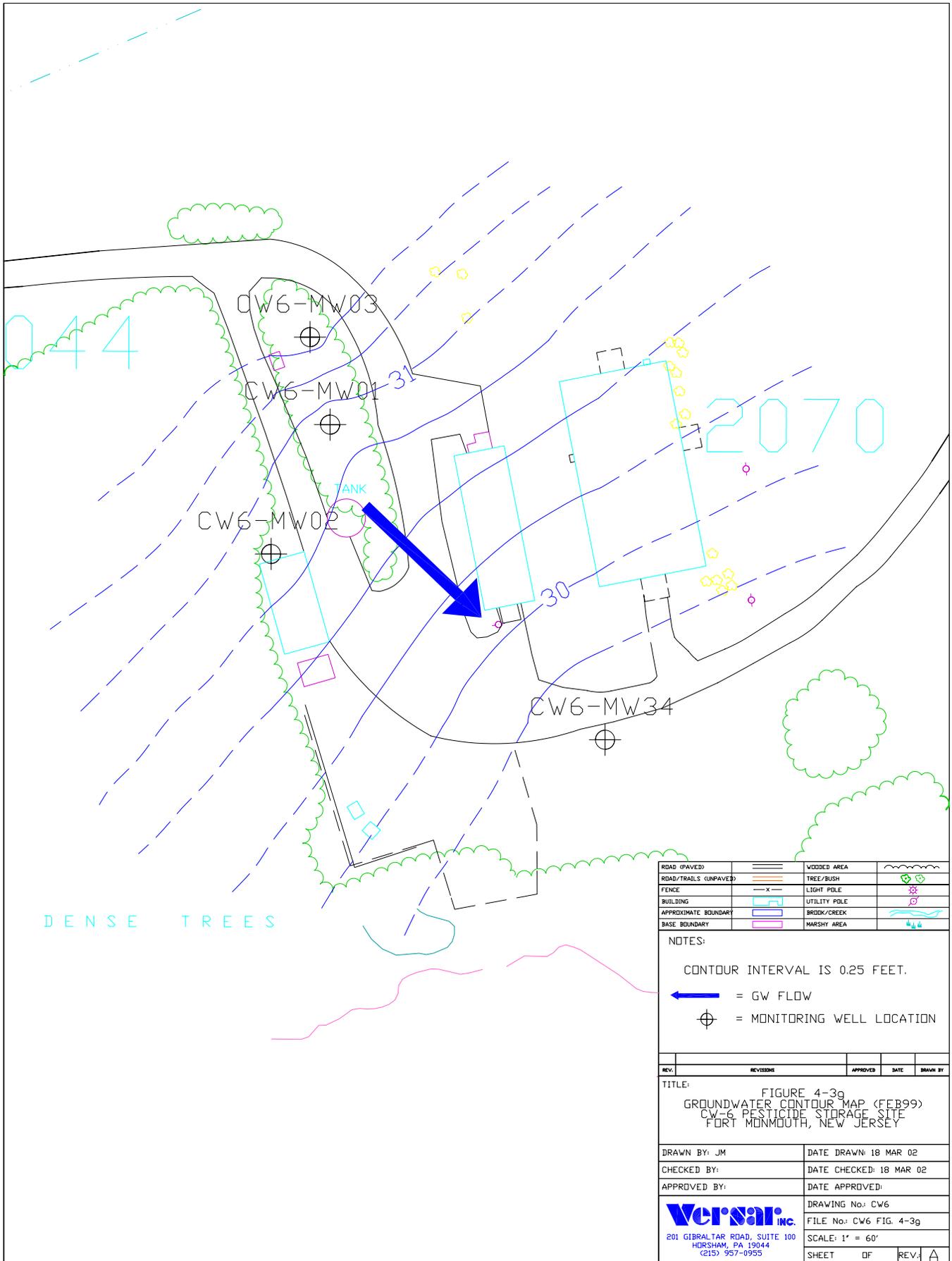
DRAWING No.: CW6

FILE No.: CW6 FIG. 4-3F

SCALE: 1" = 60'

**Versar** INC.  
 201 GIBRALTAR ROAD, SUITE 100  
 HORSHAM, PA 19044  
 (215) 957-0955

SHEET    OF    REV: A



044

2070

DENSE TREES

CW6-MW03

CW6-MW01

CW6-MW02

CW6-MW34

TANK

ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

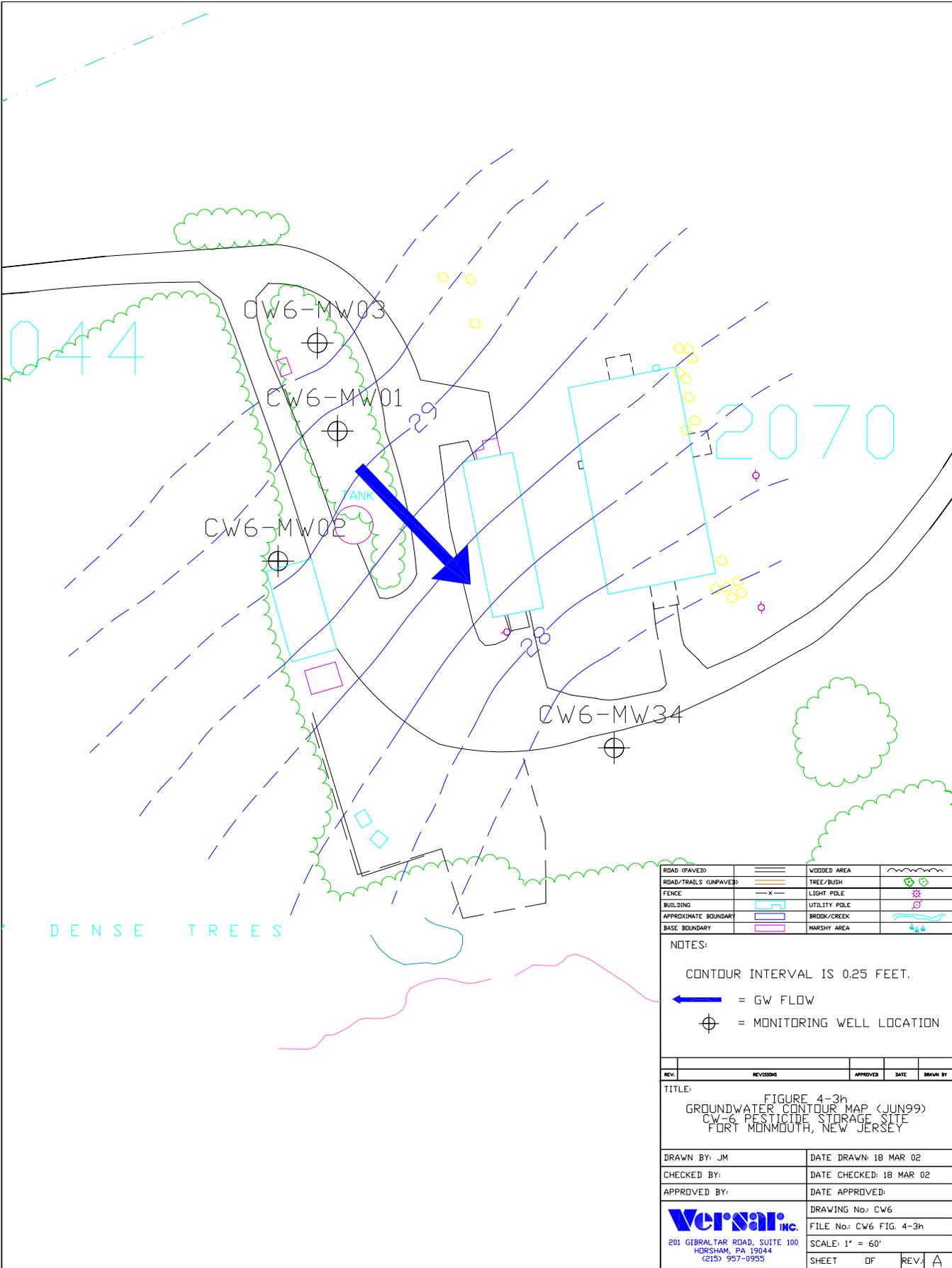
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3g				
GROUNDWATER CONTOUR MAP (FEB99)				
CW-6 PESTICIDE STORAGE SITE				
FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6 FIG. 4-3g		
201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		SCALE: 1" = 60'		
SHEET	OF	REV.	A	



ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

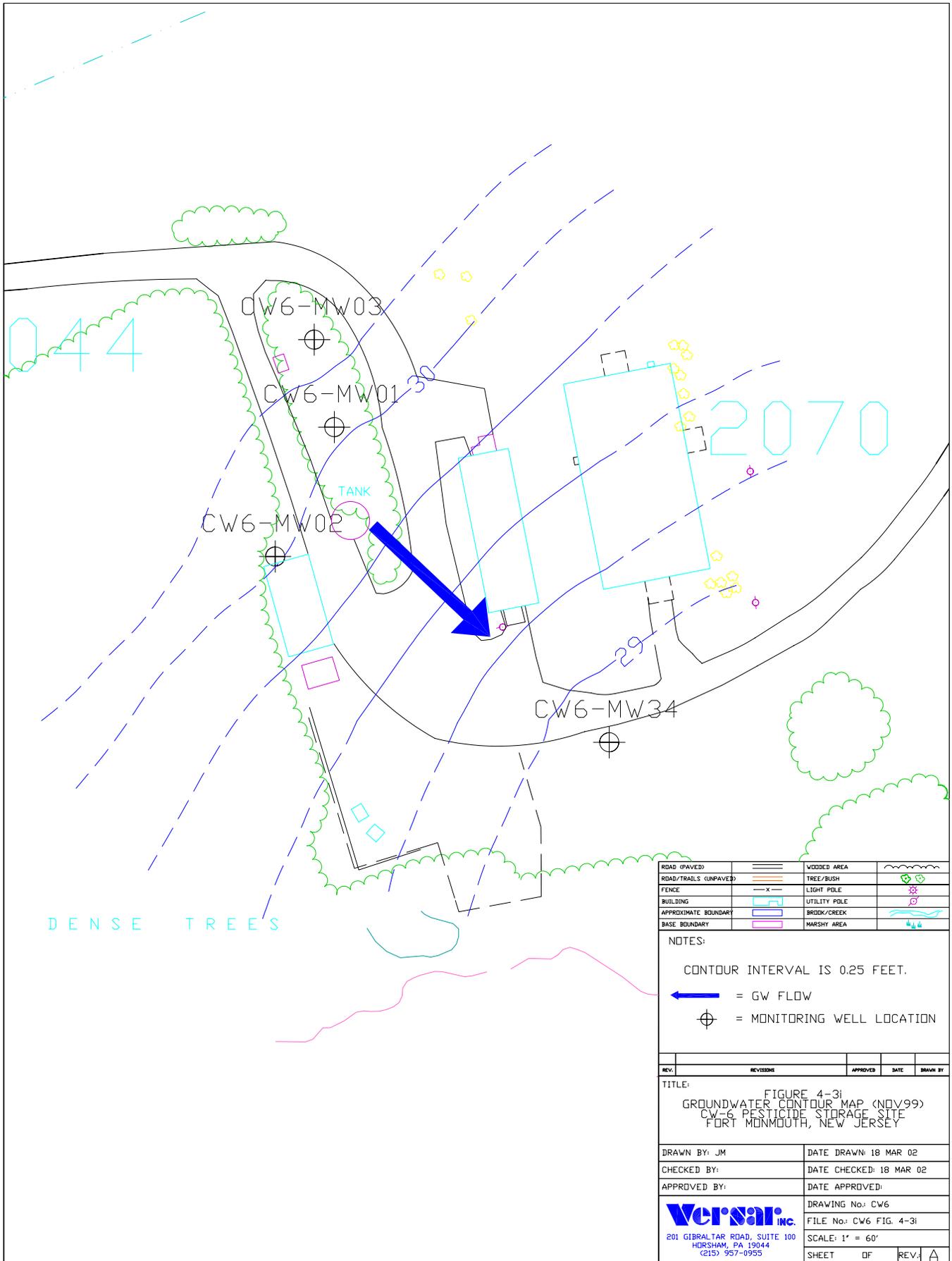
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3h GROUNDWATER CONTOUR MAP (JUN99) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6 FIG. 4-3h		
201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		SCALE: 1" = 60'		
SHEET	OF	REV.	A	



