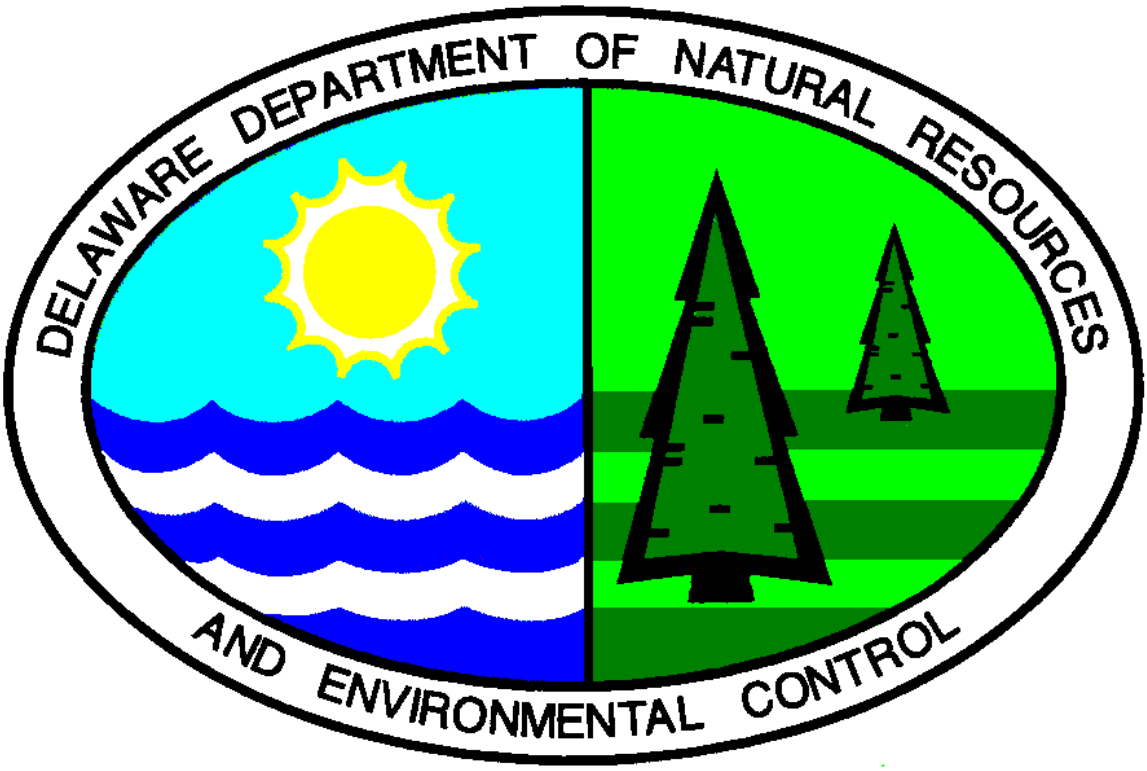
FINAL PLAN OF REMEDIAL ACTION



DRAVO SHIPYARD

Operable Unit II
RDC/Harbor Associates Properties
Wilmington, Delaware

DNREC Projects No. DE-1092 & DE-1096

February 2001

Department of Natural Resources and Environmental Control
Division of Air and Waste Management
Site Investigation and Restoration Branch

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1 INTRODUCTION

In April and June 1998, the Department of Natural Resources and Environmental Control (DNREC or Department) under the authority granted by the Hazardous Substance Cleanup Act, 7 Del. C. Ch. 91 (HSCA) reached an agreement with the Riverfront Development Corporation (RDC) and Harbor Associates to oversee environmental investigation, remediation activities, and redevelopment activities at the former Dravo Shipyard Site located on Madison Street in Wilmington, Delaware (Figures 1 and 2). The former Dravo Naval Shipyard was scheduled to be redeveloped into a catalog outlet shopping mall, an exhibition center, and related facilities by the Riverfront Development Corporation of Delaware and the Harbor Associates, Inc.

The scope of this Final Plan of Remedial Action is the soil and subsoil for the geographic area of the Operable Unit II, plus the groundwater media for Operable Units I, II and III.

