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TRANSMITTAL LETTER REGARDING FINAL OPERABLE UNIT 9 (OU 9) BASEWIDE GROUNDWATER PROPOSED PLAN WITH ATTACHMENTS NSB NEW LONDON CT
6/13/2008
TETRA TECH

RE-SEND
6/16/08
SEE ATTACHED
E-MAIL

TETRA TECH

PITT-06-8-026

June 13, 2008

Project Number 112G00894

Mr. Richard Conant
Naval Submarine Base - New London
Bldg. 439, Box 101, Room 104
Route 12
Groton, Connecticut 06349-5039

Reference: CLEAN Contract No. N62467-04-D-0055
Contract Task Order 431

Subject: Final Operable Unit 9 Basewide Groundwater Proposed Plan
Naval Submarine Base-New London, Groton, Connecticut

Dear Mr. Conant:

Please find enclosed 50 copies of the subject Proposed Plan for your distribution to the Naval Submarine Base – New London (NSB-NLON) Restoration Advisory Board (RAB). Electronic copies of the Proposed Plan were also distributed today via email to other NSB-NLON team members [Ron Pinkoski (NAVFAC MidAtlantic), Kymberlee Keckler (EPA), and Mark Lewis (CTDEP)].

If you have any questions regarding the enclosed Proposed Plan, please contact me at (412) 921-8984.

Sincerely,

Corey A. Rich, P.E.
Base Coordinator/Project Manager

CAR/clm

Enclosure(s)

c: Ms Bonnie Capito, NAVFAC Atlantic (1 copy + 1 CD)
Mr. Ron Pinkoski, NAVFAC MidAtlantic (1 copy)
Mr. John Trepanowski, TtNUS-KOP (1 copy)
CTO 431 – File Copy (1 copy)

Tetra Tech NUS, Inc.
661 Andersen Drive, Pittsburgh, PA 15220-2745
Tel 412.921.7090 Fax 412.921.4040 www.ttnus.com

Rich, Corey

From: Rich, Corey
Sent: Monday, June 16, 2008 12:22 PM
To: ronald.pinkoski@navy.mil; richard.conant@navy.mil; 'Keckler.Kymberlee@epamail.epa.gov'; 'Lewis, Mark'
Cc: 'Jurka, Val CIV NAVFAC Atlantic, Ev33'; Miller, Ralinda; Balsamo, Nina
Subject: OU9 Proposed Plan
Attachments: OU9 Proposed Plan.pdf

Team,

It was brought to my attention that there were two typographical issues (p. 23 - 2 lines of text were excluded from last paragraph and p. 27 - Site 9 and 23 header) with the final version of the Proposed Plan issued on Friday (06/13/08). Please find attached the corrected Final OU9 Proposed Plan. I appologize for the inconvenience.

Let me know if there are any other issues.

Regards,

Corey Rich | Senior Project Manager/Civil Engineer
Direct: 412.921.8984 | Main: 412.921.7090 | Fax: 412.921.4040
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Naval Submarine Base - New London, Groton, Connecticut

PROPOSED PLAN FOR BASEWIDE GROUNDWATER OPERABLE UNIT 9

Introduction

In accordance with Section 117 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the law more commonly known as Superfund, this Proposed Plan summarizes the Navy's preferred final options for addressing **groundwater** at the Area A Landfill (Site 2A), Area A Wetland (Site 2B), Area A Downstream Watercourses (Site 3), Torpedo Shops (Site 7), Waste OT-5 (Site 9), Overbank Disposal Area Northeast (Site 14), Spent Acid Storage and Disposal Area (Site 15), Solvent Storage Area (Site 18), Area A Weapons Center (Site 20), and Tank Farm (Site 23) at Naval Submarine Base - New London (NSB-NLON) (Figure 1). The **groundwater** at Sites 2A, 2B, 3, 7, 9, 14, 15, 18, 20, and 23 make up the basewide **groundwater Operable Unit (OU)** 9. The **groundwater** at Sites 2A, 2B, 3, 7, 14, and 20 is hydraulically connected. Similarly, **groundwater** at Sites 9, 15, 18, and 23 is also hydraulically connected. The proposed remedial actions for **groundwater** at Sites 3, 7, 14, 15, 18, and 20 were previously presented in a 2004 Proposed Plan and Interim **Record of Decision (ROD)**. The proposed remedial actions for **groundwater** at those sites were considered interim actions in 2004 because the remaining portions of **OU9** (Sites 2A, 2B, 9 and 23) were not addressed at that time. In this Proposed Plan, remedial actions are proposed for all portions of **OU9** (Sites 2A, 2B, 3, 7, 9, 14, 15, 18, 20, and 23 **groundwater**) and this will be the final Proposed Plan for **OU9**. Site 9 is located within Site 23, and **groundwater** issues for the site will be addressed in the proposed remedial action for Site 23. The sites addressed herein are 9 of 23 sites being addressed by the Navy's **Installation Restoration (IR)** Program at NSB-NLON. The **IR** Program identifies and cleans up sites created by past operations that do not meet current environmental standards.

The Cleanup Proposal...

After careful study of **groundwater** at Sites 2A, 2B, 3, 7, 9, 14, 15, 18, 20, and 23, the Navy and EPA propose the following plan:

Groundwater at Sites 2A and 2B

- **Groundwater** at Sites 2A and 2B is currently monitored under a **groundwater monitoring** program selected as part of the remedy for **OU1**. Post-closure **groundwater** monitoring is required by the September 2005 **ROD**. Volumes II and III of the Operation and Maintenance Manual for Installation Restoration Program Sites at Naval Submarine Base New London (January 2006) describe the **groundwater** monitoring plan in detail. This Proposed Plan proposes to continue the monitoring for Sites 2A and 2B as required by the OU1 **ROD**. **Institutional controls** will remain in place at Sites 2A and 2B and are described in the **Site Use Restrictions document**.

Groundwater at Sites 3 and 7

- Continue to implement **institutional controls** that identify the location and magnitude of **groundwater contamination**, restrict extraction and use of the **groundwater**, and control vapor intrusion (Site 3 only) based on land use. (Based on the Interim **ROD**, the **institutional controls** for Sites 3 and 7 were implemented in 2006.)
- Continue to monitor the **groundwater** contaminants until they decrease to levels at which unrestricted use of **groundwater** may be permitted. (Under the Interim **ROD**, a **monitoring** program for Sites 3 and 7 was initiated in 2006.)

Groundwater at Sites 9 and 23

- Implement **institutional controls** that identify the location and magnitude of **groundwater contamination** and restrict extraction and use of the **groundwater**.

Groundwater at Sites 14, 15, 18, and 20

- No Further Action (NFA).

June 26

PUBLIC MEETING AND HEARING

Informational Meeting: 6:30pm

Formal Public Hearing: 7:00pm

Date: Thursday, **June 26, 2008**

Location: Best Western Olympic Inn, Route 12, Groton, Connecticut

Learn More About the Proposed Plan

The Navy will describe this Proposed Plan and listen to your questions at an informational public meeting. A formal public hearing will immediately follow this meeting.

For further information regarding the proposed remedy or upcoming meeting, call Mr. Richard Conant with the NSB-NLON Public Works Environmental Division at (860) 694-5649.

Technical terms shown in bold print are defined in the glossary on Pages 29 and 30.

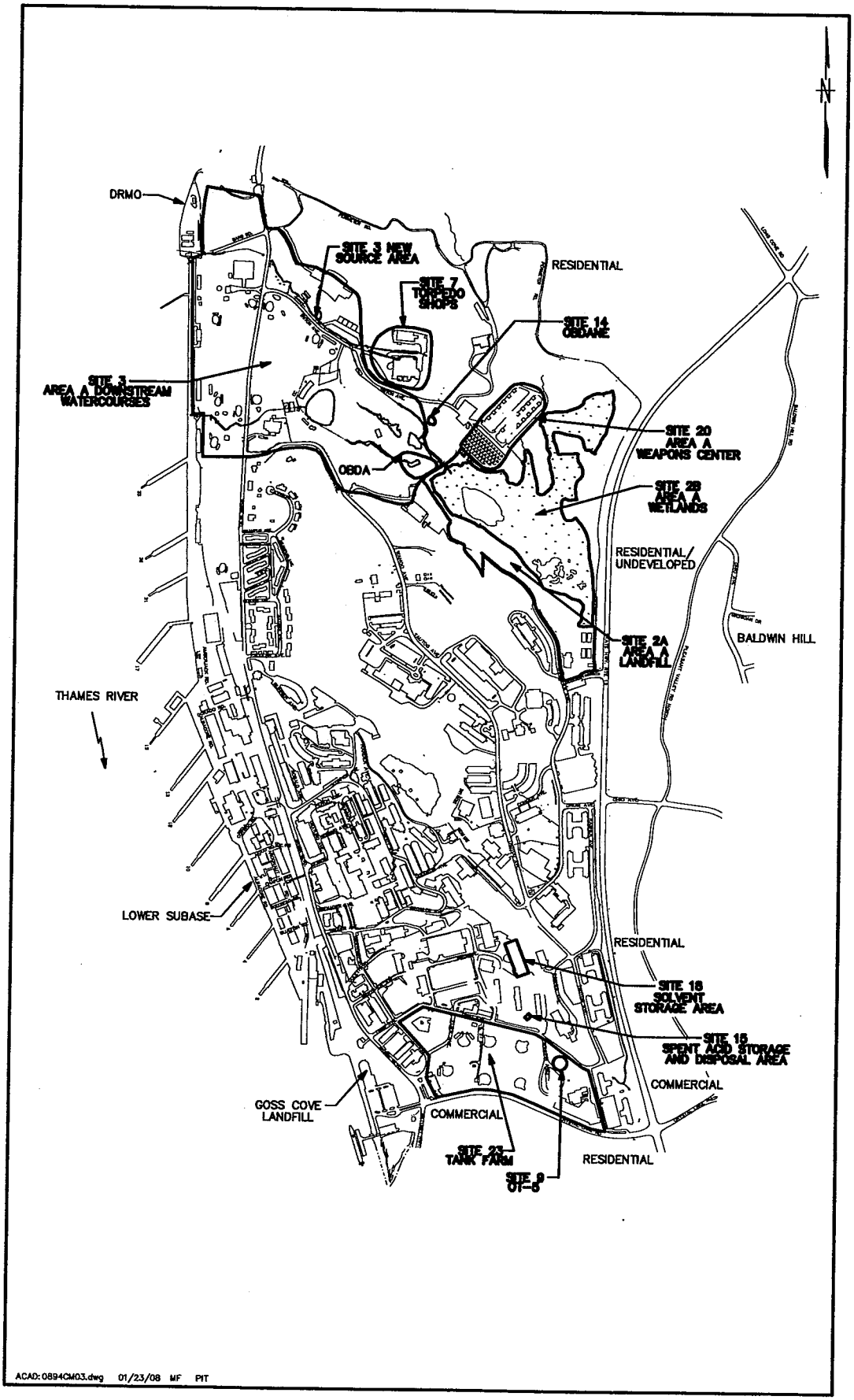

Figure 1. Site Location Map

What Do You Think?

The Navy and EPA are accepting public comments on the final Proposed Plan for **OU**9 from June 14, 2008 to July 14, 2008. You do not have to be a technical expert to comment. If you have a comment or concern, the Navy wants to hear from you before making a final decision.

There are two ways to formally register a comment:

1. Offer oral comments during the **June 26, 2008** public hearing, or
2. Send written comments postmarked no later than July 14, 2008 following the instructions provided at the end of this Proposed Plan.

To the extent possible, the Navy will respond to your oral comments during the June 26, 2008 public meeting. In addition, regulations require the Navy to respond to all formal comments in writing. The Navy will review the transcript of the comments received at the meeting, and all written comments received during the formal comment period, before making a final decision and providing written responses to the comments in a document called a **Responsiveness Summary**. The **Responsiveness Summary** will be included in the **ROD**.

Introduction

The Navy conducted various field investigations at Sites 2A, 2B, 3, 7, 9, 14, 15, 18, 20, and 23 from 1990 to the present to assess the nature and extent of **groundwater contamination**. The investigations at Sites 2A, 2B, 3, 7, 20, and 23 focused on the **groundwater** present in the overburden and bedrock, and the investigations at Sites 9, 14, 15, and 18 focused on the **groundwater** in the overburden. Overburden and bedrock **groundwater potentiometric contours** and flow directions at Sites 2A, 2B, 3, 7, 14, and 20 are presented in Figures 2 and 3, respectively. Sites 2A and 2B are located hydraulically upgradient of Site 3. Site 20 is located hydraulically upgradient of Sites 3 and 7. Overburden and bedrock **groundwater potentiometric contours** and flow directions at Sites 9, 15, and 23 are presented on Figures 4 and 5, respectively. **Groundwater** flow directions at Site 18 are shown on Figure 6. **Risk assessments** were also performed to evaluate the potential effects of the **contamination** found in the **groundwater** at Sites 2A, 2B, 3, 7, 14, 15, 18, 20, and 23 on human health and the environment.

Detailed descriptions of the sites are provided in the Phase II **RI** (March 1997), **Basewide Groundwater Operable Unit Remedial Investigation (BGOURI)** Report (January 2002), **BGOURI Update/Feasibility Study (FS)** Report (July 2004), and Second Five-Year Review Report (December 2006), which are all available in the Information Repositories at the locations identified on page 19.

The remedial actions for **groundwater** at Sites 3, 7, 14, 15, 18, and 20 are described in the December 2004 Interim **ROD**. The selected remedy for Sites 14, 15, 18, and 20 was No Further Action (NFA). Based on the interim selected remedy of **institutional controls** and **groundwater monitoring** for Sites 3 and 7, a **groundwater monitoring** program for Sites 3 and 7 was initiated in 2006. Also, a remedial design for land use controls was completed in 2005 and a **Site Use Restrictions document** that defines the Navy's policy regarding disturbance of **groundwater** at IR sites was updated in 2006 to include Sites 3 and 7 **groundwater**.

This Proposed Plan recommends final measures of **institutional controls** and **monitoring** for the **groundwater** at Sites 3 and 7. This recommendation is based on recent **monitoring** results in conjunction with the **BGOURI Update** report's conclusion that there were no significant risks to current human or ecological receptors, but there are potentially significant risks to hypothetical future human receptors from routine, long-term consumption of contaminated **groundwater**.

This Proposed Plan recommends implementation of **institutional controls** for the **groundwater** at Sites 9 and 23. This recommendation is based on recent **monitoring** results in conjunction with 2008 **risk assessment** memoranda for Sites 9 and 23 that indicated that there were no significant risks to current human or ecological receptors, but there are potentially significant risks to hypothetical future human receptors from routine, long-term consumption of contaminated **groundwater**.