ROAD (PAVED)	WOODED AREA
ROAD/TRAILS (UNPAVED)	TREE/BUSH
FENCE	LIGHT POLE
BUILDING	UTILITY POLE
APPROXIMATE BOUNDARY	BROOK/CREEK
BASE BOUNDARY	MARSHY AREA

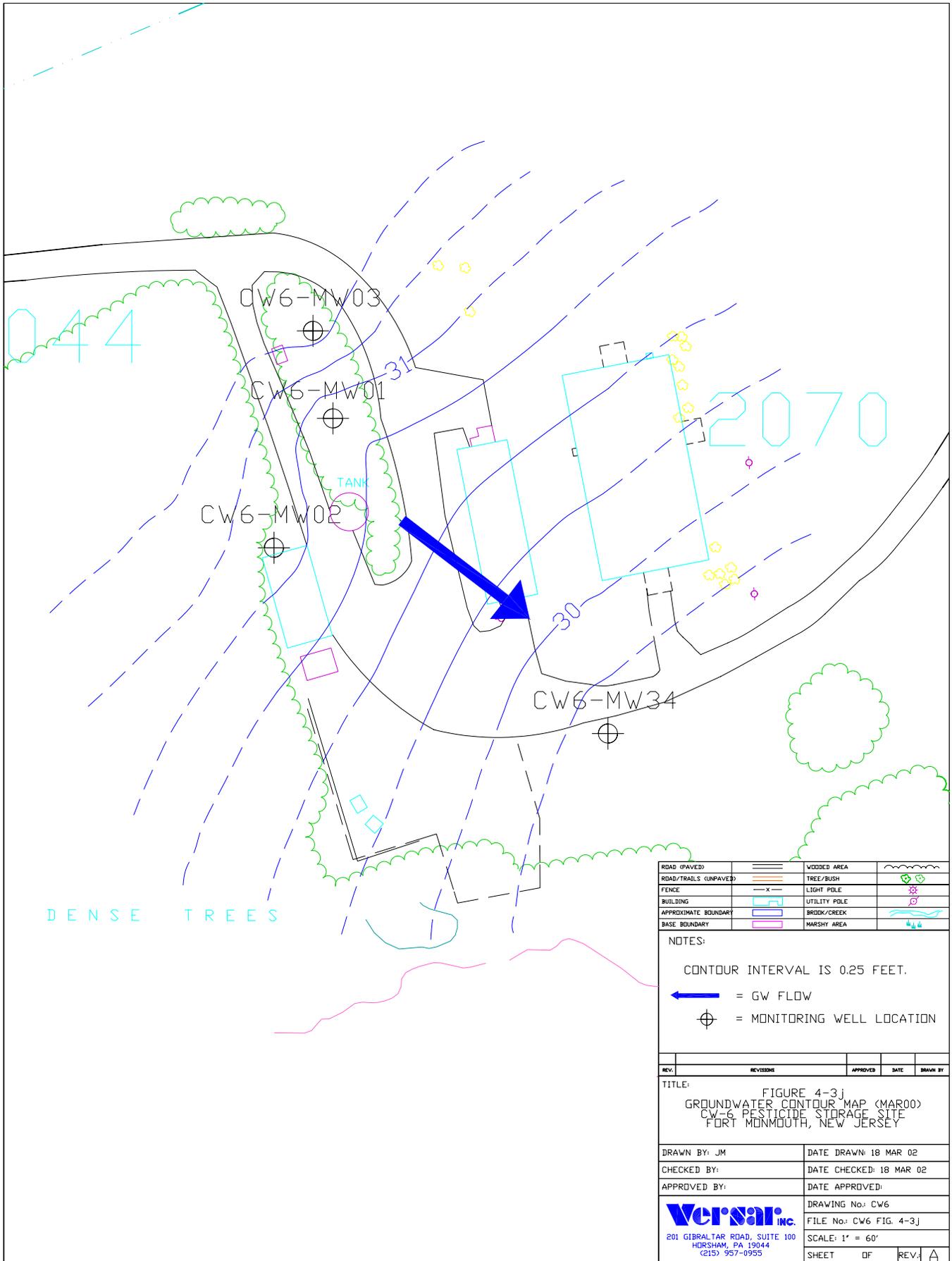
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-31 GROUNDWATER CONTOUR MAP (NOV99) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6 FIG. 4-31		
201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		SCALE: 1" = 60'		
SHEET	OF	REV.	A	



ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

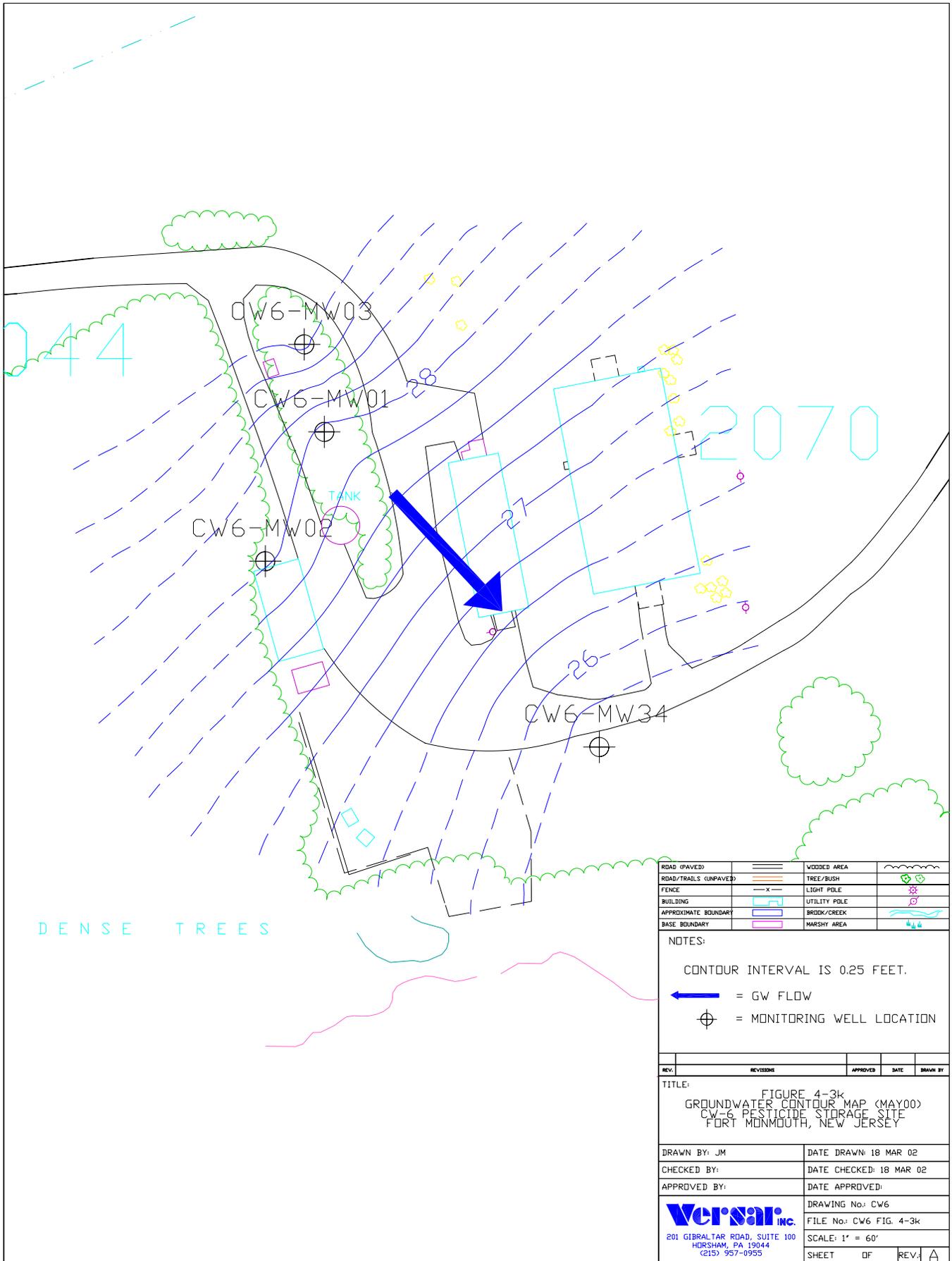
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3J GROUNDWATER CONTOUR MAP (MAR00) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6 FIG. 4-3J		
201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		SCALE: 1" = 60'		
SHEET	OF	REV.	A	



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2070

DENSE TREES

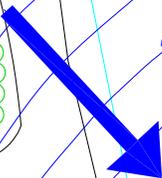
CW6-MW03

CW6-MW01

CW6-MW02

CW6-MW34

TANK



ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

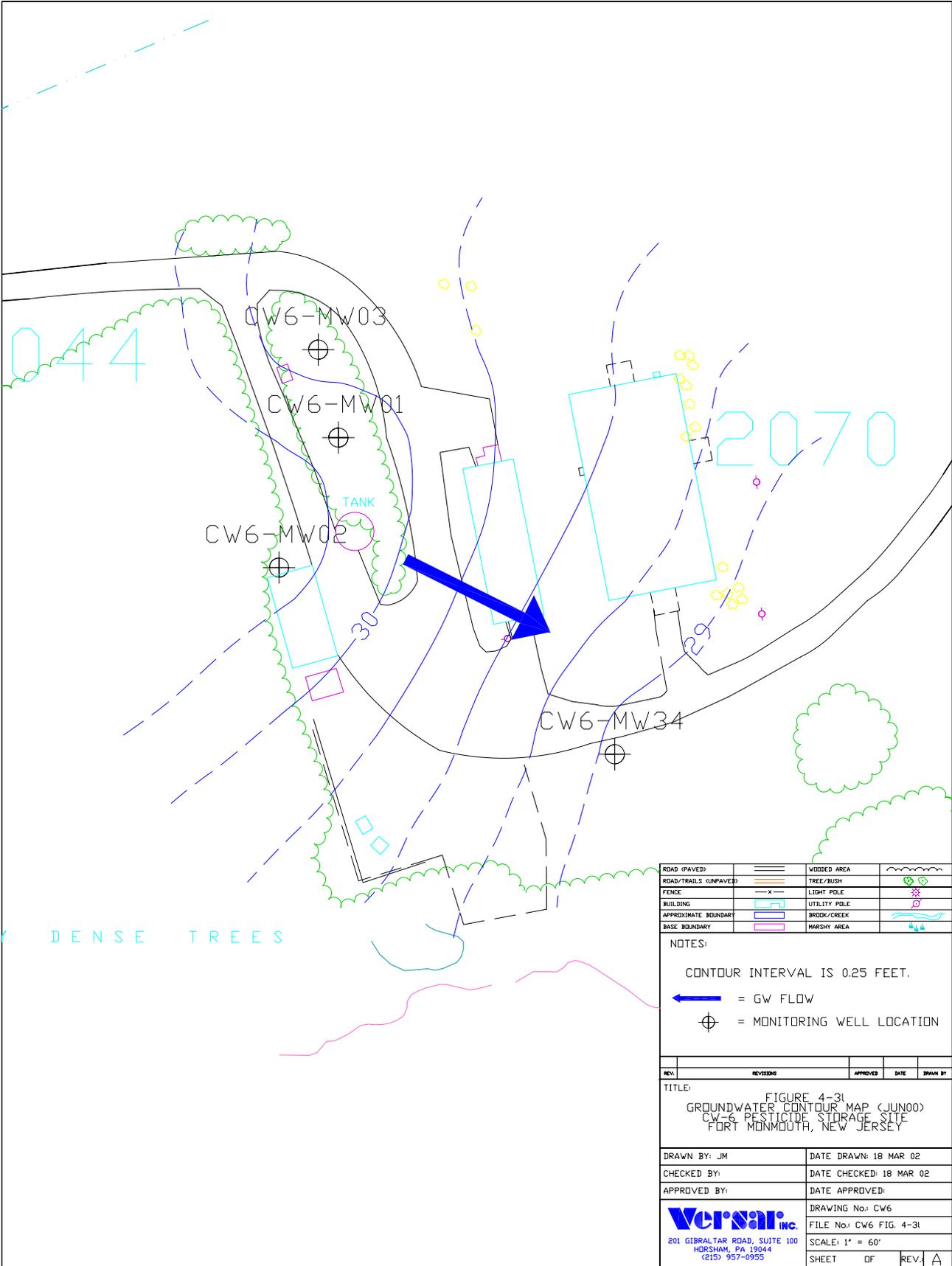
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3k GROUNDWATER CONTOUR MAP (MAY00) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6 FIG. 4-3k		
201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		SCALE: 1" = 60'		
SHEET	OF	REV.	A	



ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

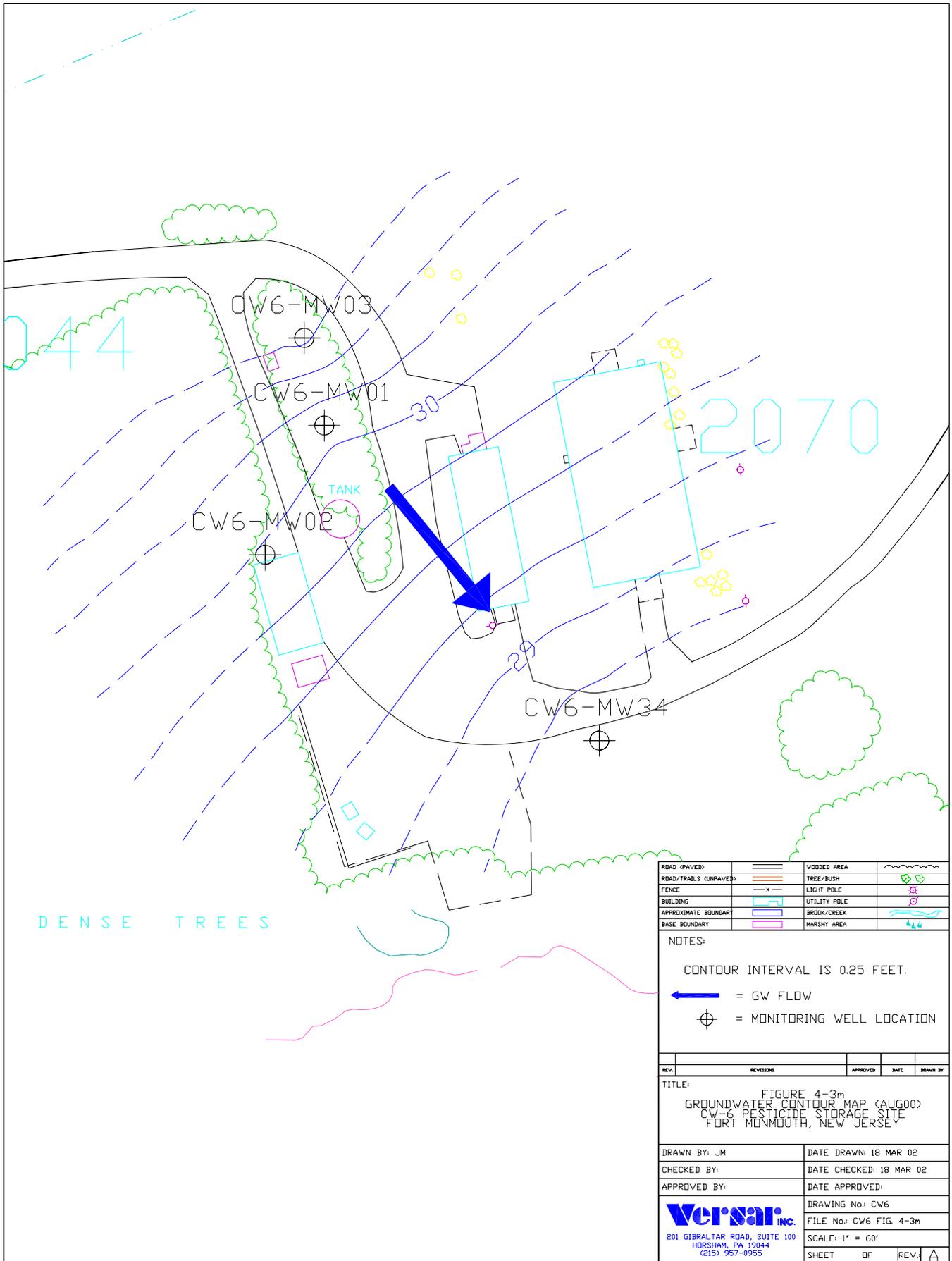
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-31 GROUNDWATER CONTOUR MAP (JUN00) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
 201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		DRAWING No.: CW6		
		FILE No.: CW6 FIG. 4-31		
		SCALE: 1" = 60'		
SHEET	OF	REV:	A	



DENSE TREES

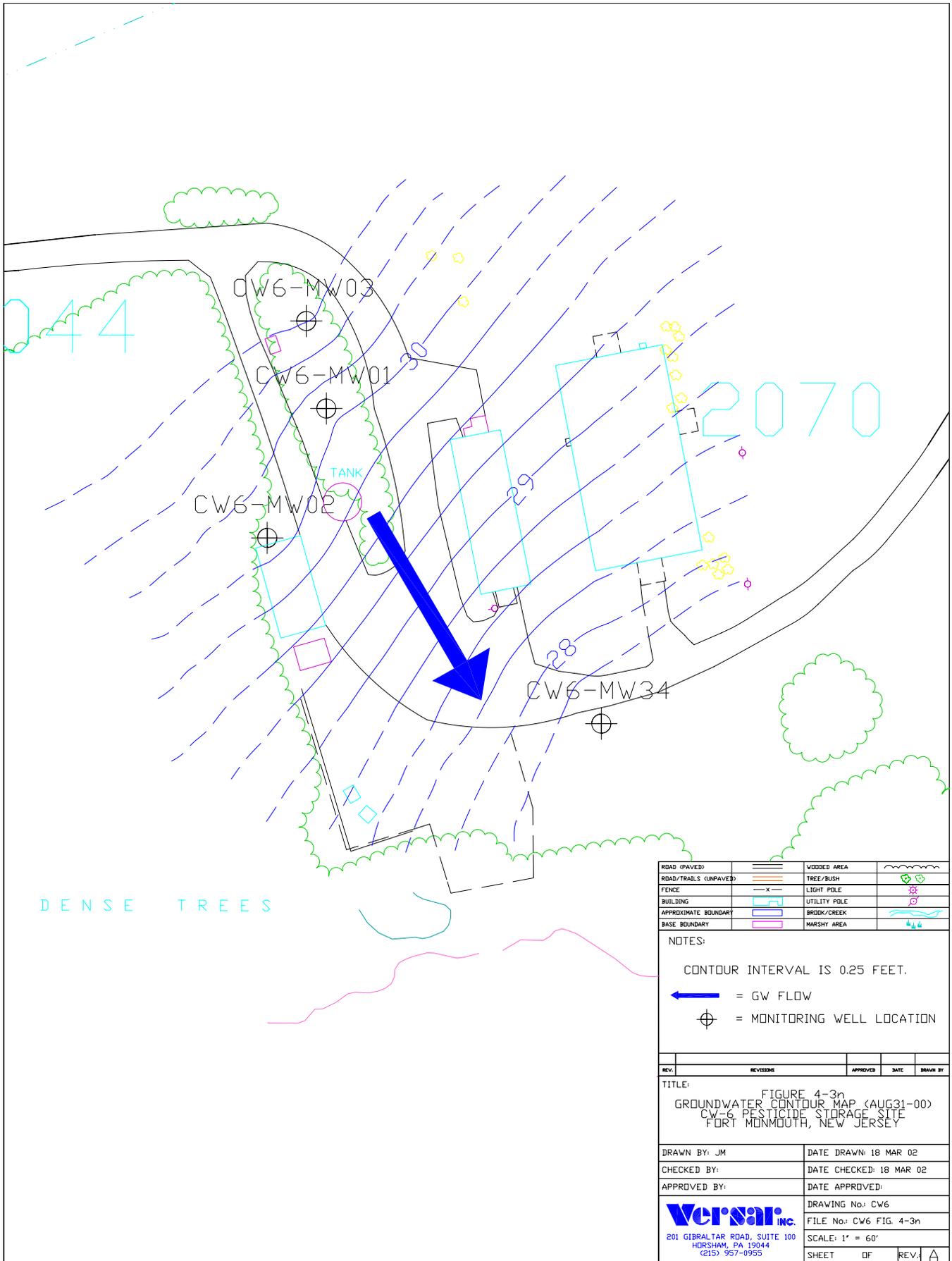
ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

- = GW FLOW
- = MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3m GROUNDWATER CONTOUR MAP (AUG00) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
 201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		DRAWING No.: CW6		
		FILE No.: CW6 FIG. 4-3m		
		SCALE: 1" = 60'		
SHEET	OF	REV.	A	



ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

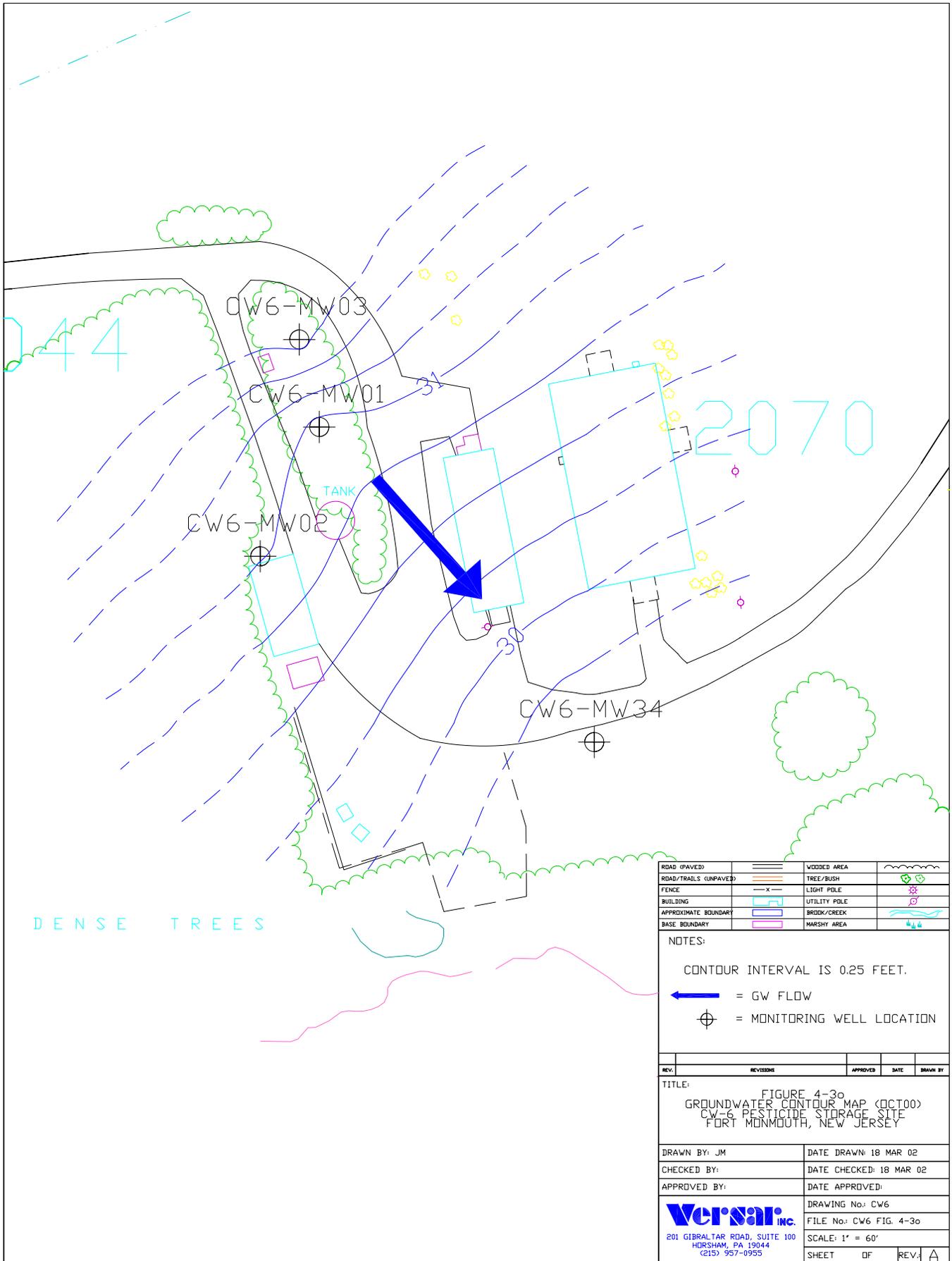
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3n GROUNDWATER CONTOUR MAP (AUG31-00) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6 FIG. 4-3n		
201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		SCALE: 1" = 60'		
SHEET	OF	REV.	A	



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2070

DENSE TREES

CW6-MW03

CW6-MW01

CW6-MW02

TANK

CW6-MW34

ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

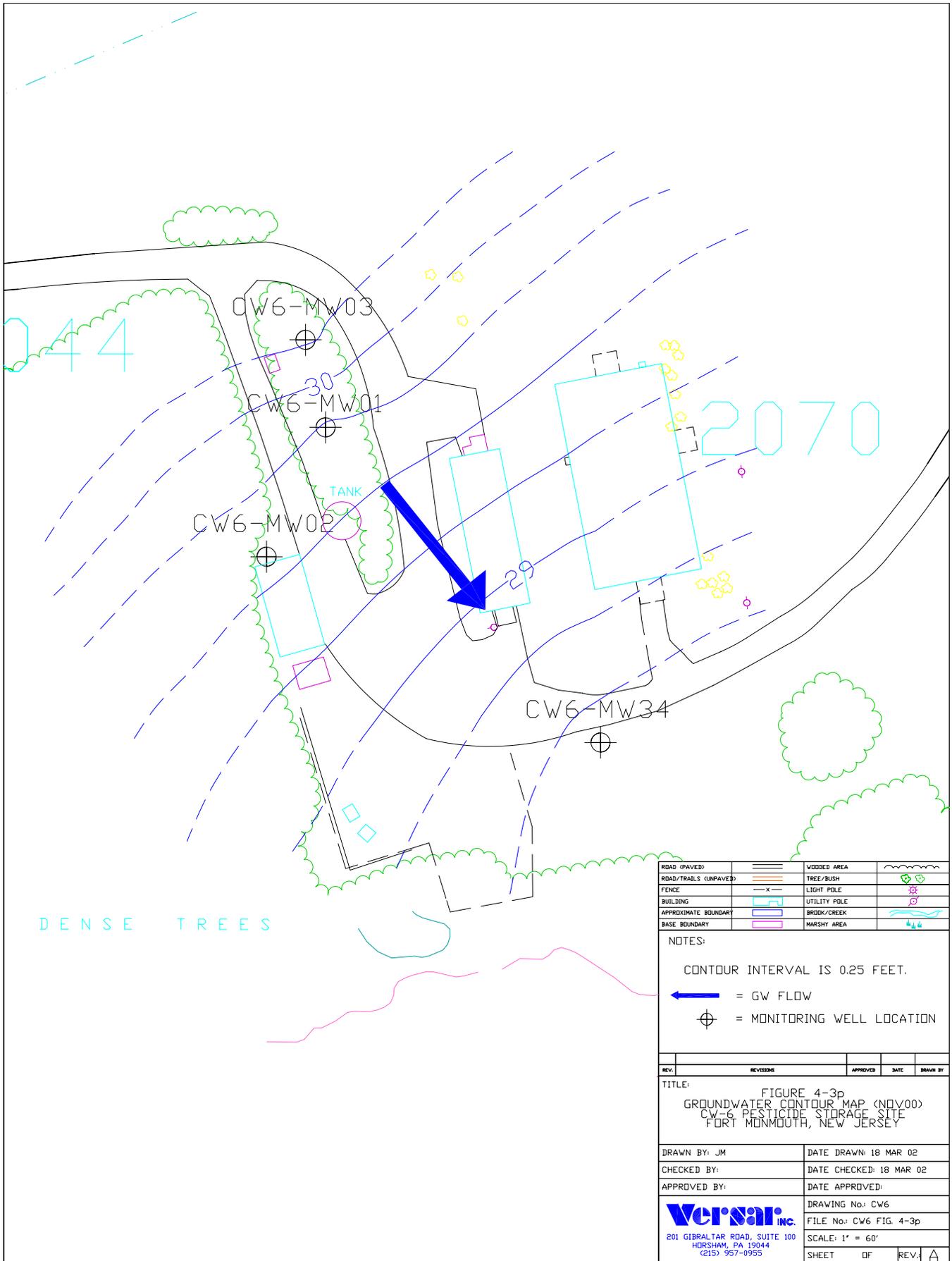
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3a GROUNDWATER CONTOUR MAP (OCT00) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6 FIG. 4-3a		
201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		SCALE: 1" = 60'		
SHEET	OF	REV.	A	



DENSE TREES

ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	

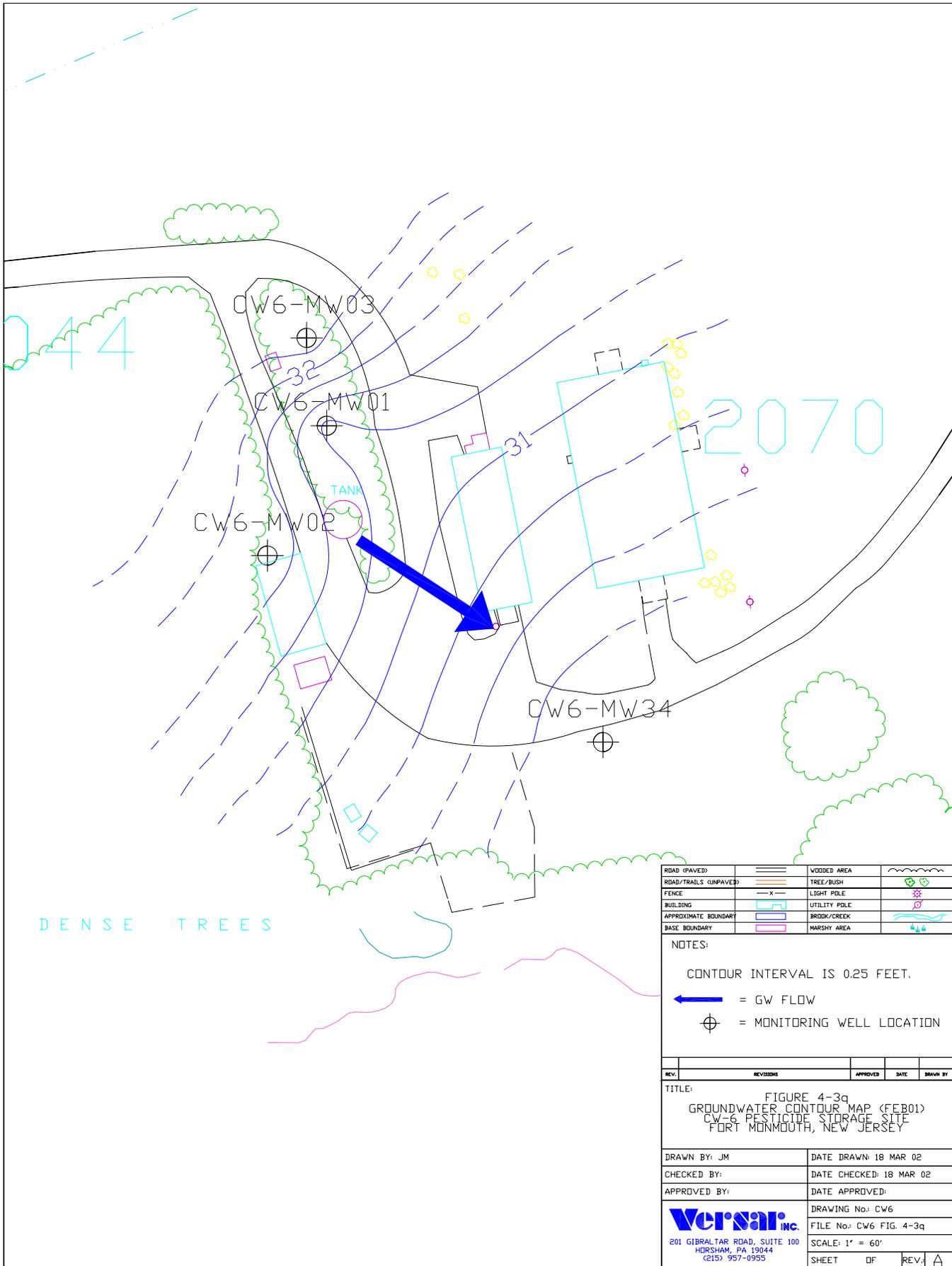
NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

= GW FLOW

= MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3p				
GROUNDWATER CONTOUR MAP (NOV00)				
CW-6 PESTICIDE STORAGE SITE				
FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6 FIG. 4-3p		
201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		SCALE: 1" = 60'		
SHEET	OF	REV.	A	



ROAD (PAVED)	———	WOODED AREA	~~~~~
ROAD/TRAILS (UNPAVED)	———	TREE/BUSH	⊕
FENCE	-x-	LIGHT POLE	⊕
BUILDING	□	UTILITY POLE	⊕
APPROXIMATE BOUNDARY	———	BROOK/CREEK	~~~~~
BASE BOUNDARY	———	MARSHY AREA	⊕

NOTES:

CONTOUR INTERVAL IS 0.25 FEET.

← = GW FLOW

⊕ = MONITORING WELL LOCATION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 4-3q GROUNDWATER CONTOUR MAP (FE801) CW-6 PESTICIDE STORAGE SITE FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JM		DATE DRAWN: 18 MAR 02		
CHECKED BY:		DATE CHECKED: 18 MAR 02		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: CW6		FILE No.: CW6 FIG. 4-3q		
201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 957-0955		SCALE: 1" = 60'		
SHEET	OF	REV.	A	

**APPENDICES**

## **Appendix A**

### **CW-6 Site Investigation, Roy F. Weston, Inc., 1995**

### **4.3.8 Pesticide Storage Building T-2044 (CW-6)**

#### **4.3.8.1 Site Location**

Building T-2044 is part of a small complex of buildings in the south-central portion of the Charles Wood area. The complex consists of Building T-2044, Building T-2070, and two metal igloos. The buildings are currently used to store golf course maintenance and landscaping equipment, such as mowers and tractors. The approximate area of site CW-6 is 25,000 ft<sup>2</sup> (0.6 acre).