This document is the Department's Final Plan of Remedial Action for the Dravo Shipyard property as defined in Figure 2. This Final Plan is issued under provisions of the HSCA and the Regulations Governing Hazardous Substance Cleanup (Regulations). It presents the Department's assessment of the potential unacceptable health and environmental risks posed by the Dravo Shipyard Site and plans for further action.

The Final Plan of Remedial Action also includes a comparison of the remedial alternatives with respect to but not limited to: current and potential land use, natural resource use, proximity of human populations, use of surrounding properties, specific environmental issues, protection of public health, welfare, and the environment, and compliance with applicable laws and regulations.

The Department provided the public with notice and opportunity to comment on the Proposed Plan in accordance with Section 12 of the Regulations. At the conclusion of the comment period, after review and consideration of the comments received, the Department issues this Final Plan of Remedial Action, designating the selected remedial action.

2 SITE DESCRIPTION AND HISTORY

2.1 Site Description

The former Dravo Shipyard consists of approximately 120 acres, and is located southwest of the City of Wilmington business district (Figure 1). Approximately 48 acres of the Dravo Shipyard encompasses the areas that are under agreement to be investigated under the Voluntary Cleanup Agreements between the DNREC and RDC, and the DNREC and Harbor Associates. The Harbor Associates property encompasses approximately 33 acres and is located on the western and southern portion of the former Dravo Shipyard Site. The RDC property encompasses approximately 14.5 acres and is located on the eastern portion of the former Dravo Shipyard Site.

Contained within the former Dravo Shipyard Site is an underground utility vault system that runs along Madison Street, with arterials to the former naval shipyard buildings. The utility vaults are not currently in use. The total area described under this Final Plan of Remedial Action for the Dravo Shipyard Operable Unit II constitutes approximately 18 acres of land and the groundwater media from Operable Units I, II and III (approximately 48 acres) (Figure 1). The area of investigation is detailed in Figure 2.

2.2 Site History

The entire redevelopment area was historically the site of shipbuilding and other heavy industrial activities. Much of the area was reclaimed from marshland by filling with slag and other industrial waste products. Because of its previous industrial use soil in the area has been impacted by environmental contaminants including total petroleum hydrocarbons (TPH), heavy metals (lead, arsenic), polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs).

3 INVESTIGATION RESULTS

A total of three environmental investigations have been performed on the site project area. In July and November 1997, the DNREC performed two Brownfield Preliminary Assessment IIs. Soils throughout the property were found to contain significant amounts of organic and inorganic contaminants from historical operations at levels well above screening benchmarks. Primary contaminants of concern were found to be polynuclear aromatic hydrocarbons (PAHs) and lead. Results indicated that relatively widespread PAH contamination of the shallow and deep soils in the project area. Toxic Characteristics Leaching Procedures (TCLP) analysis indicated that one surface soil sample exceeded the regulatory level for lead as a hazardous waste.

EA Engineering performed the Remedial Investigation (RI) for the Operable Unit II (OU2) area September through December 1998 under contract with the RDC and Harbor Associates. Soil samples were collected in a 100 foot grid pattern from the geographic OU 2 area and from the location of the Bioretention swale extension in 50 linear foot fashion (Figure 3). Soil samples were screened initially by the Department of Natural Resources and Environmental Control's Site Investigation and Restoration Branch (DNREC-SIRB) mobile lab for carcinogenic polynuclear aromatic hydrocarbons (C-PAH) using Ohmicron immunoassay kits and for Total metals, including arsenic, cadmium, chromium, lead, and mercury using an X-ray fluorescence instrument (XRF). Additional volatile and semivolatile screenings were performed by the DNREC-SIRB and the DNREC-Division of Water Resources Environmental Services Laboratory (DNREC – ESS). Groundwater samples were collected from the DNREC installed groundwater monitoring wells and the EA installed wells per HSCA protocol's and analyzed by EA Laboratories in Sparks, Maryland (Figure 4). Six ground water samples were collected from the monitoring wells.