This Proposed Plan also recommends NFA for the **groundwater** at Sites 14, 15, 18, and 20. The conclusion that there were no significant risks to human health or the environment from current or future exposure to **groundwater** was presented in the **BGOURI** report for Site 18; in the **BGOURI Update** report for Sites 14, 15, and 20; and in 2008 **risk assessment** memoranda for Sites 14, 15, 18, and 20. Sites 2A and 2B will continue to be monitored as required by the **OU**1 **ROD**.

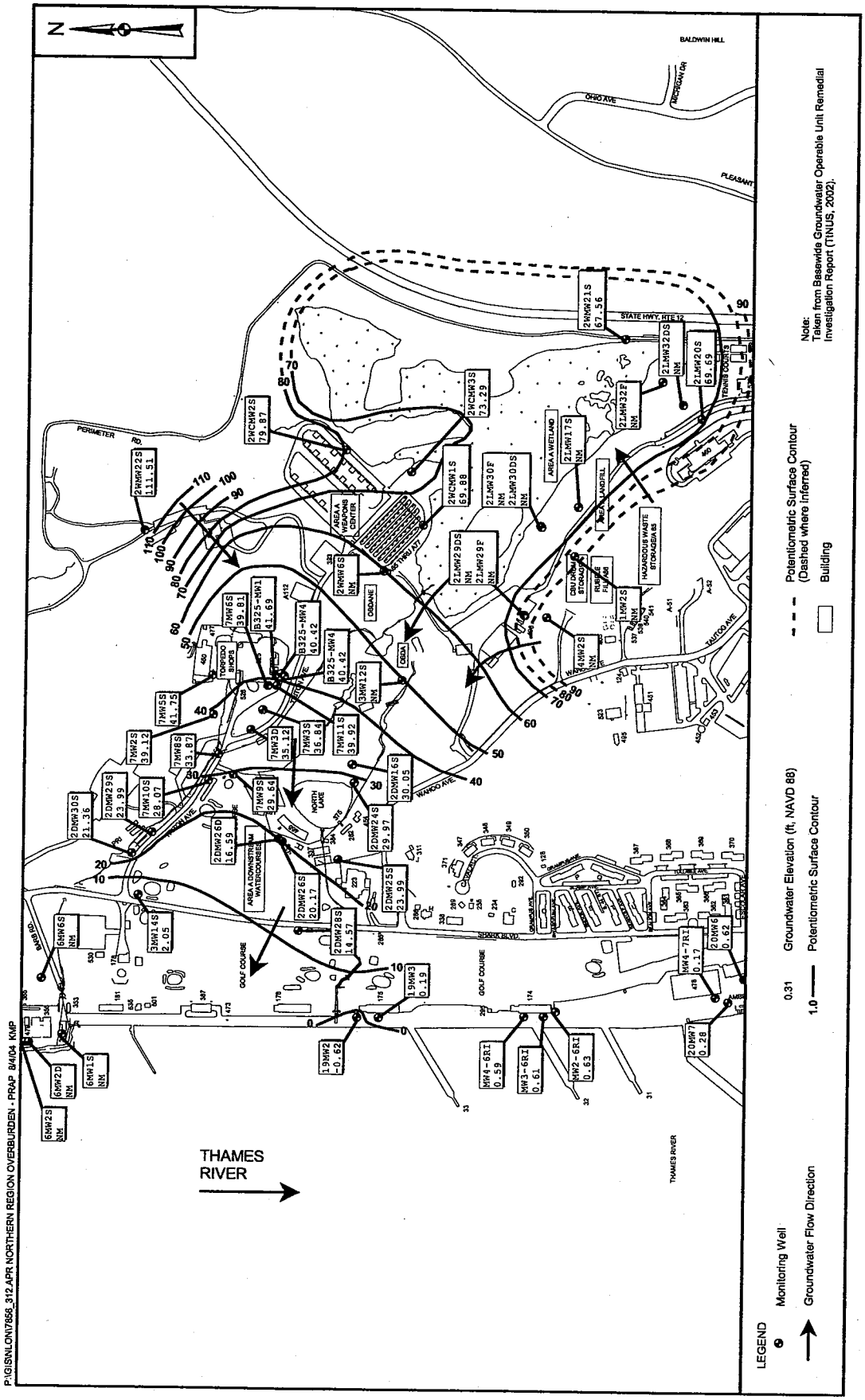

Figure 2. Shallow Overburden Potentiometric Surface Map, Sites 2A, 2B, 3, 7, 14, and 20, August 2000

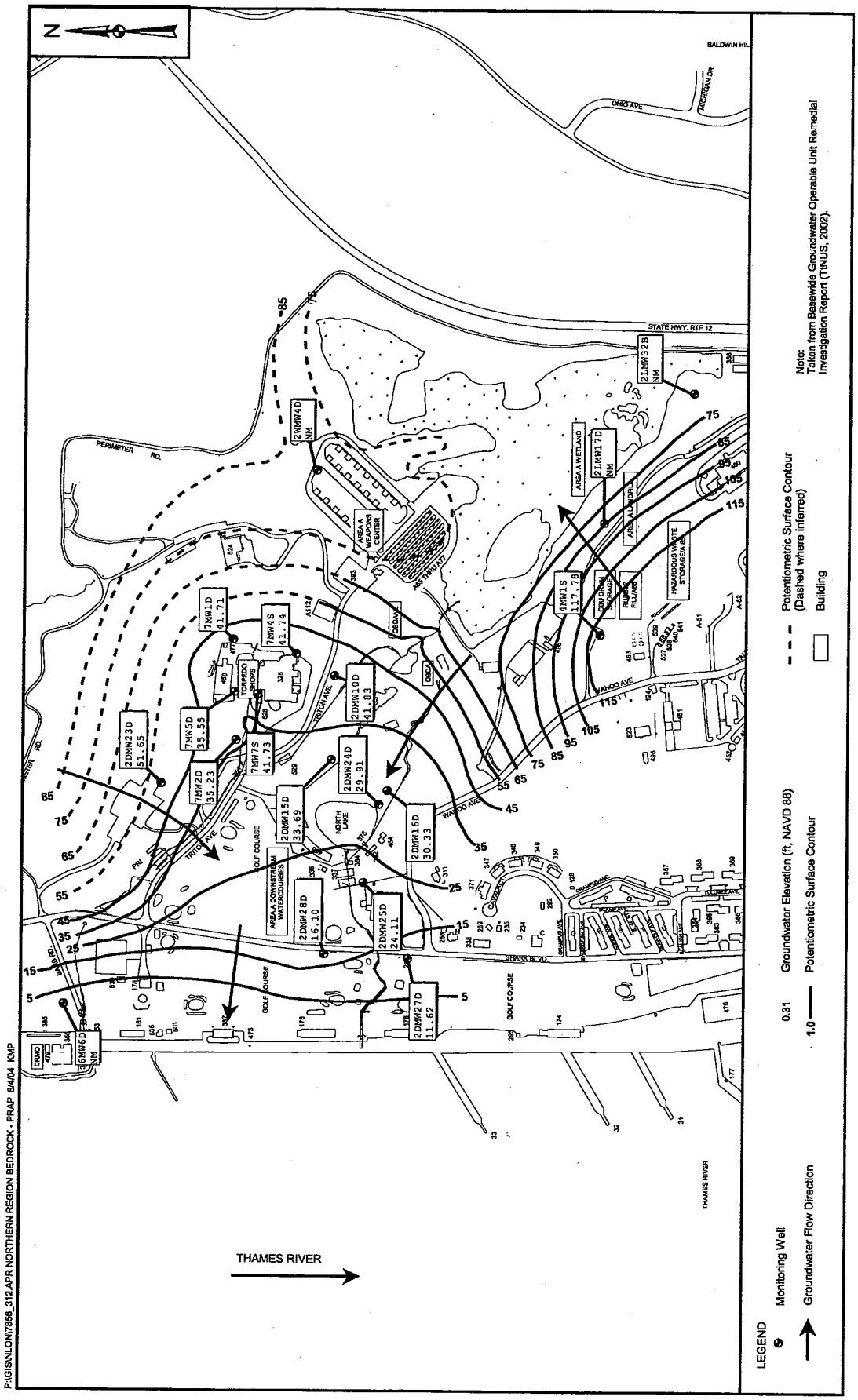

Figure 3. Bedrock Potentiometric Surface Map, Sites 2A, 2B, 3, 7, 14, and 20, August 2000

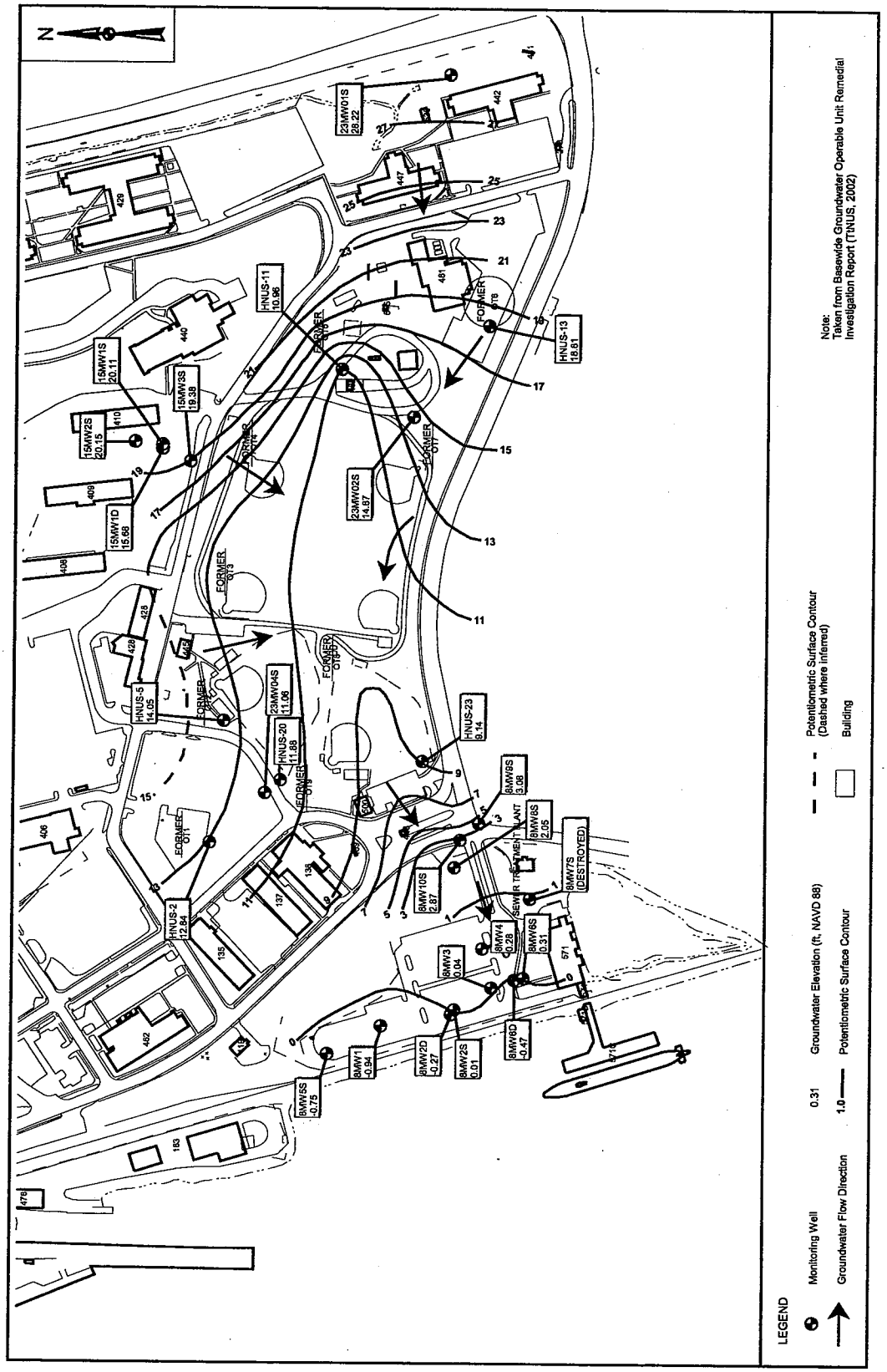

Figure 4. Shallow Overburden Potentiometric Surface Map, Sites 2A, 2B, 3, 7, 14, and 20, August 2000