#### **4.3.8.2 Site History**

The golf course maintenance complex may predate the purchase of the golf course by the Army. Pesticides and herbicides were formerly stored and mixed in this area. The IA contains a 1979 inventory of pesticides and herbicides that were used on the golf course and stored in Building T-2044. Some of the pesticides that were present in significant quantities are malathion, floriable sevin, resmethrin, Borocel IV, chlordane, and Dibrom. The IA also discusses a pest control program that was in effect in 1979. The compounds that were used in large quantities include carbaryl (sevin), malathion, chlordane, and diazinon. Some of the herbicides mentioned in the IA include 2,4-D, Dacthal, 2,4,5-T, and sodium arsenite.

The course groundskeeper, who has been part of the grounds crew for 33 years (1960 to 1993), said pesticides and herbicides were kept in a metal igloo and were mixed in two areas marked A and B in Figure 4.3-13. Area A is on a currently grass-covered area south of the igloo. At area A two USTs were excavated and the chlordane-contaminated soil was disposed of in spring 1995. Area B is on pavement near the office door in T-2044. This paved area has a drain that empties into a ditch in the woods immediately behind T-2044. The supervisor said that pesticide containers were not rinsed, but were disposed of to the landfill as is. Prior to 1980, the containers would have been disposed of at a landfill on the Main Post, such as site M-8.

Pesticides and herbicides are not currently stored or mixed on-site. The facility has hired an outside contractor to come in and apply pesticides and herbicides.



#### 4.3.8.3 Sampling Effort

Limited sampling in 1989 determined that NJDEP SCC were exceeded in one soil sample. The sampling report did not clearly identify the location of the sample.

To confirm the existence of contamination and evaluate the effect on groundwater, two soil borings were completed at locations where pesticides mixing was believed to have occurred. These locations are just north of Building T-2044 (SB-02) and just south of the pavement that extends in front of Building T-2044 (SB-34). The borings were advanced to the water table and soil samples were taken at 6 to 12 inches and at 2 feet and analyzed for TCL +30 parameters. One surface soil sample was taken in the runoff ditch that runs into the woods southwest of Building T-2044 (Figure 4.3-13).

One monitor well was installed in these borings (MW-34), shown in Figure 4.3-13, and groundwater samples were collected in two sampling rounds and analyzed for TCL +30 parameters. Furthermore, a pre-existing monitor well (MW-01) was sampled twice for TCL +30 parameters in an effort to further evaluate the nature and extent of contamination on site groundwater quality.

The location of the monitor well proposed in the CDAP (MW-35) at site CW-6 was moved to site CW-9 because an existing monitor well was located near the proposed well location.

#### 4.3.8.4 Hydrogeologic Interpretation

The lithologic logs from MW-34 indicate that the lithology consists of a thin soil cover (0.3 ft) underlain by a brown fine-medium-grained sand with olive-brown sand laminae. Saturation was observed at approximately 4 ft bgs. Monitor well MW-34 was screened across the water table and was drilled to 14.5 ft bgs. Water-level elevation data, measured on 6 March 1995, prior to the March sampling round, indicate that local groundwater flow is east toward site CW-9 (Figure 4.3-14).

The following subsections summarize the soil and groundwater analytical results for site CW-6.

#### **4.3.8.5 Soil Sampling Results**

A total of four soil samples were collected: two in the MW-34 borehole, one in SB-02, and one in SS-01. The soil samples were analyzed for the parameters listed in Table 3.6-1. Sample depths of soil borings were 0 to 2 and 2 to 4 ft bgs in SB-34 and 0.5 to 1 ft bgs in SB-02. The surface soil sample was collected from 0 to 0.5 ft bgs. The analytical results for site soils at specific sampling intervals are listed in Appendix D. Table 4.3-10 compares the detected compounds with the NJDEP SCC, and then compares the results with the site-specific and Monmouth County maximum background concentrations, where appropriate.

##### **VOCs**

VOCs were not detected in site soil.

##### **SVOCs**

SVOCs were not detected above laboratory quantitation limits in site soil.

##### **Pesticides/PCBs**

Seven pesticides were detected above laboratory quantitation limits in either SB-34, SB-02, and SS-01 from predominantly the 0- to 2-ft bgs sampling interval. In addition, one compound (dieldrin) was detected in a concentration exceeding the NJDEP SCC and background in SB-34 (0 to 2 ft bgs). Subsequently, dieldrin was not detected in groundwater samples from MW-34. Three of the compounds detected were below the NJDEP SCC and three do not have established criteria. PCBs were not detected in site soil. Figure 4.3-15 presents the locations of compounds detected above maximum background and the NJDEP criteria.

**Table 4.3-10**  
**Fort Monmouth - Charles Wood**  
**Summary of Detected Compounds**  
**In Soil at Site CW-6**

COMPOUND	METHOD DETECTION LIMIT  (mg/kg)	RESIDENTIAL DIRECT CONTACT SOIL CLEANUP CRITERIA  (mg/kg)	MAXIMUM BACKGROUND CONCENTRATION  (mg/kg)	ANALYTICAL RESULTS			
				SB34-A01 1/3/95 (0-2 ft bgs)	SB34-A02 1/3/95 (2-4 ft bgs)	SB02-A01 5/10/95 (0.5-1 ft bgs)	SS01-A01 11/30/94 (1)
<b>SVOC's (mg/kg)</b>							
Phenanthrene	0.165	NLE	ND	ND	0.24 J	ND	ND
Fluoranthene	0.198	2300	0.042 J	0.049 J	0.18 J	ND	ND
Pyrene	0.178	1700	0.048 J	0.056 J	0.270 J	ND	ND
Benzo(a)anthracene	0.162	0.9	0.046 J	ND	0.160 J	ND	ND
Chrysene	0.145	9	0.083 J	ND	0.15 J	ND	ND
Benzo(b)fluoranthene	0.188	0.9	0.078 J	ND	0.11 J	ND	ND
Benzo(a)pyrene	0.162	0.66	0.047 J	ND	0.087 J	ND	ND
Indeno(1,2,3-cd)pyrene	0.234	0.9	ND	ND	0.054 J	ND	ND
Benzo(g,h,i)perylene	0.224	NLE	0.042 J	0.057	0.066	ND	ND
<b>PESTICIDES (mg/kg)</b>							
Heptachlor epoxide	0.002	NLE	ND	0.018 P	ND	0.0078 P	0.032 R
Dieldrin	0.0039	0.042	ND	<b>0.061 DP</b>	ND	ND	ND
alpha-Chlordane	0.002	NLE	ND	0.14 P	0.0034 P	.07 JD	0.870 CD
gamma-Chlordane	0.002	NLE	ND	0.11 P	0.0027 P	.068 JD	0.800 CD
4,4'-DDE	0.0037	2	0.071	0.074 P	ND	0.34 JCD	0.13
4,4'-DDD	0.0037	3	0.053	0.0095 P	ND	2.9 CD	0.86 C
4,4'-DDT	0.0037	2	ND	0.180 P	.011 P	ND	0.81 C
<b>METALS TOTAL (mg/kg)</b>							
Aluminum	3.9	NLE	15700	NS	NS	NS	5130
Barium	0.35	20	31.6	NS	NS	NS	11.6
Boron	0.17	700	26	NS	NS	NS	72.2
Calcium	2.2	NLE	653	NS	NS	NS	4430
Cadmium	0.86	1	0.135 <sup>2</sup>	NS	NS	NS	4.4
Chromium	1.6	500	128	NS	NS	NS	65.8
Copper	2.2	600	7.27 <sup>2</sup>	NS	NS	NS	69.8
Iron	0.58	NLE	45500	NS	NS	NS	10900
Lead	0.4	400 <sup>2</sup>	15.1 <sup>2</sup>	NS	NS	NS	203
Magnesium	9.6	NLE	3960	NS	NS	NS	1260
Manganese	0.18	NLE	120 <sup>2</sup>	NS	NS	NS	78.8
Mercury	0.49	.14	ND	NS	NS	NS	6
Potassium	(12.3-25.8)	NLE	10600	NS	NS	NS	1420
Silver	0.54	110	0.26 <sup>2</sup>	NS	NS	NS	1.5
Sodium	3.8	NLE	56.8	NS	NS	NS	103
Selenium	0.3	63	0.85	NS	NS	NS	0.7
Vanadium	0.53	370	59.6	NS	NS	NS	21.8
Zinc	0.41	1500	55.6	NS	NS	NS	463

Compounds exceeding NJDEP soil cleanup criteria are bolded

NA - Not Analyzed; NS - Not Sampled

ND - Compound was not detected at or below the quantification limits

J - Indicates that the concentration value was estimated due to detection at or near the quantification limits

NLE - No Level Established

C - Pesticide identification was confirmed by GC/MS

D - Surrogate or matrix spike recoveries were not obtained because the extract was diluted for analysis

P - The percent difference between the results from two GC columns is greater than 25%, the lower of the two values is reported

R - Data rejected, URS The Data Validator

Note: MDL's for metal analysis is actually the highest detection limit with potassium given as a range due to high variability.

Note: Metals were analyzed (SS-01), but were not proposed in the scope of work.

(1) - VOC/SVOC's were collected from 6" to 12" bgs, pesticides and metals were collected from 0"-6" bgs.

<sup>2</sup> - Monmouth County maximum background concentrations.

<sup>3</sup> - Cleanup criteria are referenced in Site Remediation News, Winter 1995.

## Metals

As indicated in Table 4.3-10, of the 18 metals detected in site soils, only cadmium was found in a concentration exceeding the NJDEP SCC in SS-01. In addition, cadmium was detected in a concentration greater than that determined for site-specific and Monmouth County maximum background at Charles Wood. However, in accordance with the NJDEP *Cleanup Standards for Contaminated Sites* (NJDEP, 1992), the arithmetic mean of cadmium was calculated from the 10 surface soil samples at sites CW-6 and CW-9, since the samples were collected within the same sampling interval (0 to 6 inches). The arithmetic mean or concentration was then compared with the NJDEP SCC and established background. The arithmetic mean (1 mg/kg) was found at a level equal to the NJDEP SCC (1 mg/kg). However, sites CW-06 and CW-09 are located on a golf course. *A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersey*, 1993, provides a separate background concentration level for cadmium in golf course areas. When comparing the arithmetic mean of the analytical results at the two sites with the arithmetic mean for cadmium on golf courses in Table 9 of that document (2.26 mg/kg), the analytical result is found in a concentration below established background. Cadmium is reported in higher concentrations on golf courses due to the direct application of fertilizers, herbicides, and pesticides (Field et al., 1993). Therefore, cadmium is not considered a compounds of concern. Although metals were sampled for in surface soil location SS-01, a metals analysis was not proposed in the original scope of work.

### **4.3.8.6 Groundwater Sampling Results**

Monitor wells MW-34 and MW-1 were sampled for the analytical parameters listed in Table 3.8-1. The analytical results for groundwater samples from the individual sampling rounds are listed in Appendix D. Table 4.3-11 compares the average concentrations of the detected compounds from the February and March sampling rounds with the NJDEP GWQC, and then compares the results with the subsequent site-specific and Monmouth County maximum background concentrations, where appropriate.