A total of 109 soil samples were collected during the test pitting activities and Bioretention swale sampling (Appendix B). As a result of the mobile laboratory screening, a total of 27 soil samples

were submitted to EA Laboratories in Sparks, Maryland, for analysis of select parts of the United States Environmental Protection Agency (USEPA) Target Analyte List (Inorganics) and Target Compound List (Organics) (TAL/TCL) (Appendix A). Samples were selected by EA and the DNREC on the basis of moderate or high screening results (Appendix C).

According to the screening analysis performed at the DNREC mobile laboratory, the contaminants of concern detected were Carcinogenic Polycyclic Aromatic Hydrocarbons (C-PAH) and arsenic. Lead and polychlorinated biphenyls (PCBs) did not exceed the DNREC's unlimited reuse criterion (Table 1). The site specific reuse criterion developed for the site categorized soils on the basis of contaminant content detected in screening and fixed laboratory analysis. The soils are grouped according to level of contaminant, such as metals, semi-volatile and volatile organics, into categories of use or reuse.

> **Category A** has been determined to be those soils suitable for unlimited reuse or residential use.
>
> **Category B** soils are suitable for industrial/commercial reuse within the project area. This category of soils requires a minimum of one foot clean fill and geotextile marker fabric of a minimum quality of Amoco ACF 4508 or its equivalent as determined by the DNREC to be placed over the 'B' soils.
>
> **Category C** soils may be reused on the site, but must be covered by building foundations or asphalt/concrete and additional soils.
>
> **Category Z** soils must be disposed of off site. Of the 27 samples submitted for confirmatory analysis.

No samples exceeded the DNREC's commercial/industrial reuse criterion (Category C) (Appendix D).

The analytical results for the ground water beneath the site revealed uniform contamination of iron and manganese in the wells and one exceedence of aluminum in MW-5 (Appendix D). The ground water results also detected concentrations of arsenic above the carcinogenic DNREC Uniform Risk-Based Remediation Standards, but all levels were below the non-carcinogenic value for arsenic.

4 REMEDIAL ACTION OBJECTIVES

According to HSCA regulation 8.4(1), during a remedial investigation, remedial action objectives must be established. For the Dravo Shipyard/Harbor Associates Site, remedial action objectives were designed based on the following factors:

- The site is currently zoned as commercial and industrial land. Numerous vacant lots and former industrial buildings are present.

- The future site use is expected to be paved roadway, asphalt parking lots, shopping centers, and very limited open space.

- The site is adjacent to the Christina River.

- Surrounding land uses are mixed, including warehousing, commercial, and residential.

- Soil at the site has been impacted by various chemical constituents. Based on the nature and extent of the contaminants, PAHs and arsenic have been chosen as the primary contaminants of concern.

- The ground water at the site has been impacted with select metals, including arsenic, aluminum, iron, and manganese.

- The primary exposure pathways are inhalation, potential ingestion of ground water from the site, direct contact and incidental ingestion with/of impacted soil, and erosional transport to the Christina River.

4.1 Qualitative Remedial Objectives

Based on the above factors, the following qualitative remedial action objectives were developed:

- Control potential human contact (dermal, inhalation, and ingestion) with contaminated soil.

- Control potential human contact (ingestion) with contaminated ground water.

- Control potential contaminated soil erosion into the Christina River.

4.2 Quantitative Remedial Objectives

Based on the above qualitative remedial action objectives, the following quantitative remedial action objectives for the soil and subsoil environmental media were developed:

- Prevent human contact with soil having an arsenic concentration greater than 3 mg/Kg.

- Prevent human contact with soil having a lead concentration greater than 400 mg/Kg.

- Prevent human contact with soil having a C-PAH concentration greater than 1 mg/Kg.

- Prevent human contact with soil having a PCB concentration greater than 0.5 mg/Kg.

- Prevent human contact with soil having a benzene-toluene-ethyl benzene-xylene (BTEX) concentration greater than 10 mg/Kg.