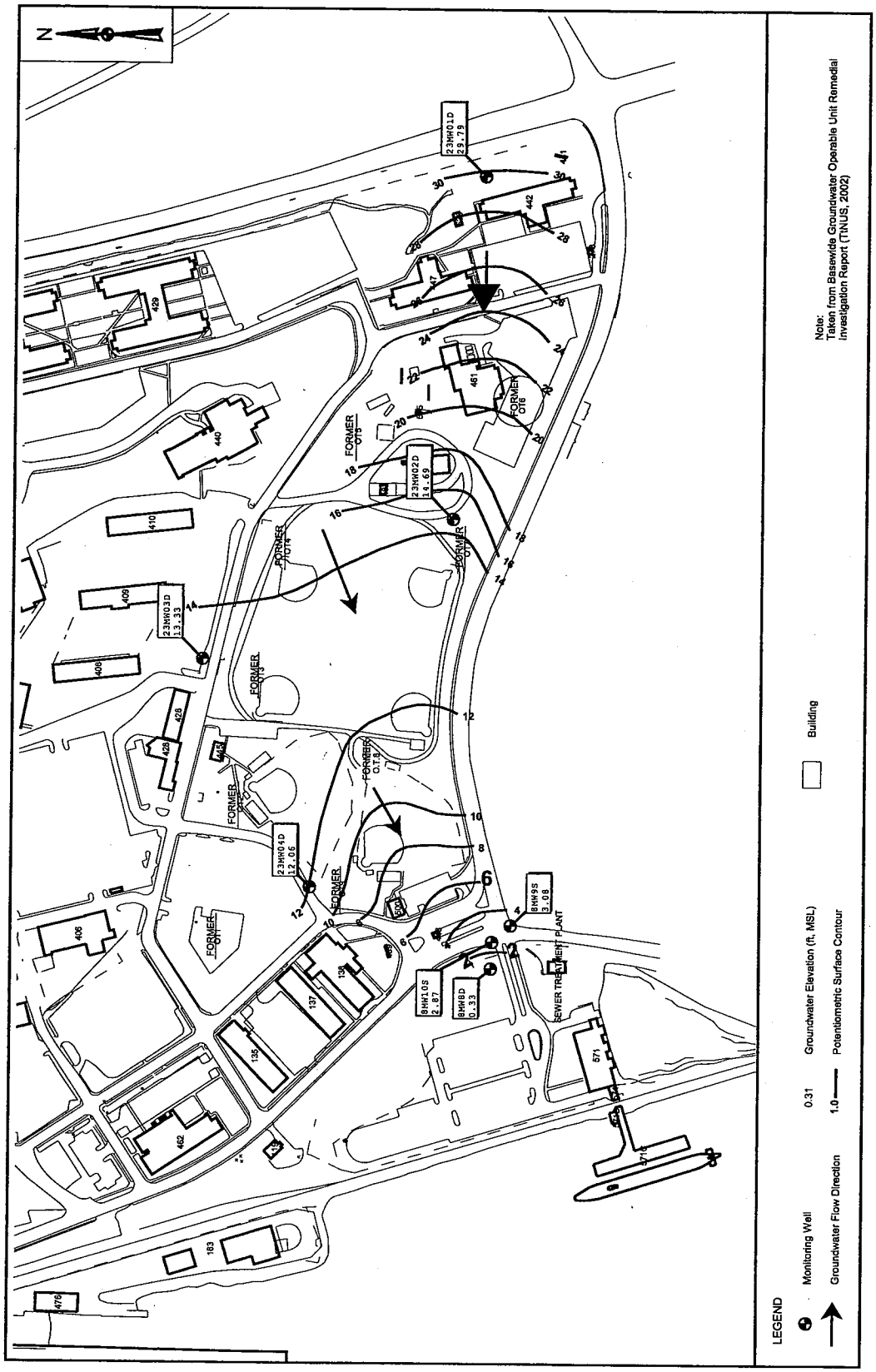

Figure 5. Bedrock Potentiometric Surface Map, Sites 9, 15, and 23, August 2000

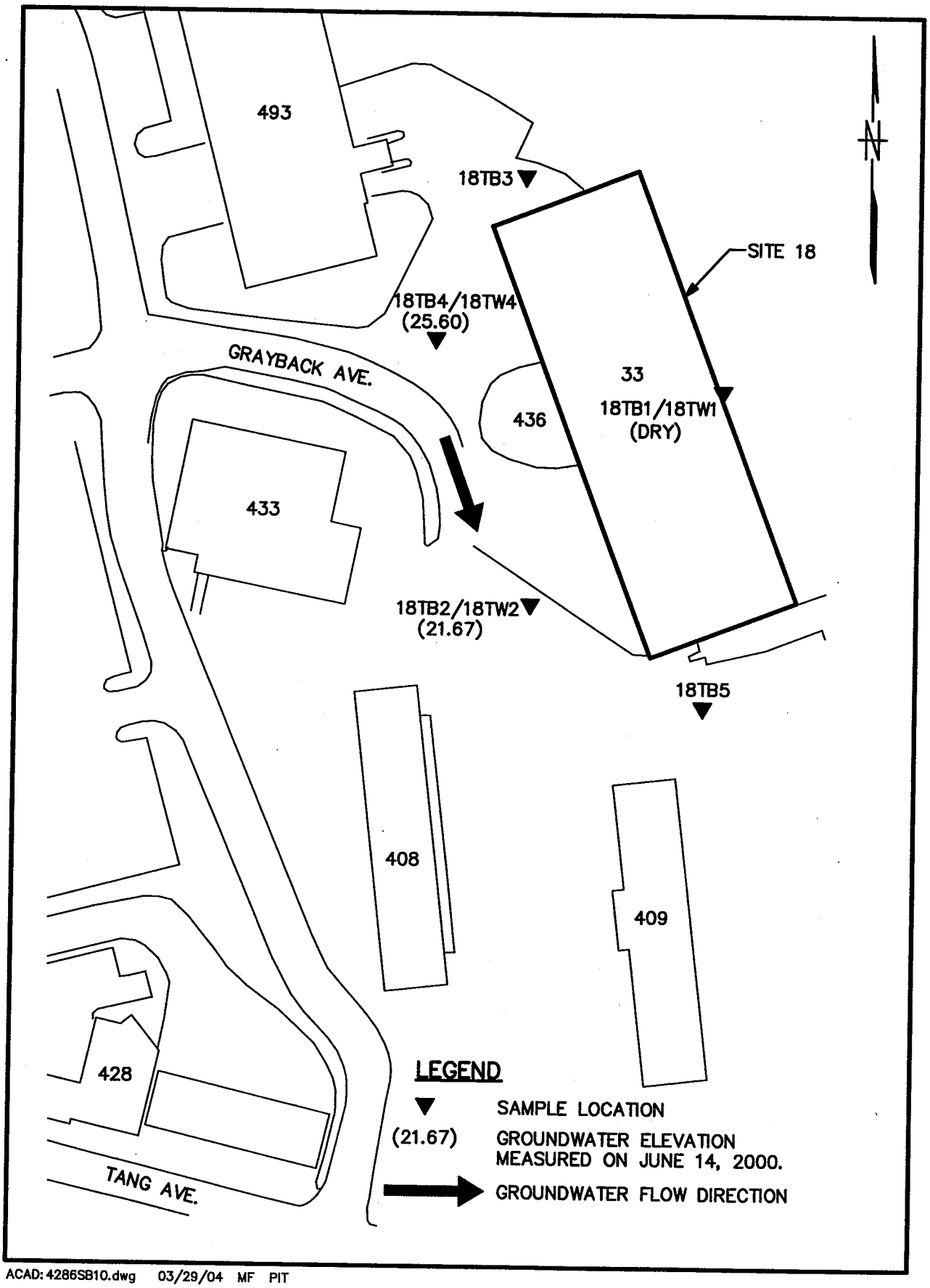

Figure 6. Site 18 Layout Map

Site Backgrounds, Characteristics, and Investigations

Site 2A

Site 2A includes the Area A Landfill, as shown in Figure 7. Area A Landfill opened around 1957. Incinerated combustible wastes were disposed at the Area A Landfill until 1963, followed by refuse and debris disposal until 1973, when landfilling operations ceased. The thickness of the landfill materials is estimated to range from 10 to 20 feet. After closure, a concrete pad was constructed on a portion of the landfill. In the early 1980s, transformers and electrical switches stored on the pad were reported to be leaking. Petroleum compounds were poured from containers at the landfill and flowed into the Area A Wetland. Spent sulfuric acid solution from batteries was poured into trenches dug in to Area A Landfill for disposal and subsequently covered with soil.

A Phase I Remedial Investigation (**RI**) (1992), Focused **FS** (1995) and Phase II **RI** (1997) were conducted for the Area A Landfill. The Phase II **RI** concluded that shallow **groundwater contamination** existed at the site, the landfill soil may pose a threat to human receptors from concentrations of PCBs, and chemicals in soil could adversely impact ecological receptors. To address Site 2A soil (**OU**1), a Remedial Action (RA), which involved the construction of a 13-acre low-permeability cover system over the landfill area, was performed in 1997. The **groundwater** at the Area A Landfill is currently monitored under a long-term **groundwater monitoring** program. The **groundwater** at the site was also investigated as part of the **BGOURI** (2002). The **BGOURI** recommended that the **monitoring** program be continued to gather data to evaluate long-term trends in contaminant concentrations and the decision to proceed to an **FS** should be made after sufficient data have been collected and evaluated. Land use controls have been implemented at the landfill to meet the requirements in the soil **ROD**. A majority of the Area A Landfill is paved and is currently used for storage of equipment and vehicles.

The initial **Groundwater Monitoring** Plan (GMP) (1999) for Site 2 called for **monitoring groundwater** and surface water for semivolatile organic compounds (**SVOCs**), volatile organic compounds (**VOCs**), **PAHs**, **metals**, pesticides/PCBs, and various field parameters.

A geochemical investigation completed during Year 3 revealed that the slightly elevated arsenic concentrations detected in the downgradient **monitoring** wells in the Area A Wetland, which were completed in dredged material, are related to the dredged material and not the landfill. It is also likely that the elevated zinc levels were related to the dredged material as well as background conditions.

The geochemical investigation also indicated that the pore water in the dredged material is not participating actively in the local **groundwater** flow system. This conclusion was based on measured hydraulic conductivities (vertical and horizontal) and the observation that the dredged material pore water retains strong signatures of seawater. Therefore, the **monitoring** results do not indicate that the Area A Landfill is acting as a significant **source** of **contamination** to **groundwater** or surface water.

After 4 years of **monitoring**, the revised GMP (2004) called for **monitoring groundwater** and surface water for **SVOCs**, **PAHs**, total and dissolved metals, and field parameters. A decision was made to eliminate **VOCs** and pesticides/PCBs from the Area A Landfill analytical program based on **monitoring** results with no exceedances of criteria for these compounds. The revised **monitoring** list for the Area A landfill is as follows:

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- BEHP
- Phenanthrene
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Copper
- Lead
- Zinc

Compliance with CTDEP Remediation Standard Regulations (RSRs) for a given constituent in a **groundwater** plume can be shown by two different methods. Compliance is achieved when sampling locations are representative of the plume and:

- The average concentration of the compound in the plume is equal to or less than the applicable criteria for at least four consecutive quarterly sampling periods, or
- Statistical comparisons of upgradient and downgradient concentrations such that the concentration of the compound is not increasing over time.

Site 2 has been monitored for 8 years. Overall the results of seven years of **monitoring** indicate that the cap system is working properly and significant contaminant migration from the landfill is not occurring. The most recent results available, those from Year 7 (2006), determined that copper was the only contaminant detected in **groundwater** in excess of criteria (Figure 8) and this was in a