**Table 4.3-11**  
**Fort Monmouth - Charles Wood**  
**Summary of Average Concentrations of Detected**  
**Compounds in Groundwater - Site CW-6**

COMPOUND	METHOD DETECTION LIMIT (µg/L)	NJDEP GROUNDWATER QUALITY CRITERIA (µg/L)	MAXIMUM BACKGROUND CONCENTRATION (µg/L)	ANALYTICAL RESULTS (µg/L)	
				SAMPLING DATE	
				MW34 2/10/95, 3/13/95 (avg.)	MW01 5/10/95, 5/27/95 (avg.)
<b>VOC (µg/L)</b>					
Benzene	2.4**	1*	ND	ND	8
Ethylbenzene	3.1	700	ND	ND	1J
Xylene (total)	3.8	40	ND	ND	2J
<b>Pesticide and PCB's (µg/L)</b>					
4,4'-DDD	0.097	0.1	ND	ND	0.086J
gamma-chlordane	0.046	NLE	ND	ND	.035JP
alpha-chlordane	0.046	NLE	ND	ND	0.0545

Compounds exceeding NJDEP groundwater quality criteria are noted by bold numbers.

NJDEP groundwater quality criteria consist of the higher number between the PQL or STANDARD

\*PQL - Practical Quantitation Limit - was used as the NJDEP groundwater quality criteria

ND - Indicates that the compound was not detected

J - Indicates that the concentration value was estimated due to detection at or near the detection limits

\*\* - Method detection limit exceeded NJDEP groundwater quality criteria

P - Percent difference between the results from the GC columns is greater than 25%, the lower of the two values is reported

### VOCs

One VOC (benzene) was detected above the laboratory quantitation limit in MW-1 from the February sampling round only. In addition, benzene was found in a concentration exceeding the NJDEP GWQC. Figure 4.3-15 presents the locations of the compounds detected above both background and criteria.

### SVOCs

SVOCs were not detected above laboratory quantitation limits in site monitor wells MW-34 and MW-1 from either sampling round. In addition, SVOCs were detected below the NJDEP GWQC.

### Pesticides/PCBs

One pesticide (alpha-chlordane) was detected in a concentration slightly above the laboratory quantitation limit in MW-1; however, NJDEP GWQCs are not established for alpha-chlordane. PCBs were not detected in site monitor wells from either sampling round.

#### **4.3.8.7 Recommendations**

The pesticide dieldrin and the metal cadmium were detected in the soil at two different locations, each at levels that exceeded NJDEP SCC and background. However, the average concentrations of dieldrin and cadmium in surface soil samples at CW-6 and CW-9 did not exceed the NJDEP SCC. Cadmium is typically present at elevated levels at golf courses. Groundwater samples indicated that benzene was detected in the existing monitor well (MW-1), which is attributed to a previously removed UST. Benzene was not detected in downgradient wells. Pesticides were not detected in any groundwater samples above NJDEP criteria.

NJDEP groundwater criteria were exceeded for one VOC, but the measured value was just slightly above the GWQC. Therefore, no immediate remedial action is necessary.

DPW proposes that a long-term groundwater monitoring program be developed and implemented for the site. Aqueous samples would be collected and analyzed on a quarterly basis to further

evaluate water quality conditions at the site. Groundwater samples would be collected from existing monitor wells. Compounds of concern identified in the first two rounds of sampling would be targeted for the monitoring program.

## **Appendix B**

### **Boring Logs and Monitoring Well Construction Records**

# Borehole Log

Roy F. WESTON, Inc.

PROJECT : FT. MONMOUTH	TOTAL DEPTH : 14.50
SITE NAME : CHARLES WOOD AREA 6	LOGGER : K VALENTI
BORING ID : CW6-MW34	DRILLING COMPANY : J.C. ANDERSON
NORTHING : 0.0000 estimated	DRILLING RIG : CME-55
EASTING : 0.0000 estimated	DATE STARTED : 01/03/95
ELEVATION : 0.000 estimated	DATE COMPLETED : 01/03/95

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			25	Silty sand with gravel, SM	BROWN	LSE	MST	10 10 10 11	HNU 0.0	Fill(?) Collected sample CW06-SB34-A01. 3" SPS used.
-1	1			No Sample Recovered						
-2	2		100	Poorly graded sand, SP	GRAYISH BROWN	LSE	WET	15 18 17 21	HNU 0.0	Fill(?). 3" SPS used. Collected samp. CW06-SB34 A02. Wet @ 2' bgs. Sands coarsens down. Fe stain.
-3	3									
-4	4		100	Poorly graded sand, SP	OLIVE GREEN-BRO	LSE	SAT	3 4 4	HNU 0.0	Colors: 4-5' olive green, 5-5.6' pale brown. 5.5-6' orange brown.
-5	5									
-6	6		100	Poorly graded sand, SP	BROWN	LSE	SAT	4 5 5		Colors: 6-6.5 brown, 6.9-7.6 orange, 7.5-8' greenish brown.
-7	7									
-8	8		100	Poorly graded sand, SP	BROWN	LSE	SAT	6 7 7	HNU 0.0	Color: 8-8.5' orange, 8.5-10' greenish brown, more olive/brown towards bottom of spoon.
-9	9									
-10	10		25	Poorly graded sand, SP	LT BROWN	LSE	SAT	10 10 13 15	HNU 0.0	

# Borehole Log

Roy F. WESTON, Inc.

PROJECT : FT. MONMOUTH	TOTAL DEPTH : 14.50
SITE NAME : CHARLES WOOD AREA 6	LOGGER : K VALENTI
BORING ID : CW6-MW34	DRILLING COMPANY : J.C. ANDERSON
NORTHING : 0.0000 estimated	DRILLING RIG : CME-55
EASTING : 0.0000 estimated	DATE STARTED : 01/03/95
ELEVATION : 0.000 estimated	DATE COMPLETED : 01/03/95

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Poorly graded sand, SP	LT BROWN	LSE	SAT		HNU 0.0	
-11	11			No Sample Recovered						
-12	12		100	Poorly graded sand, SP	LT BROWN	LSE	SAT	10 15 15	HNU 0.0	TD of borehole 14.5'. Lt orange banding from 13-13.8. 13-8-14 heavy Fe banding.
-13	13									
-14	14			Interval Not Sampled						Augered interval.
-15	15									
-16	16									
-17	17									
-18	18									
-19	19									
-20	20									

**Borehole Location Data**

**Roy F. WESTON, Inc.**

BOREHOLE ID : CW6-MW34  
BEGIN DATE : 01/03/95

PROJECT NAME: FT. MONMOUTH  
END DATE : 01/03/95

LOGGER/COMPANY : K VALENTI

BOREHOLE COMPLETED IN (<O>verburden <B>edrock) : 0

TOTAL DEPTH : 14.50 DEPTH TO BEDROCK : 0.00

BOREHOLE DIAMETER #1: 12.00  
INTERVAL: 0.00 ft. to 14.50 ft. BGS  
METHOD : HSA FLUID : WATER

BOREHOLE DIAMETER #2:  
INTERVAL:  
METHOD : FLUID :

BOREHOLE DIAMETER #3:  
INTERVAL:  
METHOD : FLUID :

DRILLING COMPANY : J.C. ANDERSON  
DRILLER : WELLS REEVE  
DRILL RIG TYPE : CME-55

	ESTIMATED	SURVEYED
SURFACE ELEVATION :	0.000	
N. COORDINATE :	0.0000	
E. COORDINATE :	0.0000	
WELL PERMIT.....(Y)es (N)o:	N	PERMIT # :
HOLE ABANDONED... (Y)es (N)o:	N	
WELL INSTALLED... (Y)es (N)o:	Y	
WELL CLUSTER..... (Y)es (N)o:	N	No. OF WELLS : 0
WELL NEST..... (Y)es (N)o:	N	No. OF WELLS : 0
PUMPS INSTALLED.. (Y)es (N)o:	N	TYPE DEPTH
	PURGE :	0.00
	SAMPLE :	0.00

**BOREHOLE TESTING**  
BOREHOLE GEOPHYSICS..... (Y)es (N)o: N  
SLUG TESTS..... (Y)es (N)o: N  
PACKER TESTS..... (Y)es (N)o: N  
PUMPING TESTS..... (Y)es (N)o: N

COMMENTS :

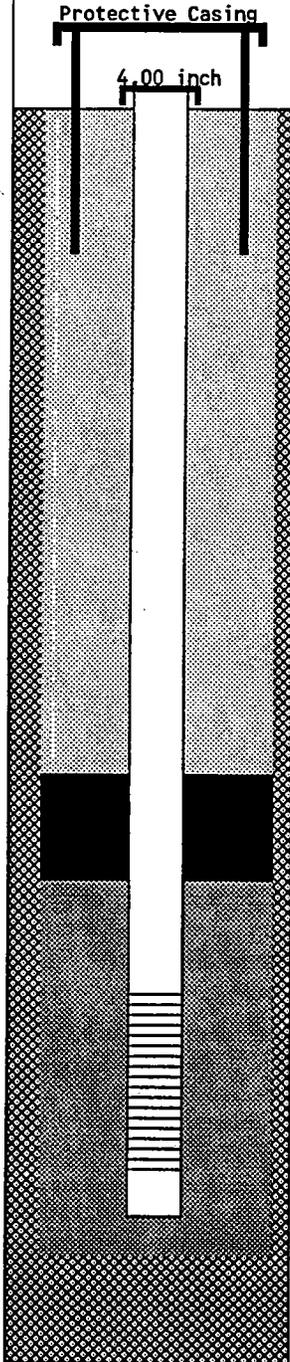
**Well Completion Summary**

**Roy F. WESTON, Inc.**

**CLIENT** FT. MONMOUTH **DRILLING FIRM** J.C. ANDERSON  
**SITE NAME** CHARLES WOOD AREA 6 **INSPECTOR** K. VALENTI

**WELL ID** CW6-MW34 **WATER LEVELS**  
**START DATE** 01/03/95  
**COMPLETION DATE** 01/03/95

DEPTH	ELEV.	DRILLING SUMMARY	
		TC	GS
1.79	33.76	TC	GS
0.00	31.97		
<b>WELL DESIGN CONSTRUCTION</b>			
<p><b>Casing #1 Diameter:</b> 4.00 inch <b>Interval:</b> 0.00 to 14.50 ft.  <b>Type:</b> PVC SCH 40</p> <p><b>Stick Up Inner Casing:</b> 1.79 ft. <b>Protective Casing:</b> 2.20 ft.</p> <p><b>Casing Grout:</b> PORTLAND CEMENT <b>Interval:</b> 0.00 to 1.00 ft.</p> <p><b>Seal Type:</b> BENTONITE <b>Interval:</b> 1.00 to 3.00 ft.</p> <p><b>Sand Pack Type:</b> MORIE #1 <b>Interval:</b> 3.00 to 14.50 ft.  <b>Grain Size:</b> UNIFORM <b>Median Diameter:</b>  <b>Screen Diameter:</b> 4.00 <b>Interval:</b> 4.50 to 14.04 ft.  <b>Type:</b> PVC <b>Slots:</b> 0.010 inches</p> <p><b>Silt Trap Interval:</b> 14.04 to 14.50 ft.  <b>Backfill Type:</b> <b>Interval:</b> 0.00 to 0.00 ft.</p>			
1.00	30.97	BN	
3.00	28.97	SP	
<b>WELL DEVELOPMENT</b>			
4.50	27.47	SC	
<p><b>Date</b> 01/06/95  <b>Method</b> Bailing/overpumping  <b>Yield</b> 3 gpm <b>Purged Volume</b> 150 gal</p>			
<b>COMMENTS</b>			
14.04	17.93	BS	
14.50	17.47	TD	
<p>TC = Top of Casing    SP = Top Sand Pack    [Dotted] = Grout  GS = Ground Surface    SC = Top Screen    [Solid Black] = Seal  BN = Top Seal    BS = Bottom Screen    [Cross-hatched] = Sand Pack  TD = Total Depth    [Diagonal Lines] = Formation</p> <p><b>Additional Comments:</b></p>			



**NOTE: Well Diagram not to Scale**

**Elevations are feet above mean sea level**

2044  
DWR-135M (7/92)

SERIAL # 37094

STATE OF NEW JERSEY  
DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ENERGY  
TRENTON, NJ

293097  
293097  
293097

Mail to

Water Allocation  
CN 029  
Trenton, N.J. 08625

Permit No.