- Prevent human contact with soil having a C5 through C8 Aliphatic Hydrocarbons concentration greater than 100 mg/Kg.

- Prevent human contact with soil having a C9 through C12 Aliphatic Hydrocarbons concentration greater than 1000 mg/Kg.

- Prevent human contact with soil having a C9 through C18 Aliphatic Hydrocarbons concentration greater than 1000 mg/Kg.

- Prevent human contact with soil having a C19 through C36 Aliphatic Hydrocarbons concentration greater than 2500 mg/Kg.

- Prevent human contact with soil having a C9 through C10 Aromatic Hydrocarbons concentration greater than 100 mg/Kg.

- Prevent human ingestion at the site of ground water containing metal contaminant concentrations greater than the DNREC Uniform Risk-Based Remediation Standards.

- Prevent release of contaminated sediment from the second phase of the Bioretention swale into the Christina River in exceedence of the DNREC Uniform Risk Based Remediation Standards for protection of the environment.

The quantitative remedial action objectives were based on the DNREC "Remediation Standards Guidance Under the Delaware Hazardous Substance Cleanup Act" (February 1998). These objectives are protective of potential human and environmental receptors.

5 PROPOSED REMEDIAL ACTION PLAN

5.1 Potential Remedial Alternatives

To accomplish the described remedial action objectives, three potential remedial alternatives were reviewed for the soil and subsoil environmental media for the project area. These are listed below and discussed further in the following section:

Alternative 1: No further action. Contaminants identified during the Remedial Investigation/Feasibility Study (RI/FS) are not remediated. The proposed redevelopment project would occur based upon local zoning requirements. Under this option no further remediation of contaminants would be required

Alternative 2: Containment of affected materials in compliance with the DNREC HSCA Regulations. Under this alternative, soil to be excavated for the redevelopment project will be handled in accordance with the DNREC established soil reuse categories. In addition to the categories for selective re-use of contaminated soils at the site, the following shall also apply:

- Provide deed restrictions for all project involved parcels for non-residential use,
- Require notification and approval from DNREC prior to any future intrusive activity in the project area and,
- Placement of a Groundwater Management Zone (GMZ) at the site to prevent future use of the groundwater beneath the site.
- Development of an Operation and Maintenance Plan (O&M) to maintain the containment system.

Alternative 3: Complete removal of materials that exceed the DNREC unlimited reuse criterion. Under this alternative, approximately 80 percent of soil in the site area would be excavated to a depth averaging 10 feet below grade, and be transported through Wilmington for off-site disposal. An equal amount of clean fill would be transported back for use in this redevelopment project. The excavated soil would represent all soils found to exceed the DNREC Unlimited Reuse Criterion (Level A) determined through soil screening analysis and confirmatory laboratory analysis. Extensive dewatering would occur under this option, as the affected soils extend below present water table levels.

6 PROPOSED AND FINAL REMEDIAL ACTION PLAN

The remedial alternatives were evaluated in accordance with the criteria set forth in the HSCA Regulations. Based on these criteria, Alternative 1 (no further action) was a viable alternative because it will neither protect human health or the environment nor comply with current laws. Alternatives 2 and 3 (containment and complete off-site disposal of all soils) were considered viable alternatives. Alternative 3 (off-site disposal) will cause short-term exposures to the public due to hauling large quantities of contaminated soil off-site. Further, there is little to no apparent increased protectiveness with Alternative 3 as compared with Alternative 2, but there is a substantial increase in cost with Alternative 3.

Therefore, the most appropriate remedial action was Alternative 2 (containment of impacted soil). Alternative 2 provided a cost effective means of meeting all the remedial objectives while satisfying the evaluation criteria. Alternative 2 also removed the potential exposure pathway of human contact with impacted soil by isolating the source.

7 PUBLIC PARTICIPATION

The Department actively solicited public comments or suggestions on the Proposed Plan and welcomed opportunities to answers questions. The public hearing was held on Wednesday,

September 15, 1999 at the City/County Building, 800 N. French Street, Wilmington, at 6:00 p.m. A Secretary's Order was finalized on ***. For additional information, contact Ann Breslin at (302) 395-2600.