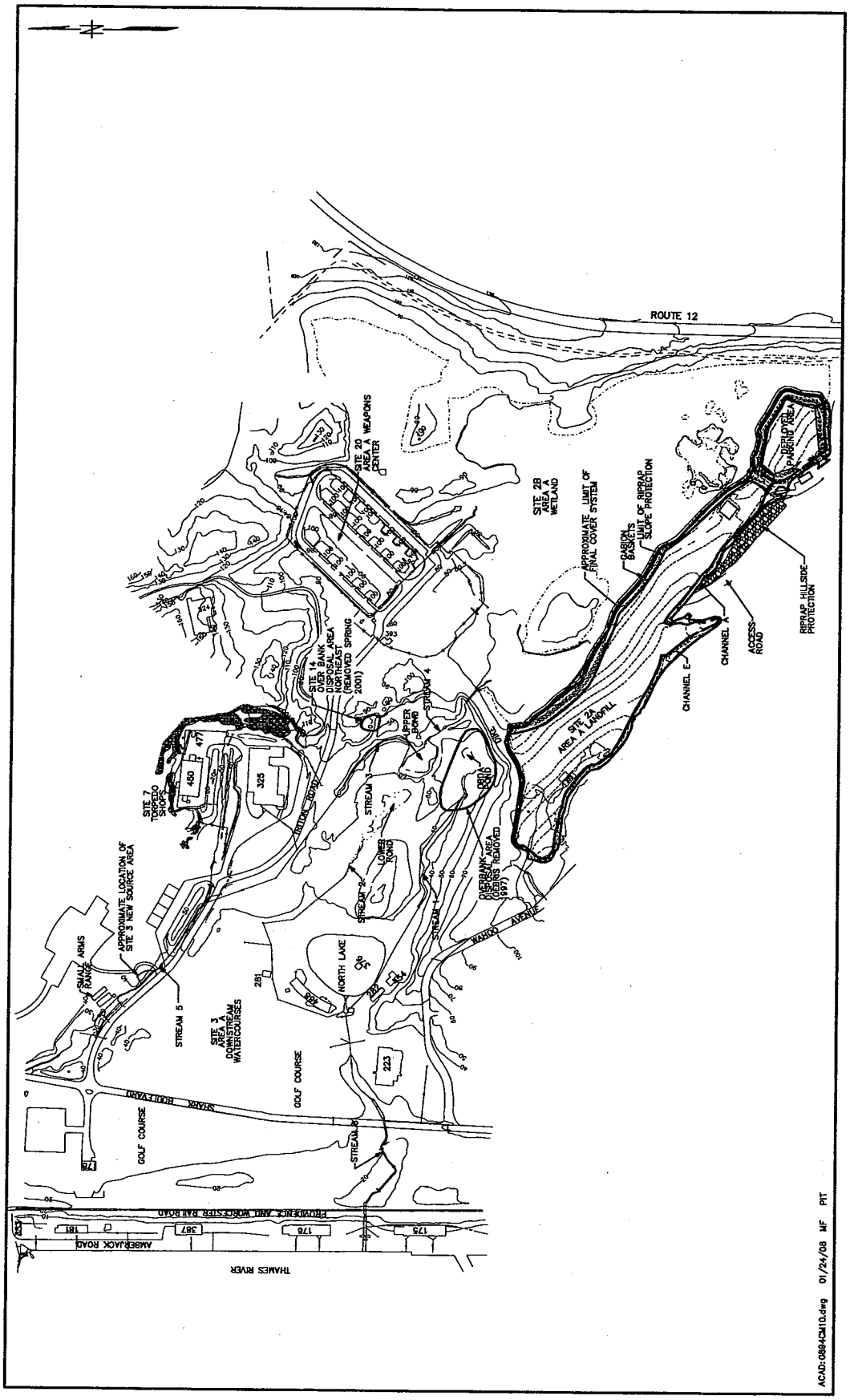

Figure 7. Sites 2A, 2B, 3, 7, 14, and 20 Layout Map

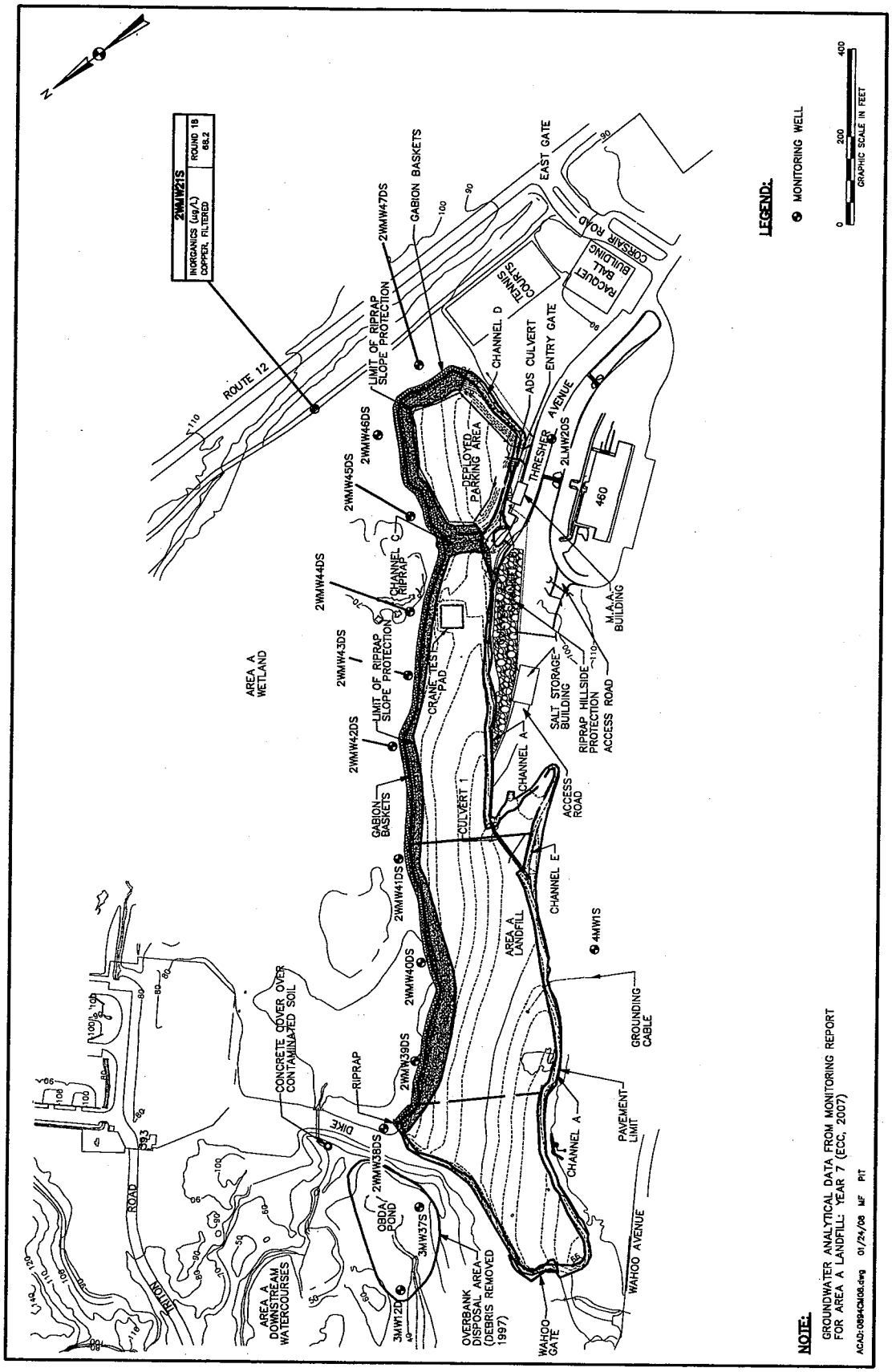

Figure 8. Significant Groundwater Contamination at Sites 2A and 2B

reference well, not a downgradient well. In addition, this well had elevated turbidity, which indicates a suspended sediment issue. The concentrations of copper in all monitored wells exhibited some spikes and appear to have a seasonal component but do not exhibit a clear trend.

The Site 2A human health **risk assessment** performed during the **BGOURI** evaluated potential risks from exposures to **groundwater** by construction workers. The **risk assessment** determined that risks for construction workers were within acceptable risk levels. The **risk assessment** was updated in a 2008 memorandum to account for current **risk assessment** guidance and Year 7 sampling results. The assessment confirmed that risks to construction workers exposed to **groundwater** would be acceptable; however, the assessment showed that there are potential risks to hypothetical residents that would exceed USEPA and CTDEP acceptable levels if **groundwater** is used as a drinking water supply. These risks are mitigated by the existing **institutional controls** that prohibit residential development of Site 2. Potential risks resulting from exposures to chemicals that have volatilized from **groundwater** and migrated through building foundations into indoor air were also evaluated by comparing concentrations of volatile chemicals detected in **groundwater** to USEPA and CTDEP screening criteria for vapor intrusion. Concentrations of chloroform, tetrachloroethene, and trichloroethene exceeded the USEPA screening criteria and they were further evaluated using USEPA's Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within USEPA and CTDEP acceptable levels and vapor intrusion is not an issue at Site 2A.

Site 2B

Site 2B, the Area A Wetland, is located north of the Area A Landfill (Figure 7). In the late 1950s, dredged material from the Thames River were pumped to this area and contained within an earthen dike that extends from the Area A Landfill to the southern side of the Area A Weapons Center. The thickness of dredged material ranges from 10 feet to 35 feet. A small pond is located at the southern portion of the wetland, where 1 to 3 feet of standing water is present year-round. *Phragmites* is the predominant type of vegetation. It was reported that formulated (water-soluble) 1,1,1-trichloro-2,2-bis(4chlorphenyl)ethane (DDT) was used in the 1960s before the 1972 ban. The Phase I and II **RIs** (1992 and 1997, respectively) and the BGOURI (2002) included investigations of the Area A Wetland. The Area A Wetland **sediment** was identified as OU12 and it is currently being investigated under CERCLA.

The Phase II **RI** found little, but some, evidence of **groundwater contamination** at Site 2B. The human health **risk assessment** concluded that carcinogenic risks were within the USEPA target risk range of 1 per 1,000,000 to 1 per 10,000. Non-carcinogenic risks were below the USEPA acceptable level of one. The cumulative hazard index exceeded one for the construction worker but the **risk assessment** assumed that the construction worker would come in direct contact with the soil and **groundwater** for 8 hours a day for 120 days a year. The cumulative non-carcinogenic risks for the construction worker scenario using assumptions of direct contact for 4 hours a day for one month a year are in the acceptable range.

The **risk assessment** was updated in a 2008 memorandum to account for current **risk assessment** guidance and Year 7 sampling results. The assessment confirmed that risks to construction workers exposed to **groundwater** would be acceptable; however, the assessment showed that there are potential risks to hypothetical residents that would exceed USEPA and CTDEP acceptable levels if **groundwater** is used as a drinking water supply. These risks are mitigated by the existing institutional controls that prohibit residential development of Site 2. Potential risks resulting from exposures to chemicals that have volatilized from **groundwater** and migrated through building foundations into indoor air were also evaluated in a separate 2008 memorandum by comparing concentrations of volatile chemicals detected in **groundwater** to USEPA and CTDEP screening criteria for vapor intrusion. Concentrations of trichloroethene and tetrachloroethene exceeded the USEPA screening criteria and they were further evaluated using USEPA's Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within USEPA and CTDEP acceptable levels and vapor intrusion is not an issue at Site 2B.

Sites 3 and 7

Site 3 covers approximately 75 acres in the northern portion of NSB-NLON. The site contains mainly undeveloped wooded areas and recreational areas [golf course and lake for swimming (North Lake)]. The Site 3 watercourses include several small ponds and interconnected streams (Figure 7) that convey surface water to the Thames River. Site 3 also includes the former Over Bank Disposal Area (OBDA). Site 3 was investigated during the Phase I **RI** (1992), Phase II **RI** (1997), Data Gap Investigation (2002), **BGOURI** (2002), and **BGOURI Update/FS** (2004). The major **sources** of **contamination** to Site 3 included historic application of pesticides, abandoned disposal areas, and the septic system leach fields at Site 7. In March 1997, accumulated debris in the OBDA (Figure 7), includ-

ing discarded wooden pallets, telephone poles, and empty tanks, was removed as part of a Time-Critical Removal Action (TCRA) and disposed off site. During 1999 and 2000, a remedial action was completed for a portion of Site 3 soil and **sediment** (**OU**3). Approximately 18,050 tons of soil and **sediment** contaminated with pesticides and **metals** were excavated and disposed at off-site disposal facilities. The Site 3-New **Source** Area (NSA), discovered during the RA for Site 3 **OU**3, contained petroleum-contaminated soil. The site was a small disposal area on the hillside adjacent to Stream 5, and debris, such as rusted drums and wire cable, was found intermingled with soil and boulders at the site. An RA for the debris and contaminated soil at the site was completed in October 2007.

Most of Site 3 is within designated Explosive Safety Quantity Distance (ESQD) arcs of Site 20; therefore, further development is not planned for this area. Navy regulations prohibit construction of inhabited buildings or structures within these arcs. Although existing buildings operate under a waiver of these regulations, no further construction is planned.

Site 7, the Torpedo Shops (Buildings 325, 450, 477, and 528), is located in the northern portion of NSB-NLON on the northern side of Triton Road (Figure 7). The Navy conducts maintenance activities on torpedoes at the site. Site 7 media were investigated during several phases from 1990 to 2000. Site 7 soil was addressed by the **ROD** for **OU**8 in 2004 and an RA (excavation and off-site disposal) in 2006. The major **sources** of **contamination** at Site 7 included possible historic disposal of solvents/chemicals into two on-site septic systems and leaks or spills associated with on-site underground storage tanks. Contaminated soil was found on the southern side of Building 325, and it appeared to be related to former underground storage tanks used to store fuel oil. **Groundwater** and suspected soil **contamination** on the western side of the building appeared to be related to the septic tank, sewer lines, or leach field associated with the former septic system. The underground storage tanks were closed in the 1990s, and the septic system was abandoned when sanitary sewers were installed in 1983. A soil RA was performed at Site 7 in 2006. Soil was excavated from two locations - south of Building 325, and the former septic tank area west of Building 325. Approximately 1,150 tons of **PAH**-, benzene-, chlorobenzene-, and dichlorobenzene-contaminated soil and 125 tons of asphalt were excavated and disposed off site. Excavations were backfilled with clean soil.

Chlorinated **volatile organic compound**s (**VOC**s) [*e.g.*, cis-1,2-dichloroethene, trichloroethene (TCE), and vinyl chloride] and **PAHs** were the primary contaminants historically detected in the **groundwater** at Site 3. Chlorinated **VOC**s were detected during all of the investigations, and it is likely that their detections are the result of solvents released to **groundwater** via the two septic systems and associated leach fields at Site 7 and migrating downgradient to Site 3. No other potential **source** of the **contamination** was found in the area. Use of the septic systems and leach fields at Site 7 was terminated in 1983 when sanitary sewers were installed. The concentrations of the **VOC**s detected during the 2002 investigation were lower than concentrations detected during previous investigations (1994), indicating that a continuing **source** of **contamination** is not present. The **VOC**s were found primarily along the length of Stream 5. The **PAHs**, which were detected infrequently, were found to be related to suspended solids in samples collected from recently installed and sampled temporary wells and not a site-specific **groundwater** concern. The results of the **risk assessment** showed that there are no unacceptable risks to current receptors from exposure to contaminants in Site 3 **groundwater**, but the maximum concentrations of TCE and vinyl chloride in Site 3 **groundwater** could result in unacceptable risks to hypothetical residents if **groundwater** is used as a drinking water supply.

Potential risks resulting from exposures to chemicals that have volatilized from **groundwater** and migrated through building foundations into indoor air were also evaluated in a 2008 memorandum by comparing concentrations of volatile chemicals detected in **groundwater** to USEPA and CTDEP screening criteria for vapor intrusion. Concentrations of chloroform, trichloroethene, and vinyl chloride exceeded the USEPA screening criteria and they were further evaluated using USEPA's Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within USEPA acceptable levels, but cancer risks from chloroform and vinyl chloride for the residential scenario exceeded CTDEP acceptable levels. Because the concentration of chloroform did not exceed the CTDEP vapor intrusion criteria, it was concluded that there are no vapor intrusion issues associated with chloroform. Further evaluation of vinyl chloride concluded that it does present a potential risk for the residential scenario. A building could be built for industrial purposes in the area where elevated concentrations of vinyl chloride were detected in **groundwater**; however, there would be restrictions on construction of a building for residential purposes within 100 feet of the area unless steps are taken to mitigate the vapor intrusion issue (subslab depressurizing system). As a result, the **NSB-NLON IR Site Use Restrictions document** for Site 3 will be expanded to include controls on vapor intrusion issues until **groundwater** concentrations reduce to levels at which vapor in-

trusion is no longer deemed an issue. Site 3 land use is currently industrial and no significant risks are expected from exposures resulting from the migration of vinyl chloride from **groundwater** into indoor air since there are no buildings in the area of the exceedance and vinyl chloride was detected infrequently in **groundwater**. As previously mentioned, most of Site 3 is within designated ESDQ arcs for Site 20 and further development is not planned within this area.

Investigations at Site 7 found benzene, chlorobenzenes (1,4-dichlorobenzene, chlorobenzene, and hexachlorobenzene), phenanthrene, and TCE in the **groundwater**. The contaminants were probably released to the **groundwater** via the two septic systems and associated leach fields historically used at the site. The results of the **risk assessment** showed that there are no unacceptable risks to current receptors from exposure to contaminants in Site 7 **groundwater**, but the maximum concentrations of benzene, chlorobenzenes, and TCE in Site 7 **groundwater** could result in unacceptable risks to hypothetical residents if **groundwater** is used as a drinking water supply.

Potential risks resulting from exposures to chemicals that have volatilized from **groundwater** and migrated through building foundations into indoor air were also evaluated in a 2008 memorandum by comparing concentrations of volatile chemicals detected in **groundwater** to USEPA and CTDEP screening criteria for vapor intrusion. Concentrations of trichloroethene exceeded the USEPA screening criterion and it was further evaluated using USEPA's Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within USEPA and CTDEP acceptable levels and vapor intrusion is not an issue at Site 7.

The initial screening of the analytical data also indicated that the maximum concentrations of hexachlorobenzene and phenanthrene could migrate from **groundwater** to surface water. However, upon further evaluation of frequency of detection information, the potential migration was determined to be insignificant.

The **groundwater** chemicals of concern (COCs) for Sites 3 and 7, based on the investigations and **risk assessments** that were conducted, and the remedial goals selected for each of the COCs are as follows:

VOCs

- 1,4-Dichlorobenzene, 75 µg/L (Site 7)
- Benzene, 1 µg/L (Site 7)
- Chlorobenzene, 100 µg/L (Site 7)
- TCE, 5 µg/L (Sites 3 and 7)
- Vinyl chloride, 1.6 µg/L (Site 3)

SVOCs

- Hexachlorobenzene, 1 µg/L (Sites 3 and 7)

In addition to these COCs, the following COCs were identified for the **PAH**-contaminated soil at Site 7. The **groundwater** is monitored for these COCs to evaluate the effectiveness of the soil remediation at Site 7. These COCs will only be analyzed in **monitoring** well 7MW13S.

PAHs

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Indeno(1,2,3-cd)pyrene

Monitored **groundwater** wells and exceedances of remedial goals from the first year (four rounds in 2006-2007) of sampling at those wells are presented on Figure 9. No COCs were detected at several wells. At Site 3, TCE and vinyl chloride were detected in three wells at concentrations that slightly exceeded their remedial goals. It is expected that these contaminants will continue to trend downward and will shortly be below the remedial goals. All compounds at Site 7 were below their remedial goals.

Site 9

Site 9 included OT-5 (Figure 10), a former underground concrete storage tank, located within Site 23 (Figure 11). The soil at Site 9 was investigated and remediated under the CTDEP RCRA UST Program. No CERCLA decision documents were prepared for the soil **OU**. The tank was constructed in the 1940s and was used to store fuel oil. The tank had a capacity of approximately 750,000 gallons. In the late 1970s, the tank was converted to a storage tank for bilge water and other waste solutions. Use of OT-5 was stopped in 1993, and all tank contents were removed. A residual sludge layer of approximately 2 to 3 inches was left in the tank after purging. This sludge contained polychlorinated biphenyls (PCBs) at concentrations exceeding 500 mg/kg. After OT-5 was emptied, **groundwater** infiltrated through cracks in the concrete surface and partially refilled the tank. Residual materials were removed in 1994. After the contents of OT-5 were removed, the tank was cleaned and the top of the tank was crushed. The tank was closed in place by filling it with inert material. Further evaluation of Site 9 **groundwater** is included under Sites 23.