### MONITORING WELL PERMIT

VALID ONLY AFTER APPROVAL BY THE D.E.P.E.

COORD #: 2923834

Owner US Army Fort Monmouth  
Address Fort Monmouth, NJ 07703  
Name of Facility General Site (Hazardous Waste)  
Building Address 2044  
Fort Monmouth, NJ 07703

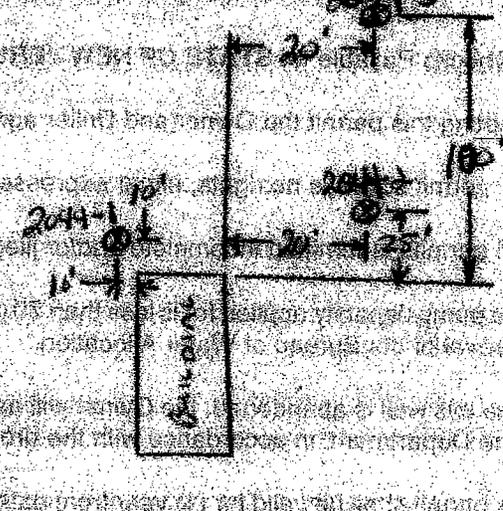
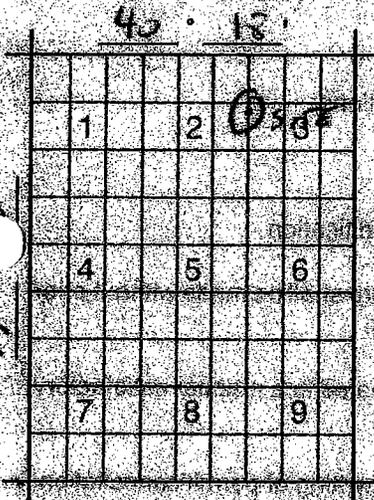
Driller Three Organization, LTD  
Address 1350 RT 130 S  
Burlington, NJ 08016  
Number of Wells (Inches) 4 / 15 Feet  
# of Wells Applied for (max. 10) 3  
Type of Well (see reverse) Monitoring/observation  
Will pumping equipment be installed? YES  NO   
If Yes, give pump capacity                      GPM

#### LOCATION OF WELL(S)

Lot #	Block #	Municipality	County
		<u>Fort Monmouth</u>	<u>Monmouth</u>

Draw sketch of well(s) nearest roads, buildings, etc. with marked distances in feet. Each well MUST be labeled with a name and/or number on the sketch.

State Atlas Map No. 29



FOR MONITORING WELLS, RECOVERY WELLS, OR PIEZOMETERS, THE FOLLOWING MUST BE COMPLETED BY THE APPLICANT. PLEASE INDICATE WHY THE WELLS ARE BEING INSTALLED.

- Soil Fund Case
- ECRA Case
- CERCLA (Superfund) Site
- RCRA Site
- Underground Storage Tank
- NJPDES Municipal Discharge Permit
- NJPDES Industrial Discharge Permit
- Water and Hazardous Waste Enforcement Case
- Water Supply Aquifer Test Observation Well
- Other (explain) \_\_\_\_\_

Case I.D. Number

93-6-28-1009-35

This Space for Approval Stamp

**WELL PERMIT APPROVED**  
 Dept. of Environmental Protection  
 Water Resources/Water Allocation

**APR 5 1994**

FOR DEPE USE

- Issuance of this permit is subject to the conditions attached. (see next page)
- For monitoring purposes only
- The well(s) may not be completed with more than 25 feet of total screen or uncased borehole.

SEE REVERSE SIDE FOR IMPORTANT PROVISIONS AND REGULATIONS PERTAINING TO THIS PERMIT.

In compliance with N.J.S.A. 58:4A-14, application is made for a permit to drill a well as described above.

Date March 28, 1994 Signature of Driller [Signature] License # 1421  
 Signature of Owner [Signature] SELF-EMPLOYED  
 COPIES: Water Allocation -- White and Pink Health Dept. -- Yellow Owner -- Blue Driller -- White



U.S. ARMY  
FORT MONMOUTH  
SEI.FM PW EV

# LOG OF BORING 2044-mw1

(Page 1 of 1)

Produced for Charles Appleby

Project Name : BLDG. 2044  
NJDEP Case # : 93-6-28-1009-35  
Logged By : TYREE INC.  
Start Date : 6/30/94

Completion Date : 6/30/94  
Northing : N 533617.263  
Easting : E 2164839.310  
Driller : M. Beck

Depth in Feet	29-30970 ELEV: 35.06	DESCRIPTION	GRAPHIC	USCS	Samples	Blows/Ft	Well Construction Information
0		Topsoil					<b>Well Construction</b> Date Completed : 6/30/94 Hole Diameter : 8 in Drill Method : HSA Company Rep : M. Beck <b>Well Casing</b> Material : PVC Diameter : 4 in Joints : Threaded <b>Well Screen</b> Material : PVC Diameter : 4 in Joints : Threaded Opening : 20 Slot Sand Pack : # 2 Morie Sand Annulus Seal : Bentonite/Portland : Tremmie <b>Well Screen</b> Material : PVC Diameter : 4 in
1		Medium to coarse sand					
2							
3	6/30/94						<b>NOTES</b> Well #1 is 2044 MW1
4							
6							
8							
10							
12							
14		Black clay and silt		CL			
15							
16							

MONITORING WELL CERTIFICATION-FORM LOCATION CERTIFICATION

Name of Permittee: U.S. ARMY  
Name of Facility: FORT MONMOUTH  
Location: MONMOUTH COUNTY, NJ  
Case NJPDES Number: 93-6-28-1001-35

LAND SURVEYOR'S CERTIFICATION

Well Permit Number:  
This number must be permanently affixed to the well casing.

29-30970-

Longitude (to nearest second):

West 74° 04' 32.64"

Latitude (to nearest second):

North 40° 17' 48.58"

Elevation of Top of Inner Casing (cap off)  
(one-hundredth of a foot):

35.06

Elevation of ground level (1/100th ft.)

32.85

Source of elevation datum (benchmark, nail, etc.) and year. (If an alternate datum has been approved by the Department, identify here, assume datum of 100', and give approximated actual elevation.)

Source: FM-12

1927  1983

Elev.: 35.26

Owners Well Number (As shown on application or plans):

BLDG 2044 MW-1

Elevations are to be determined by double run, three wire leveling methods using balanced sights, commencing from a well marked described point. This beginning point shall either be derived from Federal or State benchmarks if not more than 1000 feet from the site or from an alternate datum approved by the Department. Tolerances should meet third order standards, which are 0.05 ft x (mile)<sup>1/2</sup>. For sections less than 0.1 mile, lat miles = 0.1.

AUTHENTICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Wayne W. Burgett  
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

WAYNE W BURGETT  
PROFESSIONAL LAND SURVEYOR'S NAME  
(Please print or type)

SEAL

31654  
PROFESSIONAL LAND SURVEYOR'S LICENSE #

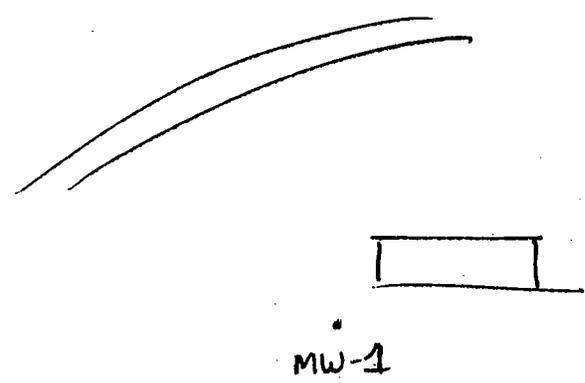


FIELD LOG OF BORING

SHEET \_\_\_ OF \_\_\_

LOCATION OF BORING: *Fort Monmouth*  
*Bldg. 2044 MW-1*

PROJECT: <i>US Army</i> <i>Fort Monmouth</i>		BORING NO: <i>MW-1</i>
JOB NO:		LOGGED BY: <i>V. Swanson</i>
PROJ. MGR.: <i>JC</i>		EDITED BY:
DRILLING CONTRACTOR: <i>Tyree</i>		
DRILL RIG TYPE: <i>Mobile B-80</i>		
DRILLERS NAME: <i>M. Beck</i>		
SAMPLING METHODS: <i>split spoon</i>		
HAMMER WT.: <i>140</i>	DROP: <i>30"</i>	
STARTED, TIME: <i>0600</i>	DATE: <i>7/1/94</i>	
COMPLETED, TIME: <i>1400</i>	DATE: <i>7/1/94</i>	



SAMPLE DEPTH	SAMPLER TYPE	BLOWS / 6 IN.	INCHES DRIVEN	INCHES RECOVERED	SAMPLE CONDITION	DRILLING RATE (min./ft.)	PID READING (ppm)	ODOR (Y/N?)	GRAPHIC WELL CONST.	DEPTH IN FEET	GRAPHIC LOG	DESCRIPTION
0-2	SS	7	6	12			0	N	SC	1	Casing Bestonite	Medium Red brown Sand and Clay with gravel and trace silt
		3	6									
		5	6									
		6	6									
2-4	SS	1	6				0	N				
		1	6									
		2	6						GP	3	Screen	Course Grey Sand and gravel Sample collected 2-4'
		1	6									
4-6							0	N				
										5		Same
6-8							0	N		6		Same
										7		
8-10							0	N		8		Same
										9		
10-12							0	N		10		
12-14							0	N				
15												Same from 10' down to 15' Fine Grey sand and clay



U.S. ARMY  
FORT MONMOUTH  
SEI.FM PW EV

# LOG OF BORING 2044-mw2

(Page 1 of 1)

Produced for Charles Appleby

Project Name : BLDG. 2044  
NJDEP Case # : 93-6-28-1009-35  
Logged By : TYREE INC.  
Start Date : 7/1/94

Completion Date : 7/1/94  
Northing : N 533556.274  
Easting : E 2164798.647  
Driller : M. Beck

Depth in Feet	29-30971 ELEV: 32.19	DESCRIPTION	GRAPHIC	USCS	Samples	Blows/Ft	Well Construction Information
0 0.6 1 2 4 6 8 10 12 14 15 16		<p>Topsoil</p> <p>Medium to coarse sand</p> <p>Black clay and silt</p>		<p>SP</p> <p>CL</p>			<p><b>Well Construction</b></p> <p>Date Completed : 7/1/94 Hole Diameter : 8 in Drill Method : HSA Company Rep : M. Beck</p> <p><b>Well Casing</b></p> <p>Material : PVC Diameter : 4 in Joints : Threaded</p> <p><b>Well Screen</b></p> <p>Material : PVC Diameter : 4 in Joints : Threaded Opening : 20 Slot</p> <p>Sand Pack : # 2 Morie Sand</p> <p>Annulus Seal : Bentonite/Portland Tremmie</p> <p><b>Well Screen</b></p> <p>Material : PVC Diameter : 4 in</p> <p><b>NOTES</b></p> <p>Well #1 is 2044 MW2</p>

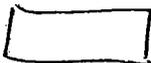
FIELD LOG OF BORING

SHEET \_\_\_ OF \_\_\_

LOCATION OF BORING: Fort Monmouth  
Building 2044  
MW-2

PROJECT: US Army  
Fort Monmouth  
BORING NO: MW-2  
TOTAL DEPTH: 15  
JOB NO: \_\_\_\_\_ LOGGED BY: V. Swanson  
PROJ. MGR.: JRC EDITED BY: \_\_\_\_\_  
DRILLING CONTRACTOR: Tyree  
DRILL RIG TYPE: Mobil B80  
DRILLERS NAME: Mike Bek  
SAMPLING METHODS: split spoon  
HAMMER WT.: 140 DROP: 30"  
STARTED, TIME: 6 AM DATE: 6/30/94  
COMPLETED, TIME: 2 PM DATE: 6/30/94