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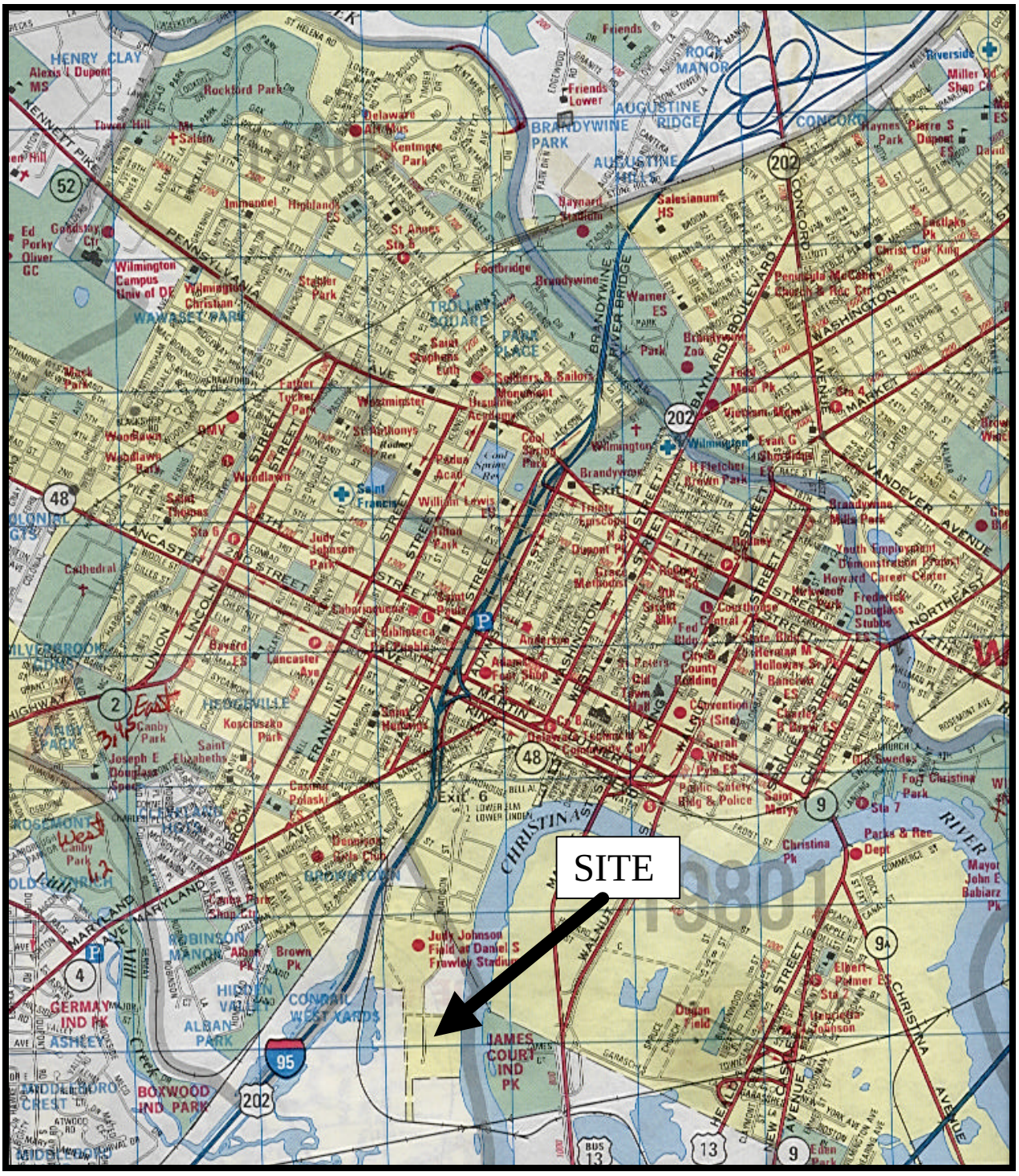