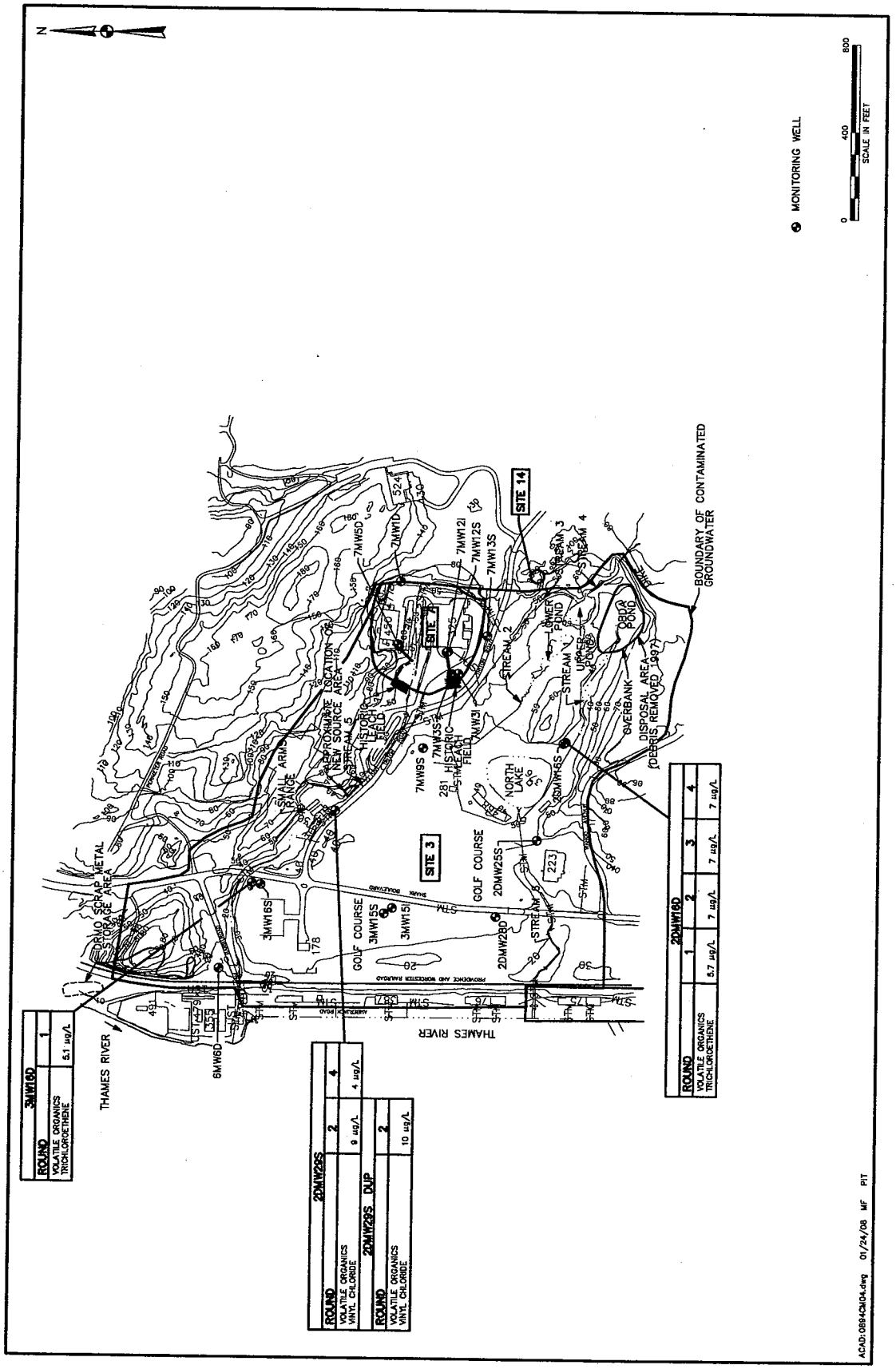

Figure 9. Significant Groundwater Contamination at Sites 3 and 7

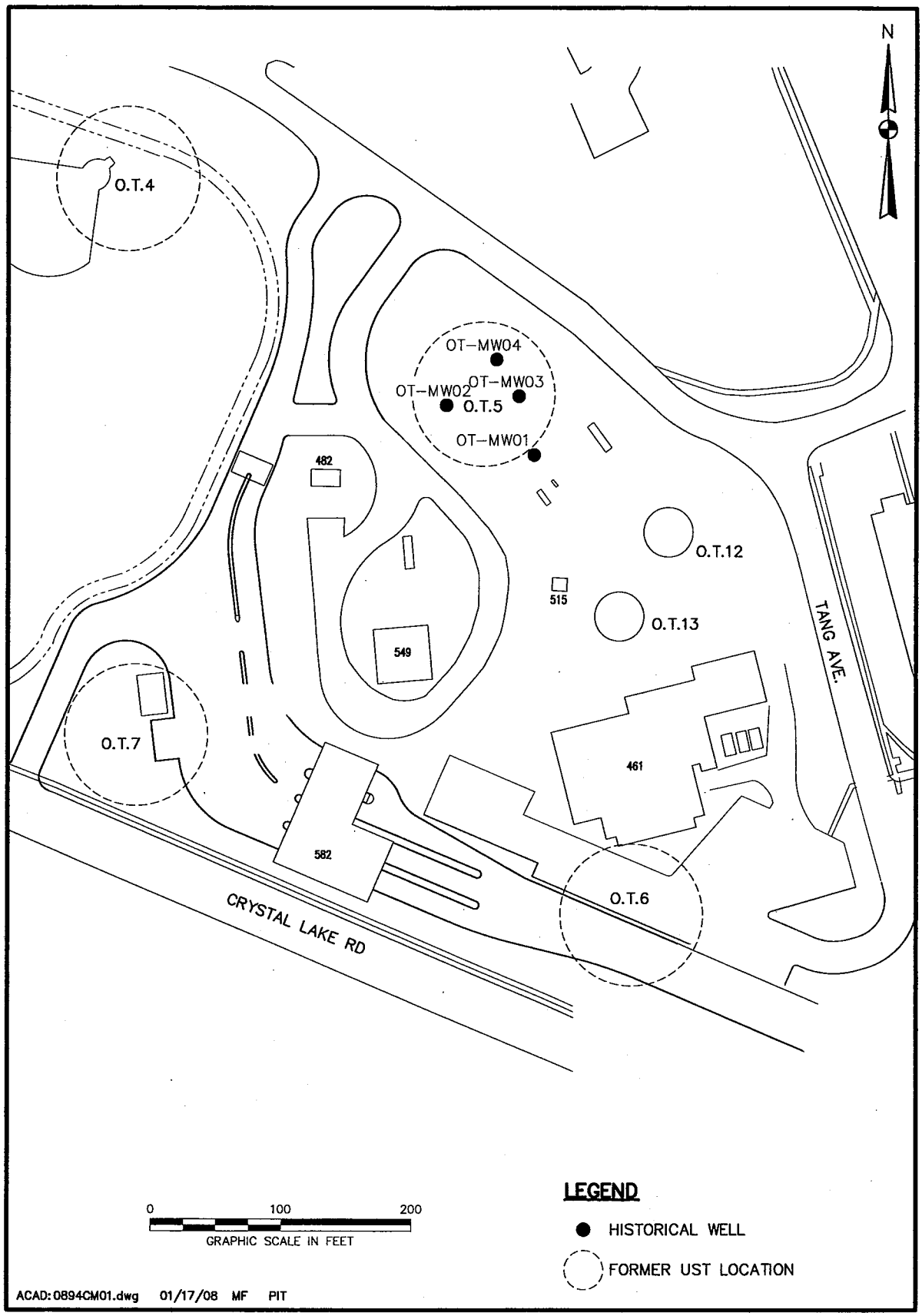

Figure 10. Site 9 Layout Map

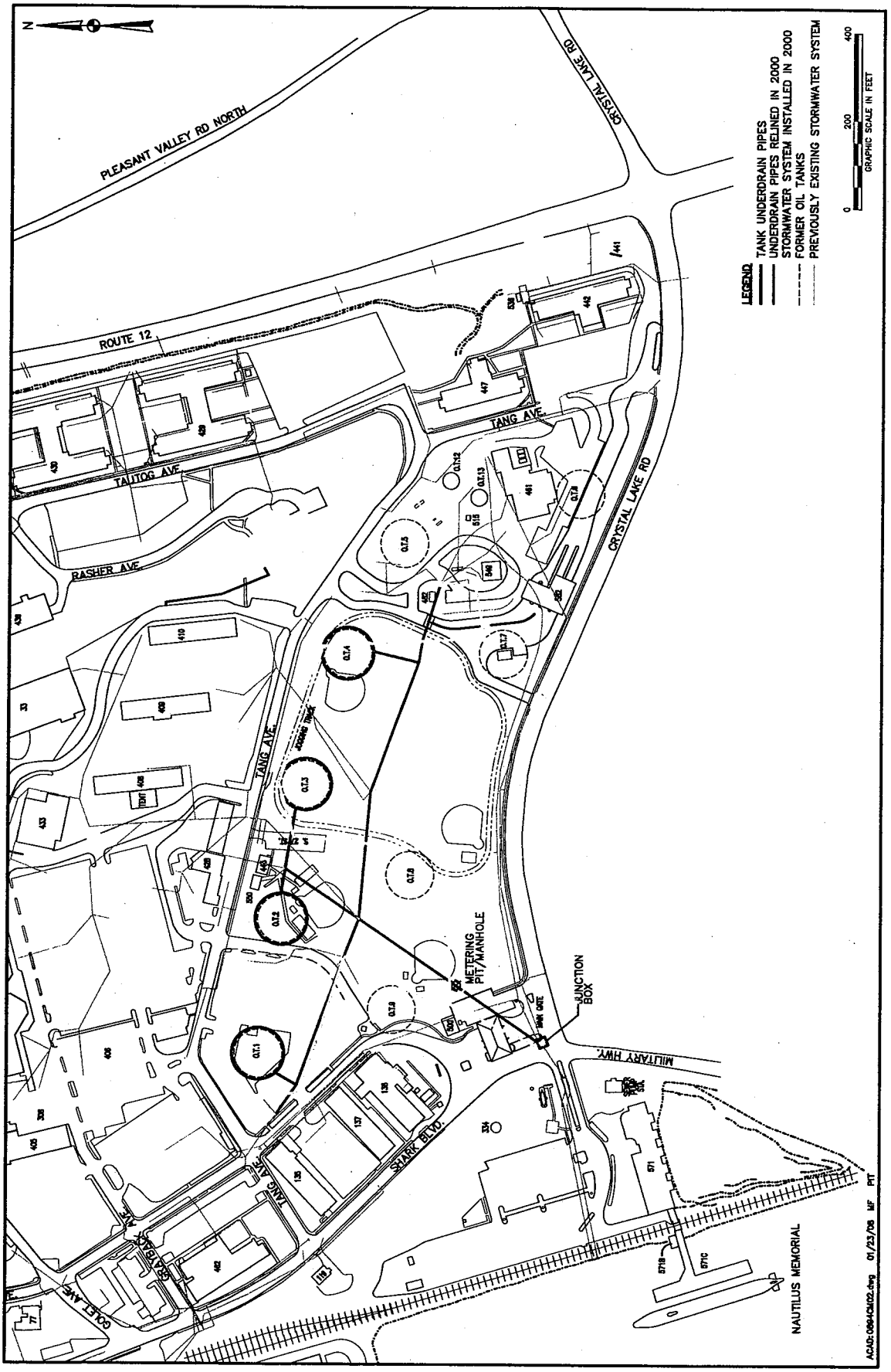

Figure 11. Sites 9 and 23 Layout Map

Site 14

Miscellaneous wastes were dumped at Site 14. It is located adjacent to Sites 3 and 7 in a wooded area on the edge of a ravine just north of Stream 3 (Figure 7). A NTCRA was completed at the site in 2001 to address the soil (**OU**8) and miscellaneous wastes dumped at the site. Approximately 270 tons of material were removed and disposed off site, and the site was subsequently restored.

One **groundwater monitoring** well was installed at Site 14. It was sampled in 1994 and 2000. Naturally occurring **metals** were the only chemicals detected in the **groundwater**. Evaluation of the Site 14 analytical data indicated that there are no adverse health effects anticipated from exposure to **groundwater** at the site.

Site 15

Site 15 is located in the southern portion of NSB-NLON (Figure 1). It is centrally located between the southern sides of Buildings 409 and 410 (Figure 12). This site was used before and after World War II for the temporary storage of waste battery acid in a rubber-lined underground tank. The tank was reportedly 12 feet long by 4 feet wide by 4 feet high. The batteries were placed on a concrete pad next to the tank onto which acids occasionally leaked. No major spills were recorded. A 1951 aerial photograph showed that the area around the tank was not paved. Acid from the batteries was stored in the tank and was subsequently pumped into a tank truck and disposed in the Area A Landfill (Site 2). Historical investigations completed at Site 15 include the Phase I **RI** (1992), Focused **FS** (1994), Phase II **RI** (1997), Supplemental Sampling Event (1997) and **BGOURI** (2002). Based on the results of the Phase I **RI** and Focused **FS**, it was determined that a TCRA was necessary for Site 15. The removal action was completed in 1995 and included removal of the tank, its contents, and 318 tons of lead-contaminated soil. Subsequent to the TCRA, completion of the Phase II **RI**, and confirmation sampling, an NFA **Source** Control **ROD** was signed for Site 15 soil **(OU6)** in 1997.

After the TCRA at Site 15, **groundwater** samples were collected in 2000 at the site during the **BGOURI**. The **BGOURI** identified TCE and **metals** as the **groundwater** chemicals of potential concern (COPCs). TCE had not been detected in previous sampling events. Additional soil and **groundwater** samples were collected during the data gap investigation (DGI) in 2002 to confirm the results of the **BGOURI**, to further define the nature and extent of **contamination** at the site, and to determine the risks to human receptors from exposure to Site 15 soil and **groundwater**. The DGI results were presented in the **BGOURI Update/FS**. TCE was not detected in the DGI **groundwater** samples, which indicated that the detections of TCE found in **groundwater** samples during the **BGOURI** were anomalous and not indicative of a site or upgradient **source** issue. The **metals** cadmium, chromium, lead, nickel, silver, and zinc were identified as **groundwater** COPCs at Site 15 during the **BGOURI**. The results of the DGI showed that the chromium, lead, nickel, and silver concentrations were also anomalies and that the elevated concentrations may have been a result of the field sampling methodology and/or laboratory issues.