~~MEW-1~~ MW-2



BORING DEPTH (ft): 15  
CASING DEPTH (ft): ~~2~~  
WATER DEPTH (ft): 3-4  
TIME: \_\_\_\_\_  
DATE: \_\_\_\_\_  
BACKFILLED, TIME: \_\_\_\_\_ DATE: 6/30/94 BY: Tyree  
SURFACE ELEV: \_\_\_\_\_ DATUM: \_\_\_\_\_  
CONDITIONS: \_\_\_\_\_

SAMPLE DEPTH	SAMPLER TYPE	BLOWS / 6 IN.	INCHES DRIVEN	INCHES RECOVERED	SAMPLE CONDITION	DRILLING RATE (min./ft.)	PID READING (ppm)	ODOR (Y/N?)	GRAPHIC WELL CONST.	DEPTH IN FEET	GRAPHIC LOG
0-2	(S)	14	6	24			0	N	* casing bentonite	1	Medium Red brown Sand and clay with decomposed vegetation. sample
		8	6							2	Green Brown Sand with some clay and trace till sample
		10	6							3	4' water encountered. SAME soil
		24	6							4	
2-4	(S)	17	6	24			0	N	SCREEN	5	
		16	6				0	N		6	SAME
		15	6				0	N		7	
		16	6				0	N		8	SAME
										9	
							0	N		10	SAME

**MONITORING WELL CERTIFICATION-FORM B-LOCATION CERTIFICATION**

Name of Permittee: U.S. ARMY  
Name of Facility: FORT MONMOUTH  
Location: MONMOUTH COUNTY, NJ

Case NJPDES Number: 93-6-28-1009-35

**LAND SURVEYOR'S CERTIFICATION**

Well Permit Number:  
This number must be permanently affixed to the well casing.

29-3017L-

Longitude (to nearest second):

West 74° 04' 33.17"

Latitude (to nearest second):

North 40° 17' 47.98"

Elevation of Top of Inner Casing (cap off)  
(one-hundredth of a foot):

35.05

Elevation of ground level (1/100th ft.)

32.19

Source of elevation datum (benchmark, nail, etc.) and year. (If an alternate datum has been approved by the Department, identify here, assume datum of 100', and give approximated actual elevation.)

Source: FM-12

1927  1983

Elev.: 35.26

Owners Well Number (As shown on application or plans):

BLDG 2044 MW-2

Elevations are to be determined by double run, three wire leveling methods using balanced sights, commencing from a well marked described point. This beginning point shall either be derived from Federal or State benchmarks if not more than 1000 feet from the site or from an alternate datum approved by the Department. Tolerances should meet third order standards, which are 0.05 ft x (mile)<sup>1/2</sup>. For sections less than 0.1 mile, let miles = 0.1.

**AUTHENTICATION**

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Wayne W. Burgett  
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

WAYNE W BURGETT  
PROFESSIONAL LAND SURVEYOR'S NAME  
(Please print or type)

SEAL

31654  
PROFESSIONAL LAND SURVEYOR'S LICENSE #



U.S. ARMY  
FORT MONMOUTH  
SER.FM PW KV

# LOG OF BORING 2044-mw3

(Page 1 of 1)

Produced for Charles Appleby

Project Name : BLDG. 2044  
NJDEP Case # : 93-6-28-1009-35  
Logged By : TYREE INC.  
Start Date : 7/1/94

Completion Date : 7/1/94  
Northing : N 533658.690  
Easting : E 2164829.734  
Driller : M. Beck

Depth in Feet	29-30972 ELEV: 36.34	DESCRIPTION	GRAPHIC	USCS	Samples	Blows/Ft	Well Construction Information
0		Topsoil					<b>Well Construction</b> Date Completed : 7/1/94 Hole Diameter : 8 in Drill Method : HSA Company Rep : M. Beck <b>Well Casing</b> Material : PVC Diameter : 4 in Joints : Threaded <b>Well Screen</b> Material : PVC Diameter : 4 in Joints : Threaded Opening : 20 Slot <b>Sand Pack</b> : # 2 Morie Sand <b>Annulus Seal</b> : Bentonite/Portland Tremmie <b>Well Screen</b> Material : PVC Diameter : 4 in
1		Medium to coarse sand					
2							<b>NOTES</b> Well #1 is 2044 MW3
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14		Black clay and silt		CL			
15							
16							

2-23-1996 C:\2044\MW\GEO\2044\_mw3.ge3

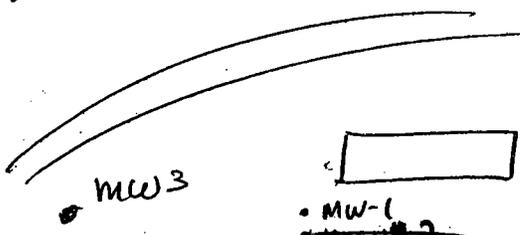
FIELD LOG OF BORING

SHEET \_\_\_ OF \_\_\_

LOCATION OF BORING:

Fort Monmouth, Building # 2044

MW3



PROJECT: US Army

Fort Monmouth

BORING NO:

TOTAL DEPTH:

JOB NO: SELFM-PW-EV

LOGGED BY: V Swanson

PROJ. MGR.: JC

EDITED BY:

DRILLING CONTRACTOR: Tyree

DRILL RIG TYPE: Mobil B80

DRILLERS NAME: Mike Beck

SAMPLING METHODS: Split Spoon

HAMMER WT.: 100 lb

DROP:

STARTED, TIME: 0600

DATE: 7/1/94

COMPLETED, TIME: 1400

DATE: 7/1/94

BORING DEPTH (ft): 15'

CASING DEPTH (ft): 2

WATER DEPTH (ft): 3-4'

TIME:

DATE:

BACKFILLED, TIME:

DATE: 7/1

BY:

SURFACE ELEV:

DATUM:

CONDITIONS:

SAMPLE DEPTH	SAMPLER TYPE	BLOWS / 6 IN	INCHES DRIVEN	INCHES RECOVERED	SAMPLE CONDITION	DRILLING RATE (min./ft.)	PID READING (ppm)	ODOR (Y/N?)	GRAPHIC WELL CONST.	DEPTH IN FEET	GRAPHIC LOG
0-2	SS	7	6	24			0	N	Casing bentonite Screen	1	<p>Red Brown <sup>medium</sup> Sand and Clay with decomposed vegetation.</p> <p>Green Brown <sup>medium</sup> Sand with some clay and trace till sample collected</p> <p>4" water encountered</p> <p>Same Soil</p> <p>Same Soil</p> <p>Same Soil</p> <p>Same Soil</p>
		4	6							2	
		4	6							3	
2-4	SS	5	6	24			0	N		4	
		6	6							5	
		7	6							6	
4-6		9	6				0	N		7	
										8	
6-8							0	N		9	
										10	
8-10							0	N			
10-15'							0	N			



MONITORING WELL CERTIFICATION-FORM LOCATION CERTIFICATION

Name of Permittee: U.S. ARMY  
Name of Facility: FORT MONMOUTH  
Location: MONMOUTH COUNTY, NJ  
Case NJPDES Number: 93-6-28-1009-35

LAND SURVEYOR'S CERTIFICATION

Well Permit Number:  
This number must be permanently affixed to the well casing.

29-30972-

Longitude (to nearest second):

West 74°04'32.76"

Latitude (to nearest second):

North 40°17'48.99"

Elevation of Top of Inner Casing (cap off) (one-hundredth of a foot):

36.34

Elevation of ground level (1/100th ft.)

33.79

Source of elevation datum (benchmark, nail, etc.) and year. (If an alternate datum has been approved by the Department, identify here, assume datum of 100', and give approximated actual elevation.)

Source: FM-12

1927  1983

Elev.: 35.26

Owners Well Number (As shown on application or plans):

BLDG 2044 MW-3

Elevations are to be determined by double run, three wire leveling methods using balanced sights, commencing from a well marked and described point. This beginning point shall either be derived from Federal or State benchmarks if not more than 1000 feet from the site or from an alternate datum approved by the Department. Tolerances should meet third order standards, which are 0.05 ft x (mile)<sup>1/2</sup>. For sections less than 0.1 mile, let miles = 0.1.

AUTHENTICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Wayne W. Burgett  
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

WAYNE W. BURGESS  
PROFESSIONAL LAND SURVEYOR'S NAME  
(Please print or type)

SEAL

31654  
PROFESSIONAL LAND SURVEYOR'S LICENSE #

### MONITORING WELL RECORD

Well Permit No. \_\_\_\_\_  
Atlas Sheet Coordinates \_\_\_\_\_

OWNER IDENTIFICATION - Owner \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_

WELL LOCATION - If not the same as owner please give address. Owner's Well No. MW 34  
County \_\_\_\_\_ Municipality \_\_\_\_\_ Lot No. \_\_\_\_\_ Block No. \_\_\_\_\_  
Address \_\_\_\_\_

TYPE OF WELL (as per Well Permit Categories) \_\_\_\_\_ Date well completed 1/1/95  
Regulatory Program Requiring Well \_\_\_\_\_ Case I.D. # \_\_\_\_\_  
CONSULTING FIRM/FIELD SUPERVISOR (if applicable) \_\_\_\_\_ Tele. # \_\_\_\_\_

**WELL CONSTRUCTION**

Total depth drilled \_\_\_\_\_ ft.  
Well finished to \_\_\_\_\_ ft.  
Borehole diameter:  
Top \_\_\_\_\_ in.  
Bottom \_\_\_\_\_ in.  
Well was finished:  above grade  
 flush mounted  
If finished above grade, casing  
height (stick up) above land  
surface \_\_\_\_\_ ft.

	Depth to Top (ft.) [From land surface]	Depth to Bottom (ft.)	Diameter (inches)	Type and Material
Inner Casing				
Outer Casing (Not Protective Casing)				
Screen (Note slot size)				
Tail Piece				
Gravel Pack				
Annular Seal/Grout				
Method of Grouting				

Was steel protective casing installed?  
 Yes  No

Static water level after drilling \_\_\_\_\_ ft.  
Water level was measured using \_\_\_\_\_  
Well was developed for 2 hours at 10 gpm  
Method of development pumpout  
Was permanent pumping equipment installed?  Yes  No  
Pump capacity \_\_\_\_\_ gpm  
Pump type: \_\_\_\_\_  
Drilling Method \_\_\_\_\_  
Drilling Fluid \_\_\_\_\_ Type of Rig \_\_\_\_\_  
Name of Driller \_\_\_\_\_  
Health and Safety Plan submitted?  Yes  No  
Level of Protection used on site (circle one) None D C B A  
N.J. License No. \_\_\_\_\_  
Name of Drilling Company \_\_\_\_\_

**GEOLOGIC LOG** (Copies of other geologic logs and/or geophysical logs should be attached.)

*[Handwritten geologic log text, including depth measurements and soil descriptions]*

I certify that I have drilled the above-referenced well in accordance with all well permit requirements and all applicable State rules and regulations.

Driller's Signature Wellington Rowe Date 4-19-95

**Appendix C**  
**Site Photographs**

**APPENDIX C**  
**Site Photographs**  
**CW-6 Pesticide Storage Site**  
**Fort Monmouth, New Jersey**



**Buildings T-2044 and T-2070**



**Monitoring Wells**

## **Appendix D**

### **Groundwater Laboratory Data Sheets**