Scale: 1 inch = 2,000 feet

Figure 1 Site location map, Harbor Associates Property, Wilmington, DE (Source: ADC Street Map book, New Castle County, Delaware, 8th Edition)

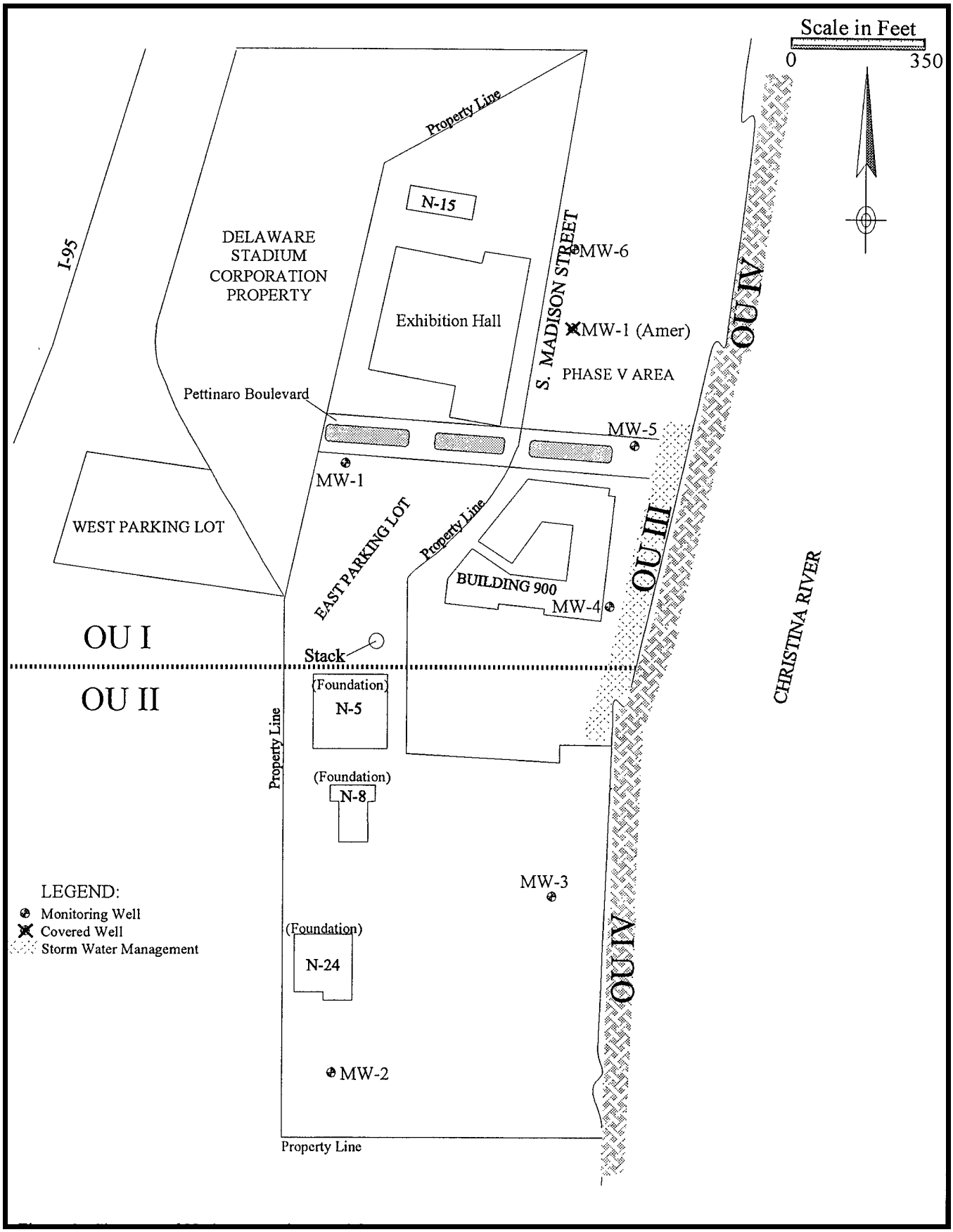

Figure 2 Site map of Harbor Associates and former Amer Properties

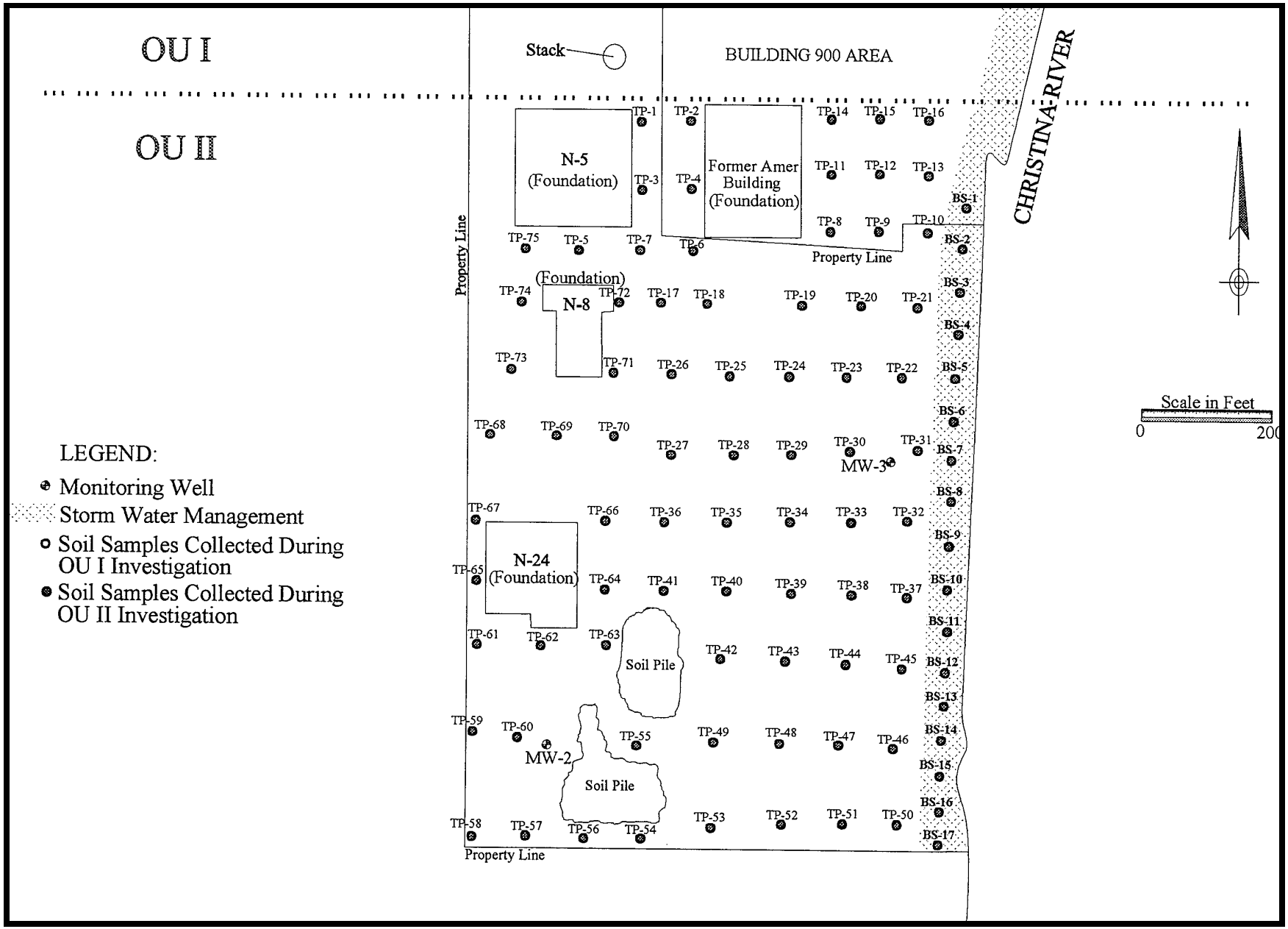