The **risk assessment** and data screening completed with the DGI results showed that there are no **groundwater** COCs for Site 15. The **risk assessment** was performed for construction workers and hypothetical adult residents. The results of the **risk assessment** indicated that the risks from direct exposure to **groundwater** were within USEPA and CTDEP acceptable risk levels. Potential risks resulting from exposures to chemicals that have volatilized from **groundwater** and migrated through building foundations into indoor air were also evaluated in a 2008 memorandum by comparing concentrations of volatile chemicals detected in **groundwater** to USEPA and CTDEP screening criteria for vapor intrusion. Concentrations of chloroform exceeded the USEPA screening criterion and it was further evaluated using USEPA's Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within USEPA and CTDEP acceptable levels and vapor intrusion is not an issue at Site 15.

Site 18

Site 18 consists of Building 33, the Solvent Storage Area. The location of Site 18 is shown on Figures 1 and 6. Building 33 has been used for the storage of gas cylinders and 55-gallon drums of solvents such as trichloroethene (TCE) and dichloroethene. The Solvent Storage Area at Building 33 was identified during the IAS. The site was identified as Study Area F in the FFA and is now identified as Site 18 for the **IR** Program. **Groundwater** samples were collected from the site during the **BGOURI** (2002).

At Site 18, no significant **groundwater contamination** was identified during the **BGOURI**. No **groundwater** COPCs were identified for Site 18 during the data screening portion of the **risk assessment**. The results of the **RI** did not indicate that subsequent rounds of investigation were necessary to further characterize the site or that an **FS** was necessary for the site.

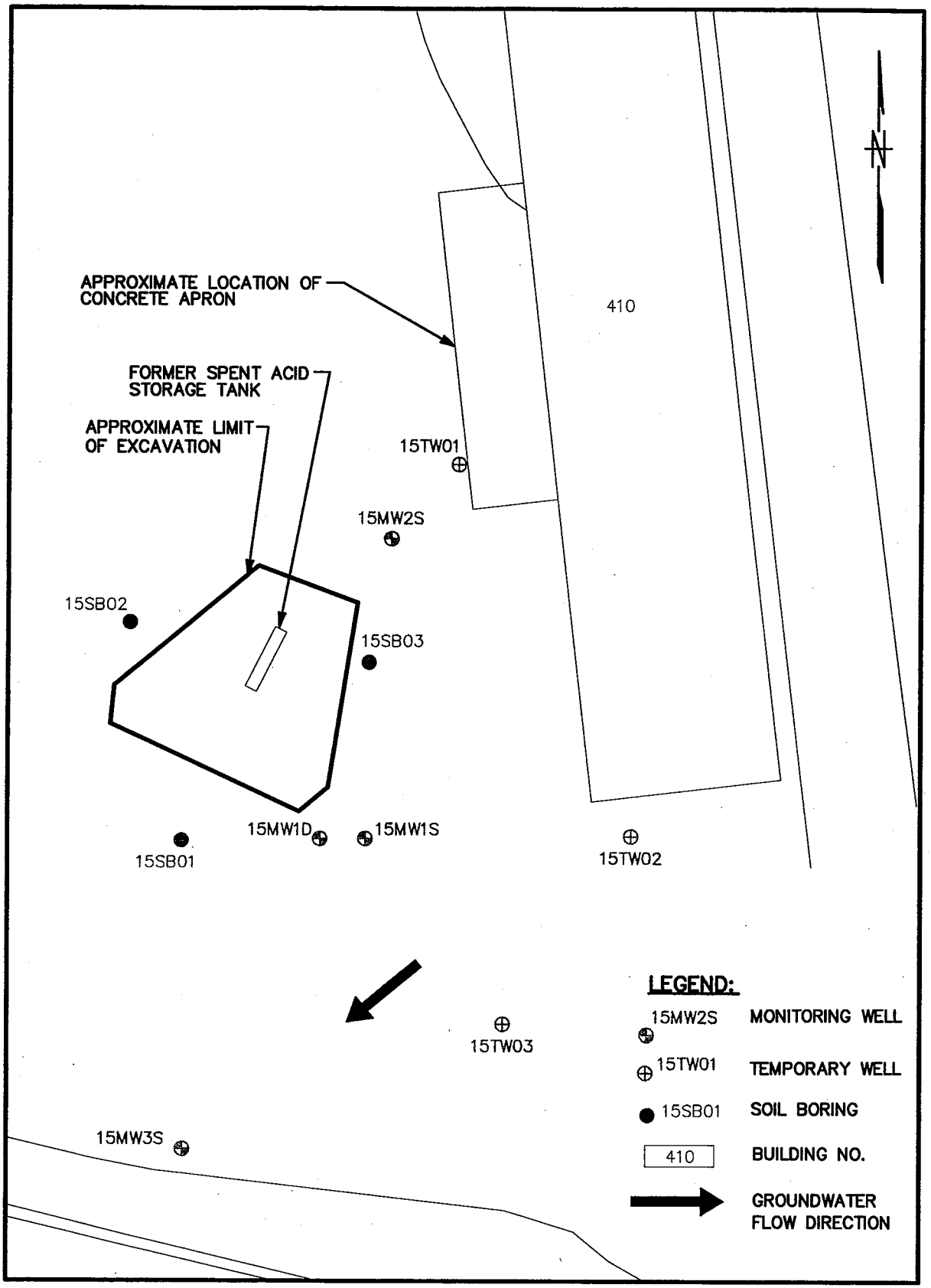

Figure 12. Site 15 Layout Map

The soil associated with Site 18 (**OU**11) was addressed in an NFA **ROD** in 2004.

Site 20

The Area A Weapons Center (Site 20) consists of Building 524 and the weapons storage bunkers. The site is located near the top of a local topographic and bedrock high (Figure 7). Building 524 is used for administration, minor torpedo assembly, and storage of simulator torpedoes. Small quantities of chemicals (cleaning and lubricating compounds, paints, and adhesives) and chemical waste generated by on-site activities are stored at the site. Liquid fuels present in the weapons storage bunkers include **Otto fuel II**, **JP-10**, and **TH Dimer** (jet rocket fuel). A small (less than 200 cubic yards) soil RA was conducted at the site in 2001 to address polynuclear aromatic hydrocarbon (**PAH**) and inorganic **contamination** in the soil and **sediment** (**OU**7). Site 20 soil is designated as **OU**7.

The overburden and bedrock **groundwater** at Site 20 was characterized during three separate investigations. **VOC**s and **SVOC**s were detected sporadically at low concentrations in the overburden and bedrock **groundwater** during the investigations. Naturally occurring **metals** were detected consistently in the **groundwater**. Evaluations of risks in the Phase II **RI** related to the site's **groundwater** indicated potentially unacceptable risks for construction workers and adult residents. The results from the **BGOURI** showed that risks to construction workers were within acceptable levels mainly as a result of lower concentrations of **metals** in **groundwater**. Risks for hypothetical adult residents exceeded acceptable levels in the **BGOURI**. The latest results from the **BGOURI Update/ FS** showed that there are no adverse health effects anticipated from exposure to Site 20 **groundwater** for hypothetical adult residents.

Potential risks resulting from exposures to chemicals that have volatilized from **groundwater** and migrated through building foundations into indoor air were also evaluated in a 2008 memorandum by comparing concentrations of volatile chemicals detected in **groundwater** to USEPA and CTDEP screening criteria for vapor intrusion. Concentrations of trichloroethene exceeded the USEPA screening criterion and it was further evaluated using USEPA's Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within USEPA and CTDEP acceptable levels and vapor intrusion is not an issue at Site 20.

Site 23

Site 23 (Tank Farm) is located in the southern portion of NSB-NLON (Figure 1). Site 23 features nine former USTs that were demolished and closed in place, a 30,000 gallon, doublewalled UST (OT10), a 10,000-gallon waste oil tank, a fuel oil loading area, a tanker truck dumping pad and trough, associated UST piping systems, baseball/ softball fields, buildings that housed the former air sparging/ soil vapor extraction (AS/SVE) facility for the Naval Exchange service station, two 150,000-gallon diesel aboveground storage tank (ASTs), and other buildings. Five of the nine tanks (OT-1, OT-2, OT-3, OT-4, and OT-6) had perimeter underdrains installed around them during their construction to depress **groundwater** levels. In addition, the storm sewers, which the underdrains tie into, were constructed of perforated corrugated metal pipe to help dewater the area. The underdrain at OT-6 was subsequently abandoned around 1966 during completion of improvements to the storm sewer system. The soil at Site 23 was remediated in 1997 and 2000 under the CTDEP Resource Conservation and Recovery Act (RCRA) Underground Storage Tank (UST) Program.

The Site 23 USTs were properly closed in place; however, the tank underdrain systems were allowed to remain in place to help reduce **groundwater** levels in the area. Evidence of releases of petroleum products from the tanks, their associated piping, and possibly from other nearby **sources** was detected in soil during previous investigations. No significant **groundwater contamination** was detected; however, petroleum hydrocarbons were detected periodically at the outfall of the storm sewer system near Goss Cove. The stormwater drainage system was rehabilitated in 2000 such that the original combined **groundwater** and stormwater system was separated into a deep **groundwater** and a new shallow stormwater system. The **groundwater** underdrain system continues to collect **groundwater** from the old tank drains. In 2000, new storm drain was installed using solid wall HDPE piping and much of the underdrain was relined with perforated plastic pipe, at the locations shown on Figure 11. An existing manhole was modified to become a **groundwater** flow-metering and sampling pit. Beyond the metering pit, the **groundwater** underdrain pipe and stormwater collection pipes are recombined (Figure 11), such that **groundwater** then enters the storm sewer system.

The **risk assessment** performed during the **BGOURI** evaluated potential risks from exposures to Site 23 **groundwater** by construction workers and hypothetical adult residents, although, it is unlikely, that direct contact exposures to Site 23 **groundwater** would occur based on current and expected future site use. The results of the **risk**

assessment showed that there are no unacceptable risks to construction workers and hypothetical adult residents.

The Site 23 underdrain metering pit was sampled after construction and quarterly for one year starting in June 2007. The metering pit collects **groundwater** from the Site 23 area underdrains from four former tanks. All relevant concentrations were below established Connecticut criteria with the exception of arsenic and six SVOCs. Arsenic was detected in one unfiltered sample during the September 2007 sampling event at a concentration exceeding the Connecticut criteria, but the concentration of arsenic in the associated filtered sample was below the criteria. Because arsenic was not detected at similar concentrations during previous or subsequent sampling events, it was concluded that the single elevated detection of arsenic was related to suspended solid particles in the water and not a true issue. Six SVOCs were detected during the December 2007 sampling round at concentrations that were greater than the Connecticut surface water protection criteria. These chemicals were not detected in the duplicate sample collected during that round and they were not detected in previous or subsequent sampling events. Therefore, it was concluded that these detections were anomalous.

The **risk assessment** was updated in a 2008 memorandum to account for current **risk assessment** guidance and the 2007/2008 underdrain metering pit quarterly sampling results. The assessment confirmed that risks to construction workers exposed to **groundwater** would be acceptable; however, the assessment showed that there are potential risks to hypothetical residents that would exceed USEPA and CTDEP acceptable levels if **groundwater** is used as a drinking water supply. These risks are mitigated by the fact that many of the major contributors to the carcinogenic and noncarcinogenic risks were only detected in one of four rounds of samples and Site 23 is not suitable for residential development.

Potential risks resulting from exposures to chemicals that have volatilized from **groundwater** and migrated through building foundations into indoor air were also evaluated in a 2008 memorandum by comparing concentrations of volatile chemicals detected in **groundwater** to USEPA and CTDEP screening criteria for vapor intrusion. Concentrations of chloroform and trichloroethene exceeded the USEPA screening criteria and they were further evaluated using USEPA's Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within USEPA and CTDEP acceptable levels and vapor intrusion is not an issue at Site 23.

Based on these results, Site 23 **groundwater** (including Site 9 **groundwater**) collected and conveyed in the storm sewer system does not pose a significant current threat to human health or the environment, but it may pose a potential threat in the future to hypothetical future human receptors if they regularly consume the **groundwater** over a prolonged period of time. **Institutional controls** are required for Site 23 to restrict extraction and use of **groundwater** to minimize the potential risk to future human receptors.

What is Risk and How is it Calculated?

A **human health risk assessment** estimates "baseline risk." This is an estimate of the likelihood of health problems occurring if no cleanup action were taken at a site. To estimate baseline risk at a site, the Navy undertakes a four-step process in accordance with USEPA guidance:

Step 1: Analyze **Contamination**
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, the Navy looks at the concentrations of contaminants found at a site as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies help determine which contaminants are most likely to pose the greatest threat to human health.

In Step 2, the Navy considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, the Navy calculates a "reasonable maximum exposure" (RME) scenario, which portrays the highest level of human exposure that could reasonably be expected to occur.

In Step 3, the Navy uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential health risks. The likelihood of any kind of cancer resulting from exposure to a site is generally expressed as an upper bound probability; for example, a "1 in 10,000 chance." In other words, for every 10,000 people that could be exposed, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected from all other causes. For non-cancer health effects, the Navy calculated a "haz-

ard index," where a "threshold level" (measured usually as a hazard index of less than 1) exists below which non-cancer health effects are no longer predicted.

In Step 4, the Navy determines whether site risks are great enough to cause health problems for people at or near the site. The results of the three previous steps are combined, evaluated, and summarized. The Navy adds the potential risks from the individual contaminants to determine the total risk resulting from the site. The following table summarizes cancer and non-cancer risks for all OU9 Sites:

Table 1: Summary of Cancer Risks and Hazard Indices

	Site 2A	Site 2B	Site 3	Site 7
Construction Workers – Direct Exposure				
Cancer Risk	1.2 per 100,000,000	3.3 per 100,000,000	1.3 per 1,000,000	4.2 per 10,000,000
Hazard Index	0.006	0.2	0.001	0.09
Adult Residents – Direct Exposure				
Cancer Risk	3.3 per 10,000	NA	1.4 per 1000	6.4 per 10,000
Hazard Index	6.4	NA	2.4	5.6
Industrial Workers – Vapor Intrusion				
Cancer Risk	1.1 per 1,000,000,000	1.4 per 100,000,000	2.3 per 1,000,000	6.2 per 1,000,000,000
Hazard Index	0.000003	0.00003	0.01	0.00001
Adult Residents – Vapor Intrusion				
Cancer Risk	7.8 per 1,000,000,000	9.8 per 100,000,000	1.6 per 100,000	4.2 per 100,000,000
Hazard Index	0.00002	0.0001	0.06	0.00008

	Site 15	Sites 14 & 18	Site 20	Sites 9 & 23
Construction Workers – Direct Exposure				
Cancer Risk	No COPCs	No COPCs	1.1 per 10,000,000	8.8 per 100,000,000
Hazard Index	0.002	No COPCs	0.0002	0.2
Adult Residents – Direct Exposure				
Cancer Risk	No COPCs	No COPCs	5.6 per 100,000	2.6 per 10,000
Hazard Index	0.3	No COPCs	0.3	13
Industrial Workers – Vapor Intrusion				
Cancer Risk	5.1 per 10,000,000	No COPCs	1.1 per 100,000,000	3.4 per 10,000,000
Hazard Index	0.001	No COPCs	0.00003	0.0008
Adult Residents – Vapor Intrusion				
Cancer Risk	3.5 per 1,000,000	No COPCs	7.4 per 100,000,000	2.3 per 1,000,000
Hazard Index	0.007	No COPCs	0.0001	0.005

NA - Not applicable. A residential scenario was not evaluated since Site 2B is a wetland.