Figure 3 Site map showing soil sampling locations for OU II

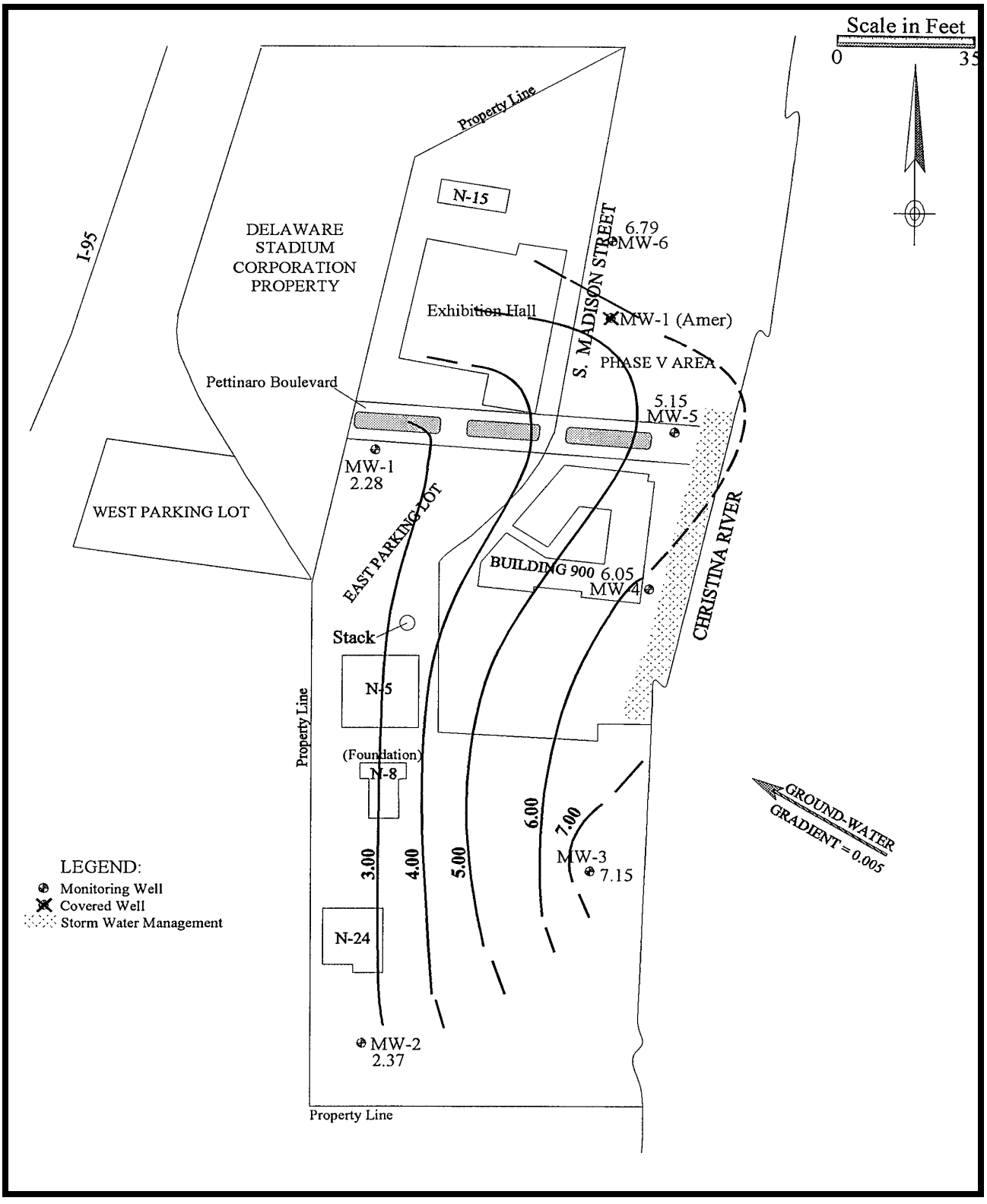

Figure 4 Site map showing groundwater elevations (ft) from the 29 January 1999 gauging event