No COPCs - Maximum concentrations of all chemicals were less than the screening criteria; therefore, no evaluation was required.

Summary of Alternatives Considered for OU9

The Navy prepared **FS**s to evaluate remedial alternatives for the **groundwater** at Sites 3 and 7 and risk evaluations and alternative evaluations were included in the **ROD** to evaluate **groundwater** at Sites 9 and 23. **FS**s were not prepared for Sites 14, 15, 18, or 20 because there were no actionable risks under CERCLA (see Table 1). **Groundwater** at Sites 2A and 2B is currently monitored under a **groundwater monitoring** program selected as part of the remedy for **OU**1.

Sites 3 and 7

For Sites 3 and 7, the Navy prepared an **FS** that involved development and evaluation of alternatives that would address the COCs detected exclusively at Site 3 (vinyl chloride) and the COCs detected at both Sites 3 and 7 (TCE and hexachlorobenzene). The Navy prepared a second **FS** that involved preparation and evaluation of alternatives that addressed the COCs detected exclusively at Site 7 (1,4-dichlorobenzene, benzene, and chlorobenzene). The alternatives evaluated in the two **FS**s are described separately below.

The two alternatives evaluated in the **FS** for combined Sites 3 and 7 **groundwater** included Alternative GW1-1 (No Action) and Alternative GW1-2 (**Institutional Controls** with **Monitoring**). These alternatives were presented in the 2004 Proposed Plan. Active **groundwater** remedial technologies were evaluated but not retained for alternative development because of the absence of a contaminant plume. Alternative GW1-1 was evaluated for comparison purposes, and Alternative GW1-2 was evaluated because of site conditions (generally low concentrations of contaminants, **groundwater** not classified as a suitable potable water **source**, and the availability and use of a public water supply) and its ability to meet the Remedial Action Objectives (RAOs). The RAOs as defined in the **FS** and amended based on recent **groundwater** data are: (1) to protect current receptors (construction workers) from incidental exposure to contaminated **groundwater**, (2) to protect potential future receptors from exposure to contaminated **groundwater** via ingestion (potable water supply and vapor intrusion), and (3) to protect aquatic ecological receptors. The following table summarizes the remedial alternatives considered in the **FS**. Estimated costs are presented including capital, operation and maintenance (O&M), and total present worth costs.

Table 2: Remedial Alternatives Considered for Sites 3 and 7, Area A Downstream Watercourses and the Torpedo Shops

Remedial Alternatives	Components	Comments
Alternative GW1-1: **No Action**	None, except mandatory five-year site reviews.	This alternative is not expected to be fully protective of human health and the environment because of unrestricted access to contaminated **groundwater**. Total Cost = $89,600 (30 years)
Alternative GW1-2: **Monitoring and Institutional Controls**	Continue to implement existing **institutional controls** that identify the location and magnitude of **groundwater contamination** and restrict extraction and use of **groundwater**. Amend existing **institutional controls** to address vapor intrusion. Continue to monitor **groundwater** contaminants. Conduct five-year site reviews.	Under this alternative, human health and the environment would be protected through **institutional controls** that identify the location and magnitude of **groundwater contamination** , address vapor intrusion, and restrict extraction and use of **groundwater** and through **monitoring** of the **groundwater** contaminants at the site. Total Cost = $319,500 (30 years)

The three alternatives evaluated in the **FS** for Site 7 **groundwater** included Alternative GW2-1 (No Action), Alternative GW2-2 (**Institutional Controls** with **Monitoring**), and Alternative GW2-3 (Extraction and Off-Site Discharge). Alternative GW2-1 was evaluated for comparison purposes, and Alternatives GW2-2 and GW2-3 were evaluated because of site conditions and their ability to meet the RAOs. The RAOs for this **FS** were (1) to protect current receptors (construction workers) from incidental ex-

posure to contaminated **groundwater**, (2) to protect potential future receptors from exposure to contaminated **groundwater** via ingestion (potable water supply), and (3) to protect aquatic ecological receptors. Table 3 summarizes the remedial alternatives considered in the Site 7 **groundwater FS**.

The proposed remedial actions for **groundwater** at Sites 3 and 7 were previously presented in the September 2004 Proposed Plan and December 2004 Interim **ROD**. Based on the interim selected remedy of **institutional controls** and **groundwater monitoring** for Sites 3 and 7, a **groundwater monitoring** program for Sites 3 and 7 was initiated in 2006. Also, a remedial design for land use controls was completed in 2005 and the Navy instruction document that defines the Navy's policy regarding disturbance of soil and **groundwater** at IR sites was updated in 2006 to include Sites 3 and 7 **groundwater**. The document will need to be updated to include the restrictions for vapor intrusion at Site 3.

The two alternatives evaluated for Sites 9 and 23 **groundwater** included Alternative GW3-1 (No Action) and Alternative GW3-2 (**Institutional Controls**). Active **groundwater** remedial technologies were not evaluated because of the absence of a contaminant plume and other site conditions (generally low concentrations of contaminants, **groundwater** not classified as a suitable potable water **source**, and the availability and use of a public water supply). Alternative GW1-1 was evaluated for comparison purposes and Alternative GW1-2 was evaluated because of site conditions and its ability to meet the Remedial Action Objectives (RAOs). The RAOs as defined in the **ROD** are: (1) to protect potential future receptors from exposure to contaminated **groundwater** via ingestion (potable water supply and vapor intrusion), and (2) to protect aquatic ecological receptors. Table 4 summarizes the remedial alternatives that were considered. Estimated costs are presented including capital, operation and maintenance (O&M), and total present worth costs.

Alternatives Evaluation Criteria

The following is a summary of the nine Superfund-mandated criteria used to balance the pros and cons of the remedial alternatives. The **FS** alternatives were evaluated using the first seven criteria. After comments from the State of Connecticut and public are received, the alternatives will be compared using the last two criteria to select the remedies for Sites 3 and 7 **groundwater**.

Table 3: Remedial Alternatives Considered for Site 7, the Torpedo Shops

Remedial Alternatives	Components	Comments
Alternative GW2-1: **No Action**	None, except mandatory five-year site reviews.	This alternative is not expected to be fully protective of human health and the environment because of unrestricted access to contaminated **groundwater**. Total Cost = $89,600 (30 years)
Alternative GW2-2: **Monitoring and Institutional Controls**	Continue to implement **institutional controls** that identify the location and magnitude of **groundwater contamination** and restrict extraction and use of **groundwater**. Continue to monitor the **groundwater**. Conduct five-year site reviews.	Under this alternative, human health and the environment would be protected through **institutional controls** that identify the location and magnitude of **groundwater contamination** and restrict extraction and use of **groundwater** and through **monitoring groundwater** contaminants at the site. Total Cost = $303,800 (30 years)
Alternative GW2-3: **Extraction and Offsite Discharge**	Install **groundwater** extraction and **monitoring** system. Extract approximately 1,250,000 gallons of **groundwater** over nearly 8 months. Pretreat extracted **groundwater**, if necessary, and discharge water to Publicly-Owned Treatment Works. Perform **monitoring** to confirm achievement of the remedial goals. Decommission the extraction system and restore the site to its original conditions.	Under this alternative, human health and the environment would be protected since the contaminated **groundwater** would be extracted from the site, treated as necessary, and discharged. Total Costs = $1,121,000 (1.5 years)

Table 4: Remedial Alternatives Considered for Sites 9 and 23, Tank Farm

Remedial Alternatives	Components	Comments
Alternative GW3-1: **No Action**	None, except mandatory five-year site reviews.	This alternative is not expected to be fully protective of human health and the environment because of unrestricted access to contaminated **groundwater**. Total Cost = $89,600 (30 years)
Alternative GW3-2: **Institutional Controls**	Implement **institutional controls** that identify the location and magnitude of **groundwater contamination** and restrict extraction and use of **groundwater**. Conduct five-year site reviews.	Under this alternative, human health and the environment would be protected through **institutional controls** that identify the location and magnitude of **groundwater contamination**, and restrict extraction and use of **groundwater**. Total Cost = $119,000 (30 years)

1. Overall protection of human health and the environment: The alternative should protect human health as well as plant and animal life on and near the site.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs): The alternative should meet applicable and relevant and appropriate federal environmental statutes, regulations, and requirements and State environmental and facility siting statutes, regulations, and requirements.

3. Long-term effectiveness and permanence: The alternative should maintain reliable protection of human health and the environment over time.

4. Reduction of toxicity, mobility, or volume through treatment: CERCLA prefers that the selected alternative use treatment to permanently reduce the level of toxicity of contaminants at the site, the spread of contaminants away from the **source** of **contamination**, or the amount of **contamination** at the site.

5. Short-term effectiveness: The alternative should minimize short-term hazards to workers, residents, or the environment during implementation of the remedy.

6. Implementability: The alternative should be technically feasible, and the materials and services needed to implement the remedy should be readily available.

7. Cost: Capital costs, annual operation and maintenance costs, and their associated net present values of all alternatives retained for detailed analysis shall be compared.

8. State acceptance: The State environmental agencies should agree with the proposed remedy.

9. Community acceptance: The community should agree with the proposed remedy. Community acceptance is based on comments received during the public comment period.

The Proposed Remedies

Sites 3 and 7

The Navy reviewed the results of the two **FS**s and decided that it was appropriate to select one remedial alternative that could address **groundwater contamination** found in the portion of **OU**9 associated with Sites 3 and 7. The proposed alternative **Institutional Controls** with **Monitoring**. This alternative was selected in the 2004 Interim **ROD**. The alternative meets all of the RAOs by restricting access to and use of contaminated **groundwater** and **monitoring** the **groundwater** at the site. This remedial alternative has three major components: (1) implement **institutional controls** at the sites, (2) conduct a comprehensive **monitoring** program to ensure that the remedial goals are met and the resulting concentrations are shown to be protective of human health and the environment, and to verify that **groundwater** contaminants are not migrating and impacting other resources, and (3) complete 5-year reviews of the site until the remedial goals are consistently reached. The components of the alternative are discussed in more detail below.

- Implementation of **institutional controls** at the sites involved identifying the location, magnitude, and type of **contamination** and documenting it in a remedial design for land use controls and the **NSB-NLON IR Site Use Restrictions document**. These documents present the land use control objectives and include specific drawings and instructions for Navy personnel so that contaminated **groundwater** would not be extracted or used in a manner that would threaten human

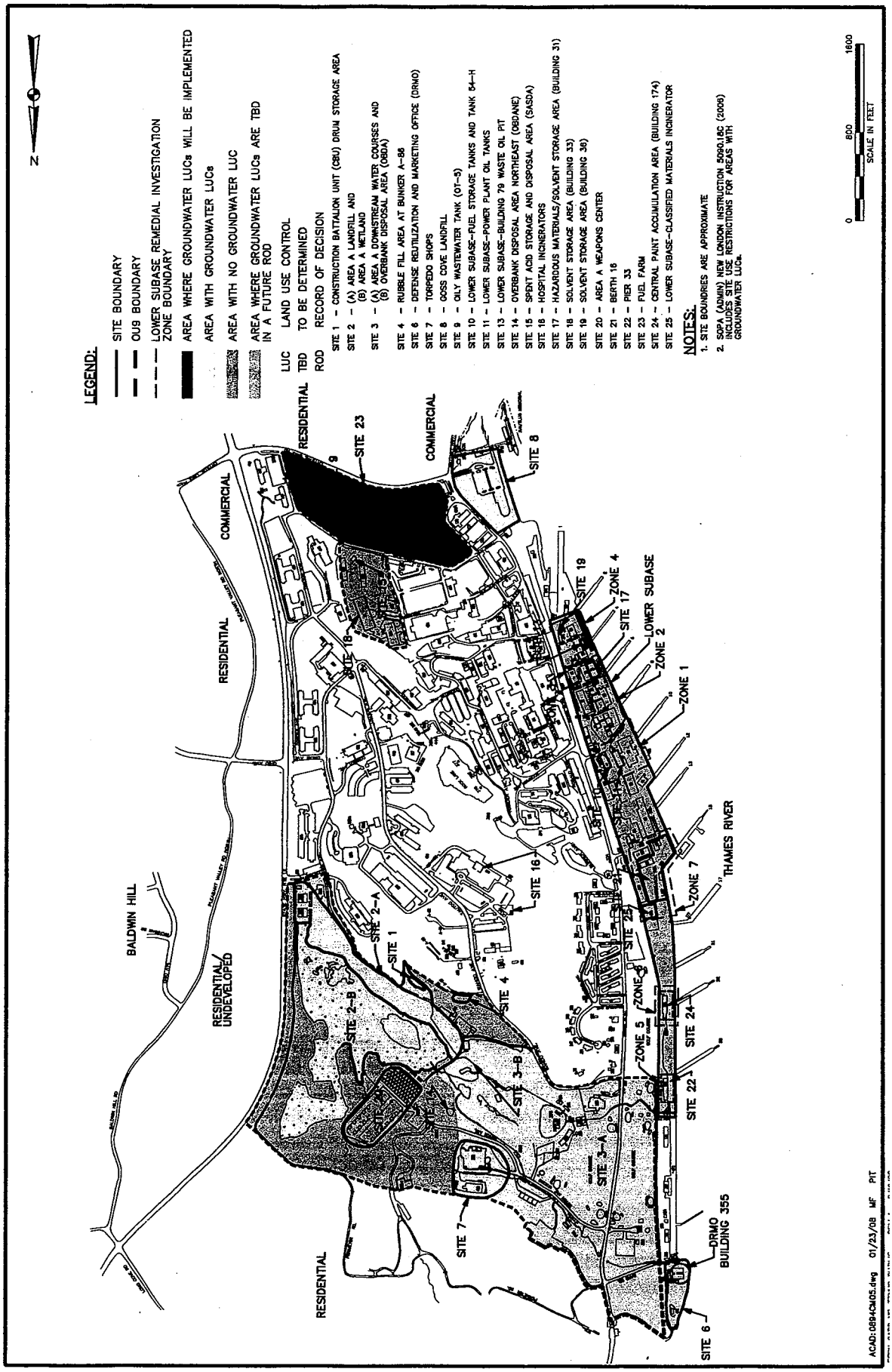

Figure 13. Location of Basewide Groundwater Operable Unit 9 and Areas with Groundwater Land Use Controls

health or the environment. Figure 13 shows the areas of Sites 3 and 7 that have **groundwater** land use controls. Areas of NSB-NLON with soil land use controls are shown on Figure 14. In the event of property transfer, and with confirmation that contaminated **groundwater** remains at the site, an environmental land use restriction pursuant to State law will be used to prohibit the use of **groundwater**. The **institutional controls** will also be amended to state that additional evaluation or the installation of mitigation measures relating to vapor intrusion will be implemented if future construction takes place.

- A **groundwater monitoring** plan has been developed to document the details of the **monitoring** program. Eight additional **monitoring** wells were installed and used in conjunction with previously existing **monitoring** wells to create the **monitoring** well network required for the Sites 3 and 7 **monitoring** program. During each sampling event all wells within the **monitoring** network will be sampled. Initially, sampling events will occur quarterly. Sampling frequency could be reduced after sufficient data are acquired and contaminant concentrations have diminished. Based on the contaminants at the sites, it is possible that **monitoring** activities will be required for decades until the remedial goals are reached and the resulting concentrations are shown to be protective of human health and the environment. It is expected that contaminants present in **groundwater** will continue to trend downward and will shortly be below the remedial goals.

- Five-year reviews will be conducted for Sites 3 and 7 **groundwater** as required under CERCLA until the **monitoring** program shows that the remedial goals have been reached. The goal of conducting the site reviews is to verify that no changes have occurred that would impact the protectiveness of the selected remedy.

It is Navy's and EPA's current judgment that the Preferred Alternative for Sites 3 and 7 identified in this Proposed Plan is necessary to protect public health, welfare, and the environment from actual or threatened releases of pollutants or contaminants in the **groundwater** at Sites 3 and 7 because they may present an imminent and substantial endangerment to public health or welfare.

Sites 9 and 23

The Navy reviewed the results of the evaluations and decided that it was appropriate to select one remedial alternative that could address **groundwater contamination** found in the portion of **OU**9 associated with Sites 9 and 23. The proposed alternative is Alternative 3-2 **Institutional Controls**. The alternative meets all of the RAOs by restricting access to and use of contaminated **groundwater**. This remedial alternative has two major components: (1) implement **institutional controls** at the site and (2) complete 5-year reviews of the site. The components of the alternative are discussed in more detail below.

- Implementation of **institutional controls** at the site involves identifying the location, magnitude, and type of **contamination** and documenting it in a remedial design for land use controls and the **NSB-NLON IR Site Use Restrictions document**. These documents present the land use control objectives and include specific drawings and instructions for Navy personnel so that contaminated **groundwater** would not be extracted or used in a manner that would threaten human health or the environment. Figure 13 shows the areas of Sites 9 and 23 that have **groundwater** land use controls. Areas of NSB-NLON with soil land use controls are shown on Figure 14. In the event of property transfer, and with confirmation that contaminated **groundwater** remains at the site, an environmental land use restriction pursuant to State law will be used to prohibit the use of **groundwater**.

- Five-year reviews will be conducted for Sites 9 and 23 **groundwater** as required under CERCLA. The goal of conducting the site reviews is to verify that no changes have occurred that would impact the protectiveness of the selected remedy.

It is the Navy's and EPA's current judgment that the Preferred Alternative for Sites 9 and 23 identified in this Proposed Plan is necessary to protect public health, welfare, and the environment from actual or threatened releases of pollutants or contaminants in the **groundwater** at Sites 9 and 23 because they may present an imminent and substantial endangerment to public health or welfare.

Sites 2A and 2B

Groundwater at Sites 2A and 2B is currently monitored under a **groundwater monitoring** program selected as part of the remedy for **OU**1. Post-closure **groundwater** monitoring is required by the September 2005 **ROD**. Volumes II and III of the Operation and Maintenance Manual for Installation Restoration Program Sites at Naval Submarine Base New London (January 2006) describe the **groundwater** monitoring plan in detail. This Plan proposes to continue that monitoring for Site 2A. **Institu-**

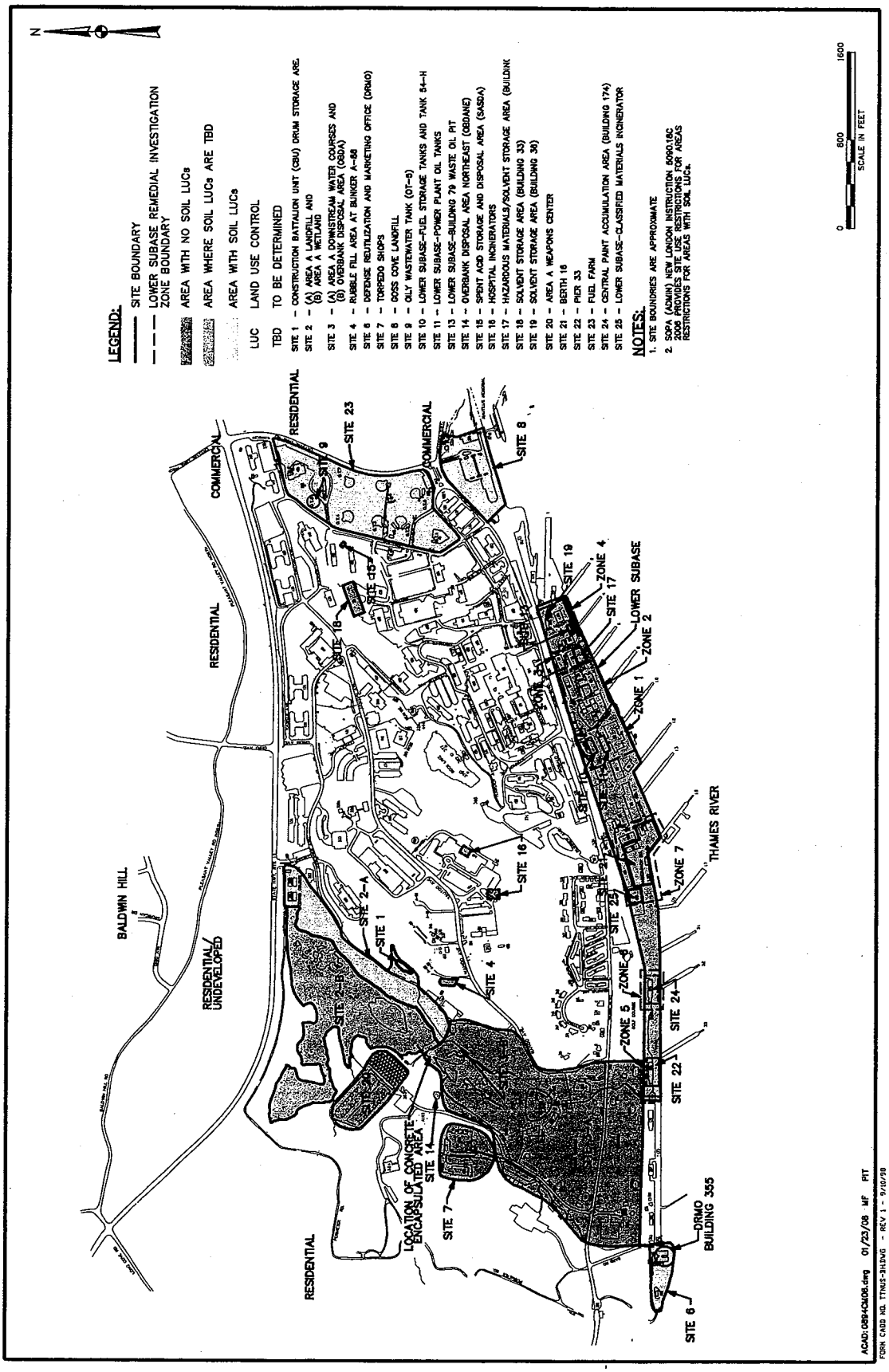

Figure 14. Location of Areas at NSB-NLON with Soil Land Use Controls

tional controls will remain in place at Site 2A and are described in the **Site Use Restrictions document**.

Sites 14, 15, 18, and 20

The Navy and EPA have determined that No Further Action is necessary for the **groundwater** at Sites 14, 15, 18, and 20 to protect public health or welfare or the environment.

Concluding Summary

Based on information currently available, the Navy believes the Preferred Alternatives meet the threshold criteria and provide the best balance of tradeoffs among the other alternatives with respect to balancing and modifying criteria. The Navy expects the Preferred Alternatives to satisfy the following statutory requirements of CERCLA §112(b): (a) be protective of human health and the environment; (b) comply with **ARARs**; (c) be cost-effective; (d) use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (e) satisfy the preference for treatment as a principal element or explain why the preference for treatment will not be met.

The CTDEP concurs with the proposed remedies.

The Public's Role in Alternative Selection

Community input is integral to the selection process. The Navy and regulatory agencies will consider all comments in selecting the remedial actions before signing the **ROD**. The public is encouraged to participate in the decision-making process. This Proposed Plan for Basewide **Groundwater OU**9 is available for review, along with supplemental documentation, at the following Information Repositories:

Groton Public Library 52 Newtown Road Groton, CT 06340 (860) 441-6750	Hours: Mon.-Thurs.: 9:00 am-9:00 pm Fri.: 9:00 am - 5:30 pm Sat.: 9:00 am - 5:00 pm Sun.: Noon - 5:00 pm
Bill Library 718 Colonel Ledyard Highway Ledyard, CT 06339 (860) 464-9912	Hours: Mon.-Thur.: 9:00 am-9:00 pm Fri. & Sat.: 9:00 am - 5:00 pm Sun.: 1:00 pm - 5:00 pm

For further information, please contact:

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Glossary of Technical Terms

Applicable or Relevant and Appropriate Requirements (ARARs): The federal environmental rules, regulations, and criteria and State environmental and facility siting statutes, regulations, and requirements that must be met by the selected remedy under Superfund.

Basewide Groundwater Operable Unit Remedial Investigation (BGOURI) Update/Feasibility Study (FS): A Remedial Investigation report describes the site, documents the nature and extent of **contaminants** detected at the site, and presents the results of the **risk assessment.** An **FS** report presents the development, analysis, and comparison of remedial alternatives.

Contamination: Any physical, biological, or radiological substance or matter that, at a certain concentration, could have an adverse effect on human health and the environment.

Groundwater: Water found beneath the earth's surface in the pores of the soil or the cracks in the bedrock. **Groundwater** may transport substances that have percolated downward from the ground surface as it flows towards its point of discharge.

Installation Restoration (IR) Program: The purpose of the program is to identify, investigate, assess, characterize, and clean up or control releases of hazardous substances, and to reduce the risk to human health and the environment from past waste disposal operations and hazardous material spills at Navy activities in a cost-effective manner.

Institutional Controls: Engineered or physical controls and/or administrative or legal mechanisms designated to protect public health and the environment from contamination.

JP-10: A popular missile fuel that is a single-component hydrocarbon (C10H16), rather than a mixture of many hydrocarbons. **JP-10** fuel is a storable liquid.

Metals: Metals are naturally occurring elements in the earth. Some **metals**, such as arsenic and mercury, can have toxic effects. Other **metals**, such as iron, are essential to the metabolism of humans and animals.

Micrograms per Liter (µg/L): One part of contaminant in a billion parts of water.

Monitoring: Collection of environmental information that helps to track changes in the magnitude and extent of **contamination** at a site or in the environment.

Operable Unit (OU): Contaminated media, site, or set of sites that are evaluated as a group.

Otto Fuel II: **Otto Fuel II** is a distinct-smelling, reddish-orange, oily liquid that produces hydrogen cyanide when burned. The U.S. Navy uses **Otto Fuel II** as a fuel for torpedoes and other weapon systems. It is a mixture of three synthetic substances: propylene glycol dinitrate (the major component), 2-nitrodiphenylamine, and dibutyl sebacate.

Polynuclear Aromatic Hydrocarbons (PAHs): High molecular weight, relatively immobile, and moderately toxic organic chemicals featuring multiple benzenic (aromatic) rings in their chemical formula. Typical examples of **PAHs** are naphthalene and phenanthrene.

Potentiometric Contours: Contours that represent the height (usually above sea level) at which the water level stands in tightly cased wells that penetrate the aquifer. Potentiometric contours define a surface that is equivalent to the water table in an unconfined aquifer.

Record of Decision (ROD): An official document that describes the selected Superfund remedy for a site. The **ROD** documents the remedy selection process and is issued by the Navy and USEPA following the public comment period on the Proposed Plan.

Remedial Investigation (RI): A report that describes the site, documents the nature and extent of contaminants detected at the site, and presents the results of the **risk assessment**.

Responsiveness Summary: A summary of written and oral comments received during the public comment period, together with the Navy's and USEPA's responses to these comments.

Risk Assessment: Evaluation and estimation of the current and future potential for adverse human health or environmental effects from exposure to contaminants.

Sediment: Soil, sand, and minerals typically transported by erosion from soil to the bottom of surface water bodies such as streams, rivers, ponds, and lakes.

Site Use Restrictions Document: SOPA (ADMIN) New London Installation 5090.18C, Installation Restoration Site Use Restrictions at Naval Submarine Base New London defines Navy policy and procedures regarding disturbance of contaminated soils/sediments and/or extraction of contaminated groundwater. The locations of impacted media are also identified in figures provided in the Instruction.

Semi-Volatile Organic Compound (SVOC): Carbon-based chemical compounds that have low vapor pressures and only evaporate at elevated temperatures. **PAHs** are examples of **SVOC**s.

Source(s): Area(s) of a site where **contamination** originated.

TH Dimer: Tetrahydromethylcyclopentadiene, also called RJ-4, is a missile fuel which is used alone or as a component of JP-9 jet fuel.

Volatile Organic Compound (VOC): Carbon-based chemical compounds that have high vapor pressures and evaporate readily at normal temperatures. Examples of **VOC**s are the components of gasoline (*i.e.*, benzene, toluene, ethylbenzene, and xylenes) and solvents (*e.g.*, TCE).

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the Basewide **Groundwater OU**9 at Naval Submarine Base – New London is important to the Navy and EPA. Comments provided by the public are valuable in helping to select the remedies for **groundwater** at these sites.

You may use the space below to write your comments, then fold and mail. Comments must be postmarked by July 14, 2008. Comments can be submitted via mail or e-mail and should be sent to either of the following addresses:

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If you have any questions about the proposed remedies or the comment procedures please contact Mr. Ron Pinkoski at (757) 444-0735.

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Name _____

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